Carbon Taxes and the Future of Green Tax Reform

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Key Findings

- By driving changes to the climate, carbon emissions will impose major long-term economic costs, both here in the U.S. and around the world.
- Carbon taxes are an option to make the market reflect future costs of carbon emissions, discouraging emissions and incentivizing development and implementation of clean technology.
- Carbon taxes also come with design challenges and economic costs, including reducing growth and falling more heavily on lower-income households.
- The problems of a carbon tax are shared by other environmental policies, as regulation disproportionately burdens low-income people, while subsidies for green technology tend to benefit the wealthy.
- The revenues from a carbon tax could be used to offset growth and distributional concerns by lowering more distortionary taxes elsewhere and providing cash payments to households.

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Introduction

Climate change has become an increasingly pressing issue in Washington, D.C., as well as around the world. The economic impact of climate change could be severe, thanks to both the increasing frequency of extreme weather events and rising sea levels driving displacement.[1] Changes to the natural environment will create significant net costs for human well-being.

The solutions politicians propose are increasingly muddled. Some link climate change to an all-encompassing agenda that expands government control over the whole economy. Meanwhile, the bipartisan status quo in climate policy is a poorly designed patchwork of subsidies and regulatory regimes: take, for example, tax credits for alternative fossil fuels and green energy investments or energy efficiency standards for appliances and automobiles.

The status quo policies have produced mixed results—sometimes helping to reduce carbon emissions, but often at a high cost for a small environmental gain. One policy skirts many of the problems intrinsic to government-planned and top-down schemes: a simple price on carbon. By addressing the problem directly and equally across the whole economy, a price on carbon through a carbon tax avoids the distortions of Rube Goldberg schemes to reduce emissions.

Furthermore, in a time with record deficits and slow growth, carbon tax revenue can help address other long-term problems. Revenue could be put towards fixing the tax code's bias against capital investment, public infrastructure projects, improved support for working families, or simply reducing the deficit. The carbon tax has twin benefits: in addition to reducing the long-run costs of climate change, the revenue can be used to lower other, more economically harmful taxes. Over a longer time horizon, however, the revenue potential declines as the tax encourages firms and individuals to reduce carbon emissions.

This paper reviews the basic structure of carbon taxes, how they compare to the existing set of climate policies, and how they could fit into various pro-growth tax reform packages.

Carbon Tax Basics

The economic theory behind carbon taxes is simple, but transforming the theory into a real-world policy is more challenging.

Markets are very good at matching buyers and sellers: for a transaction to happen, it has to be beneficial to both parties, and ergo, everyone ends up better off from the transaction. Some behaviors or transactions, however, have social costs the two parties directly involved do not bear.

As an example, say a factory makes detergent, and the byproducts pollute the local river. The detergent manufacturer and the detergent customers both benefit from the detergent's sale. The detergent business has other costs borne not by the manufacturer or the customer, but by the town's

1 Intergovernmental Panel on Climate Change, "Climate Change 2022: Impacts, Adaptation, and Vulnerability," Summary for Policymakers, March 2022, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf.

residents, who now face elevated health risks due to the pollution. Without some form of policy intervention, the price of the detergent will not reflect the health risks imposed on the community—as a result, people will produce and use more of the detergent than is socially optimal.

A Pigouvian tax (named for economist Arthur Pigou, credited with devising the idea) is a tax on negative externalities, namely the social costs of a particular economic activity that are not borne by the buyer and the seller. The tax forces the buyer and seller to "internalize" the externalities.[2] Producers are incentivized to reduce the social harms related to the particular product, while consumers are incentivized to consume less of it.

If the tax reflects the social costs associated with a good, then the market for the good becomes socially optimal. In this way, the Pigouvian tax is perhaps the only tax which leads to a better market outcome. Some taxes, like taxes on consumption, might be less distortive or harmful to economic growth than others (such as taxes on investment), but consumption taxes do not correct a market inefficiency.

Some critics of a carbon tax argue it is not a real solution to correct the inefficiencies created by carbon emissions; instead, they say the only real solution to climate change is innovation, with a tax on carbon emissions being a distraction.[3] While it is true that innovation is a major reason why carbon emissions have not grown in the United States over the past decade, carbon taxes would kick innovation into a higher gear. By raising the price of carbon emissions, a carbon tax raises the return to new developments in energy-saving or low-carbon technologies. In a landmark paper, economist David Popp found high energy prices have a strong impact on innovations in energy-efficient technology.[4]

On paper, carbon taxes look fantastic, but they do have a few challenges in practice.

The most important challenge is calculating the social cost of carbon emissions so an accurate carbon tax can be applied. The calculations are simple if one has an estimate of the expected future damage caused by an increase in carbon emissions, which can then be discounted to determine the cost in present terms.

Two variables can have a large effect on the estimate of the social cost of carbon. The first is what damages to consider: some suggest when making policy within the U.S. we should consider only the costs of carbon that will impact the U.S., while others say we should take the whole world into account. The second is the discount rate to use: a high discount rate will mean costs far in the future will be worth much less in real terms than if we used a low discount rate.[5]

2 Tax Foundation, "Pigouvian Tax," TaxEDU, https://www.taxfoundation.org/tax-basics/pigouvian-tax/.

3 John Barrasso, "Cut Carbon Through Innovation, Not Regulation," *The New York Times*, Dec. 18, 2018, https://www.nytimes.com/2018/12/18/opinion/climate-carbon-tax-innovation.html.

4 David Popp, "Induced Innovation and Energy Prices," *The American Economic Review* 92:1 (March 2002), https://www.aeaweb.org/articles?id=10.1257/000282802760015658.

5 Lorraine Woellert and Zack Colman, "Biden Hikes Cost of Carbon, Easing Path for New Climate Rules," Politico, Feb. 26, 2021, https://www.politico.com/news/2021/02/26/biden-carbon-price-climate-change-471787.

Governments have used a wide array of estimates for the social cost of carbon. Using a 7 percent discount rate and excluding global impacts, the Trump administration estimated the social cost of carbon to be $8 per ton, while the Biden administration currently uses a social cost of carbon of $51 per ton, calculated using a discount rate of 3 percent and global costs.[6] Meanwhile, high-end estimates of the social cost of carbon can reach well above $100 per ton—as an example, the state of New York uses a discount rate of 2 percent to arrive at the social cost of carbon of $125 per ton.[7] Economists tend to support setting the social discount rate around 2 to 3 percent.[8]

The number of assumptions required for an estimate of the social cost of carbon leads to a wide variety of dollar figures, but $51 per ton is roughly middle of the pack.

Governments also face a decision on where to administer the carbon tax in the production process. Upstream carbon taxes are levied where emitting fuel is produced (upstream), at the point of fuel consumption (downstream), or in between (midstream).[9] Levying a carbon tax further upstream reduces administrative costs because the tax needs to be collected at fewer points—for instance, the United States has 129 petroleum refineries but more than 193 *million* light-duty passenger cars.[10] According to a 2009 study, it would be possible to collect a carbon tax on 80 percent of U.S. carbon emissions while only directly taxing 3,000 businesses, illustrating the relative simplicity of an upstream point of collection.[11]

While administrative burdens might make catching some carbon emissions impractical, it is feasible to cover the vast majority of carbon emissions without a uniquely high administrative and compliance burden relative to other taxes. Nonetheless, many existing carbon taxes cover a small sliver of a country or jurisdiction's emissions. Some have broad coverage: Ukraine's carbon tax covers 71 percent of the country's carbon emissions, while British Columbia's carbon tax covers 78 percent of the province's emissions. On the other hand, other so-called carbon taxes include only a token share of carbon: in Poland's case, less than 5 percent.[12] Some carbon taxes only cover certain portions of carbon emissions because other taxes, regulatory policies, or emissions trading schemes apply to emissions in certain sectors.[13] Ideally, the carbon tax base should be broad to cover the vast majority of carbon emissions.

6 Ibid.

7 Kevin Rennert, Brian C. Prest, William A. Pizer, Richard G. Newell, David Anthoff, Cora Kingdon, Lisa Rennels, Roger Cooke, Adrian E. Raftery, Hana Ševčíková, and Frank Errickson, "The Social Cost of Carbon: Advances in Long-Term Probabilistic Projections of Population, GDP, Emissions, and Discount Rates," Resources for the Future Working Paper 21-28 (October 2021), https://media.rff.org/documents/WP_21-28_V2.pdf. See also New York State Department of Environmental Conservation, "DEC Announces Finalization of 'Value of Carbon' Guidance to Help Measure Impacts of Greenhouse Gas Emissions," Dec. 30, 2020, https://www.dec.ny.gov/press/122070.html.

8 Moritz A. Drupp, Mark C. Freeman, Ben Groom, and Frikk Nesje, "Discounting Disentanglement," *American Economic Journal: Economic Policy* 10:4 (November 2018), https://eprints.whiterose.ac.uk/125845/1/Actual_resubmission_DiscountingDisentangled_AEJP_2017_R2.pdf.

9 Kyle Pomerleau and Elke Asen, "Carbon Tax and Revenue Recycling: Revenue, Economic, and Distributional Implications," Tax Foundation, Nov. 6, 2019, https://www.taxfoundation.org/carbon-tax/.

10 U.S. Energy Information Administration, "When Was the Last Refinery Built in the United States?" June 25, 2021, https://www.eia.gov/tools/faqs/faq.php?id=29&t=6. See also Bureau of Transportation Statistics, "Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances," https://www.bts.gov/content/number-us-aircraft-vehicles-vessels-and-other-conveyances.

11 David A. Weisbach and Gilbert E. Metcalf, "The Design of a Carbon Tax," *Harvard Environmental Law Review* 33 (2009), https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=3033&context=journal_articles.

12 World Bank, "Carbon Pricing Dashboard," updated Apr. 1, 2022, https://carbonpricingdashboard.worldbank.org/map_data.

13 Samuel Jonsson, Anders Ydstedt, and Elke Asen, "Looking Back on 30 Years of Carbon Taxes in Sweden," Tax Foundation, Sept. 23, 2020, https://www.taxfoundation.org/sweden-carbon-tax-revenue-greenhouse-gas-emissions/.

Another concern with carbon taxes is how they would affect people across the income distribution. Generally, a carbon tax is thought of as regressive, as it works like a consumption tax.[14] Typically, lower-income households consume a larger share of their annual income than higher-income households do—and conversely, higher-income households save a larger share of their income. Ergo, taxes on consumption fall more on people with lower incomes. But higher-income households do not just keep the money in savings forever—they eventually use their savings for consumption (typically in retirement), and at that point, they will owe the tax as well. A similar issue exists with the value-added tax.[15] A further consideration is that tax burdens are usually measured according to annual income, not lifetime income, and when measured against lifetime income, a carbon tax looks less regressive.[16]

The challenges associated with designing a carbon tax mean a perfect, textbook carbon tax would be difficult to enact; however, a carefully designed carbon tax to address the social costs of carbon emissions is attainable.

Contrasting Carbon Taxes to Regulatory Policies and Subsidies

It is also worth comparing carbon taxes to the environmental policy status quo. Currently, four major regulatory regimes address carbon emissions. Corporate Average Fuel Economy (CAFE) standards target emissions from transportation, requiring a manufacturer's fleet of cars in a model year reach a certain fuel efficiency level. The Clean Power Plan (CPP) targets emissions from electricity generation, mandating that states choose from a series of emissions-restricting policies. The Renewable Fuel Standards (RFS) requires fuel distributors have a certain percentage of renewables in their fuel, while appliance and equipment efficiency standards target both residential and commercial sector emissions.[17]

The federal government also provides a variety of subsidies through the tax code to support green energy. The justification for tax subsidies for low-emissions or emission-free technology in theory works similarly to the carbon tax. If carbon emissions are a problem, instead of levying a tax to match the cost of carbon, put an equivalent subsidy to things that do not emit carbon. But in practice, the credits are haphazard and incomplete, wrongly favoring some low-emission technologies and ignoring others altogether.

14 Pomerleau and Asen, "Carbon Tax and Revenue Recycling: Revenue, Economic, and Distributional Implications."

15 Cristina Enache, "Contrary to Popular Belief, Value-Added Taxes Found to be Slightly Progressive," Tax Foundation, Aug. 13, 2020, https://www.taxfoundation.org/value-added-tax-vat-progressive/.

16 Kevin A. Hassett, Aparna Mathur, and Gilbert E. Metcalf, "The Incidence of a Carbon Tax: A Lifetime and Regional Analysis," *The Energy Journal* 30:2 (2009), https://www.jstor.org/stable/41323238. See also Aparna Mathur and Adele C. Morris, "Distributional Effects of a Carbon Tax in Broader U.S. Fiscal Reform," The Brookings Institution, Climate and Energy Discussion Paper, Dec. 14, 2012, https://www.brookings.edu/wp-content/uploads/2016/06/14-carbon-tax-fiscal-reform-morris.pdf.

17 EY, "Carbon Regulations vs. a Carbon Tax : A Comparison of the Economic Impacts," prepared for Alliance for Market Solutions, October 2018, https://amsresearch.org/wp-content/uploads/2018/10/AMS_EY-Report_Full-Report.pdf.

TABLE 1

Major Green Tax Subsidies Under Current Law

Tax Expenditure	10-Year Cost (2022-2031)
Energy Production Credit	$60.0 billion
Energy Investment Credit	$52.9 billion
Carbon Oxide Sequestration Credit	$20.1 billion
Credit for Residential Energy	$4.5 billion
Tax Credits for Clean Fuel-Burning Vehicles and Refueling Property	$4.0 billion
Advanced Nuclear Power Facilities Production Credit	$2.1 billion
Credit for Construction of New Energy-Efficient Homes	$1.6 billion
Reduced Tax Rate for Nuclear Decommissioning Funds	$1.4 billion
Other Subsidies	$1.7 billion
Total	$148.2 billion

Note: Numbers may not add exactly due to rounding. Treasury Department tax expenditures estimates do not necessarily equal the increase in federal receipts that would result from repeal. Additionally, some of the policies phase out within the budget window.

Source: Author's calculations; Office of Tax Analysis, "Tax Expenditures," U.S. Department of the Treasury, December 2021, https://home.treasury.gov/policy-issues/tax-policy/tax-expenditures.

The benefits of environmental tax subsidies tend to go to wealthy individuals, while the costs of top-down regulation fall on lower-income individuals much more than a carbon tax would.

The evidence on the environmental credits is clear. Using IRS data, economists Severin Borenstein and Lucas Davis found that since 2006, the top 20 percent of earners have received more than 60 percent of the benefits of environmental tax credits, while the bottom 60 percent have only received 10 percent of the benefits. Tax credits for electric vehicles look particularly extreme, with 90 percent of the benefits going to the top 20 percent of earners.[18]

Similarly, regulatory measures have a disproportionate impact on low-income households, both in absolute terms and relative to a carbon tax. Regulatory regimes are less efficient than carbon pricing schemes and place disproportionate burdens based on income and re gion.[19] Specific analysis of CAFE standards finds emissions standards drive up the cost of new cars, which raises demand for used cars, thus raising prices in the secondhand market and pinching the generally lower-income consumers in that market.[20] Energy efficiency standards broadly create the problem of pushing all consumers towards high upfront costs (trading lower utility bills later for a more expensive appliance now), and upfront costs are harder to manage for low-income consumers.[21]

As such, research indicates while carbon taxes in isolation tend to be slightly regressive, when compared to the policy status quo of credits and top-down regulation, they would be an improvement.[22]

18 Severin Borenstein and Lucas W. Davis, "The Distributional Effects of U.S. Clean Energy Tax Credits," *Tax Policy and the Economy* 30:1 (2016), https://www.journals.uchicago.edu/doi/full/10.1086/685597.

19 Sebastian Rausch and Valerie J. Karplus, "Markets vs. Regulation," *The Energy Journal* 35:1 (2014), https://www.jstor.org/stable/10.2307/26606202.

20 Lucas W. Davis and Christopher R. Knittel, "Are Fuel Economy Standards Regressive," *Journal of the Association of Environmental and Resource Economists* 6:51 (March 2019), https://www.journals.uchicago.edu/doi/full/10.1086/701187.

21 Arik Levinson, "Energy Efficiency Standards Are More Regressive than Energy Taxes: Theory and Evidence," *Journal of the Association of Environmental and Resource Economists* 6:51 (March 2019), https://www.journals.uchicago.edu/doi/epdf/10.1086/701186.

22 Gilbert E. Metcalf, "The Distributional Impacts of U.S. Energy Policy," *Energy Policy* 129 (June 2019), https://www.sciencedirect.com/science/article/abs/pii/S0301421519300606.

In addition to distributional advantages, carbon taxes also have efficiency advantages over regulatory policies. EY estimated the existing regulatory approach to emissions reduces long-run growth by 0.7 percent, while reducing carbon emissions by roughly 22 percent.[23] On the other hand, Tax Foundation estimates of a $50 per carbon tax in isolation found it would only reduce long-run growth by 0.4 percent (although using a different type of model).[24] Additionally, recent estimates suggest a carbon tax of around $50 would reduce emissions by between 26 and 47 percent.[25] Taken together, the carbon tax is more effective than the existing regulatory environment, while less harmful for both growth and distribution.

The Double Dividend Effect: Theory and Evidence

Another piece of the distribution puzzle is how to use the revenue a carbon tax would generate. Regulatory policy does not produce tax revenue that can be returned to taxpayers to ameliorate the burden of regulation. A carbon tax thus has what is called a "double dividend" effect.[26]

The double dividend is simple. The direct benefit of the carbon tax is lower carbon emissions, which translates to lower environmental harms in the future. The carbon tax also provides policymakers with revenue that can be used to lower taxes that are more economically harmful than a carbon tax, or alternatively, to pay for new spending that would have otherwise required raising a different, more harmful tax.

The case for the first dividend is clear. The second is more in question. A carbon tax imposes economic costs much like any other excise tax, and similar to taxes on consumption or labor income.[27] For the double dividend to happen, the tax reduced alongside the carbon tax must be more economically harmful than the carbon tax.[28] For example, a meta-analysis of carbon tax simulation studies found 55 percent of the studies showed a double dividend effect: most models that paired a carbon tax with a reduction in capital taxation found a double dividend, but the evidence was weaker for a double dividend in studies that paired a carbon tax with a labor tax reduction.[29] That trend is consistent with previous Tax Foundation analyses of carbon tax revenue recycling proposals, whichfound significant economic growth from pairing a carbon tax with a lower corporate tax rate and better cost recovery for capital investment, but a muted economic response from pairing a carbon tax with a payroll tax cut.[30]

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23 EY, "Carbon Regulations vs. a Carbon Tax : A Comparison of the Economic Impacts."

24 Tax Foundation, "Option 50: Institute a Carbon Tax" in *Options for Reforming America's Tax Code 2.0*, Apr. 19, 2021, https://www.taxfoundation.org/publications/options-for-reforming-americas-tax-code/?option=50.

25 Alexander R. Barron, Marc A. C. Hafstead, and Adele C. Morris, "Policy Insights from Comparing Carbon Pricing Modeling Scenarios," The Brookings Institution, Climate and Energy Economics Discussion Paper, May 7, 2019, https://www.brookings.edu/wp-content/uploads/2019/05/ES_20190507_Morris_CarbonPricing.pdf.

26 David Pearce, "The Role of Carbon Taxes in Adjusting to Global Warming," *The Economic Journal* 101:407 (July 1991), https://www.jstor.org/stable/2233865.

27 Pomerleau and Asen, "Carbon Tax and Revenue Recycling: Revenue, Economic, and Distributional Implications."

28 Don Fullerton and Gilbert E. Metcalf, "Environmental Taxes and the Double Dividend Hypothesis: Did You Really Expect Something for Nothing," *Chicago-Kent Law Review* 73:1 (December 1997), https://scholarship.kentlaw.iit.edu/cgi/viewcontent.cgi?article=3112&context=cklawreview.

29 Jaimee Freire-González, "Environmental Taxation and the Double Dividend Hypothesis in CGE Modelling Literature: A Critical Review," *Journal of Policy Modeling* 40:1 (January-February 2018), https://www.sciencedirect.com/science/article/pii/S0161893817301205?via%3Dihub.

30 Pomerleau and Asen, "Carbon Tax and Revenue Recycling: Revenue, Economic, and Distributional Implications."

Additionally, in practice, the revenues from carbon taxes have not usually been put into just one policy priority. One study found across existing carbon taxes, 44 percent of the revenue was used for revenue recycling (either through reducing rates or issuing rebates), while 15 percent went towards subsidies for clean energy and 28 percent went towards general government programs.[31]

Despite the challenges of assessing the double dividend effect, several examples of the effect are available. British Columbia passed a revenue-neutral carbon tax in 2008, which included marginal reductions in corporate and individual tax rates, a means-tested payment for low-income households, and a handful of smaller subsidies and programs.[32]

Over the course of its existence, the tax has sometimes been revenue-negative, and sometimes revenue-positive, and while most revenue has gone towards corporate and individual rate reductions and a broader low-income credit, some has gone towards less efficient targeted subsidies, some to green energy, but also unrelated industries like film production.[33] Analyses agree the package has reduced carbon emissions.[34] The package's impact on the economy is harder to identify, but at the very least it does not seem to have reduced growth, and perhaps marginally raised employment and growth.[35]

Europe also provides case study opportunities. Given the number of European carbon taxes and other carbon pricing schemes, and the variance between them, rigorous analysis is easier to perform.[36] A broad study of the impact of various European carbon tax experiences on economic growth find a nil to modestly positive impact on macroeconomic growth and employment.[37] Sweden's carbon tax, among the highest in Europe, has not noticeably hurt growth either.[38]

Ultimately, the double dividend effect is possible, but it is no guarantee. When thinking about what to do with the tax revenue from a carbon tax, policymakers should follow fundamental principles of sound tax reform to maximize the economic benefits of the reform and capitalize on the double dividend effect.

31 Jeremy Carl and David Fedor, "Tracking Global Carbon Revenues: A Survey of Carbon Taxes Versus Cap-and-Trade in the Real World," *Energy Policy* 96 (September 2016), https://www.sciencedirect.com/science/article/pii/S0301421516302531#. The total does not sum to 100 percent as these categories are not comprehensive, and new spending may not match the revenue generated in a given year.

32 British Columbia Ministry of Finance, "Budget and Fiscal Plan, 2013/2014 and 2015/2016," Feb. 19, 2013, https://www.bcbudget.gov.bc.ca/2013/bfp/2013_budget_fiscal_plan.pdf. See also British Columbia Government, "Climate Action Tax Credit," last updated Apr. 20, 2021, https://www2.gov.bc.ca/gov/content/taxes/income-taxes/personal/credits/climate-action.

33 Brian Murray and Nicholas Rivers, "British Columbia's Revenue-Neutral Carbon Tax: A Review of the Latest Grand Experiment in Environmental Policy," *Energy Policy* 86 (November 2015), https://www.sciencedirect.com/science/article/abs/pii/S0301421515300550.

34 Ibid.

35 Ibid. See also Akio Yamazaki, "Jobs and Climate Policy: Evidence from British Columbia's Revenue-Neutral Carbon Tax," *Journal of Environmental Economics and Management* 83 (May 2017), https://contacts.ucalgary.ca/info/econ/files/info/unitis/publications/1-7729354/Yamazaki_CarbonTax_JEEM_2017.pdf, and Akio Yamazaki, "Environmental Taxes and Productivity: Lessons from Canadian Manufacturing," *Journal of Public Economics* 205 (January 2022), https://www.sciencedirect.com/science/article/abs/pii/S0047272721001961?dgcid=raven_sd_via_email.

36 Elke Asen, "Carbon Taxes in Europe," Tax Foundation, June 3, 2021, https://www.taxfoundation.org/carbon-taxes-in-europe-2021/.

37 Gilbert E. Metcalf and James H. Stock, "Measuring the Macroeconomic Impact of Carbon Taxes," *AEA Papers and Proceedings* 110 (May 2020), https://www.aeaweb.org/articles?id=10.1257/pandp.20201081.

38 Jonsson, Ydstedt, and Asen, "Looking Back on 30 Years of Carbon Taxes in Sweden."

Modeling the Impact of Green Tax Reforms

We model three policy options for using the revenue from a carbon tax. First, expand transfer payments in some way. A common example is the carbon dividend, where each individual receives a check equal to the revenue raised divided by the number of people in the United States. Using the carbon tax to pay for a larger Child Tax Credit is also a good example.

Previous studies have estimated if just 11 percent of the tax's revenue were directed towards additional social safety net funding, it would eliminate the negative impact of the carbon tax on income earners in the bottom quintile of the earnings distribution.[39] The advantage of using carbon tax revenue for social spending is that it effectively addresses, or fully overcomes, the regressive impact of the tax—and beyond—the bottom 70 percent majority of households would see a net tax cut under a carbon-tax-and-dividend plan.

The disadvantage of putting revenue toward transfers is that takes away the opportunity for pro-growth reforms. Alternatively, a second option is to use the carbon tax to pay for full expensing of capital investment, the most pro-growth tax reform option available to policymakers, or pay for public infrastructure and R&D.

Lastly, the carbon tax could be a deficit reduction tool. As inflation, driven in large part by profligate deficit-financed spending, becomes a larger issue, and as concern about the national debt reenters the conversation, a carbon tax would be a convenient way to address both issues while working towards the policy objective of lowering carbon emissions.

Carbon taxes in practice usually end up splitting the revenue between several priorities. If enacted, it is likely the revenue would not be focused entirely on one of the three options we discuss below, but instead spread among them. Accordingly, the options we model include different combinations of the three policies to accompany a carbon tax.

Option 1: A $50 per Ton Carbon Tax Paired with Full Expensing for All Capital Investments, Small Dividend

Option 1 involves a $50 per ton carbon tax (increasing by 5 percent nominally each year) coupled with full expensing for all capital investments and a small annual transfer payment for all taxpayers of $100 ($50 for each dependent). Full expensing would include immediate deductions for R&D expenses, short-lived investments currently eligible for temporary 100 percent bonus depreciation, and long-lived assets, all on a permanent basis. We chose the dividend size to make the plan revenue-neutral over the budget window on a conventional basis.

As our modeling results show, Option 1 produces significant economic growth. Full expensing of all capital investment, which reduces the cost of capital, would significantly raise investment and productivity and offset the negative economic impact of a carbon tax. The cash payments have no long-run economic impact, as they do not change the marginal incentives to work or investment, but they do help offset the carbon tax burden, especially for the bottom 20 percent of households.

39 Mathur and Morris, "Distributional Effects of a Carbon Tax in Broader U.S. Fiscal Reform."

On a conventional basis, Option 1 is revenue-neutral over the budget window, but when considering the positive economic impact, which would boost other tax collections, it would raise $297 billion on a dynamic basis over the next decade. Beyond the budget window, Option 1 would raise $135.9 billion a year on a conventional basis and $284.7 billion on a dynamic basis in the long run. The higher long-run revenue is because the cost of full expensing is frontloaded, while revenues from the carbon tax are roughly steady (emissions fall but the rate increases).

TABLE 2

Economic Effects of a $50 per Ton Carbon Tax Paired with Full Expensing for Capital Investments, Dividend of $100

GDP	+1.8%
GNP	+1.9%
Capital Stock	+3.8%
Wage Rate	+1.8%
10-Year Conventional Revenue	+$0.9 billion
10-Year Dynamic Revenue	+$297.0 billion
Long-run Annual Revenue, Conventional (in 2022 dollars)	+$135.9 billion
Long-run Annual Revenue, Dynamic (in 2022 dollars)	+$284.7 billion
Full-Time Equivalent Jobs	+122,000

Source: Taxes and Growth Model, May 2022

TABLE 3

The Distributional Effects of a $50 per Ton Carbon Tax Paired with Full Expensing for Capital Investments, Dividend of $100

Income Group	Long-run Conventional	Long-run Dynamic
0% - 20.0%	+0.5%	+1.9%
20.0% - 40.0%	-0.1%	+1.4%
40.0% - 60.0%	-0.3%	+1.2%
60.0% - 80.0%	-0.3%	+1.1%
80.0% - 100%	+0.2%	+1.8%
80.0% - 90.0%	-0.3%	+1.1%
90.0% - 95.0%	-0.3%	+1.2%
95.0% - 99.0%	+0.1%	+1.6%
99.0% - 100%	+1.3%	+3.1%
TOTAL	**Less than +0.05%**	**+1.5%**

Source: Taxes and Growth Model, May 2022

Option 2: a $50 per Ton Carbon Tax Paired with Expensing for R&D/Bonus, Larger Dividend per Month

Option 2 would introduce a carbon tax of $50 per ton (increasing by 5 percent nominally per year) and improve cost recovery by allowing immediate deductibility for R&D expenses and making 100 percent bonus depreciation for short-lived investment permanent instead of allowing it to phase out from 2022 through 2026. It would also include an annual rebate of $445 per taxpayer, with $222.50 per dependent. Option 2 is revenue-neutral over the budget window on a conventional basis.

The improvements to R&D and short-lived investment costs would lower the cost of capital, incentivizing investment and growth and preventing the package from reducing economic output. The full-time equivalent jobs estimate falls as a carbon tax reduces the returns to work, but wages would rise as increased investment drives productivity growth. The economic boost is smaller than in Option 1 because Option 2 does not improve cost recovery for long-lived assets. The larger rebate has no effect on economic output in the long run, as it does not change incentives to work and invest, but it would help increase after-tax income for the bottom four quintiles—including a disproportionately large increase for the bottom 20 percent of taxpayers.

Option 2 is revenue-neutral on a conventional basis over the 10-year budget window but loses nearly $138 billion on a dynamic basis because the economic boost of improved cost recovery does not occur until the latter half of the budget window, while the economic drag of a carbon tax kicks in immediately. As a result, GDP would shrink in the short term, thus reducing other tax revenues on a dynamic basis within the 10-year budget window. Over the long run, revenue would increase by $62.8 billion yearly on a conventional basis and $72.3 billion on a dynamic basis.

TABLE 4

Economic Effects of Carbon Tax Paired with Expensing for R&D/ Bonus, Dividend of $445

GDP	+0.2%
GNP	+0.1%
Capital Stock	+0.7%
Wage Rate	+0.5%
10-Year Conventional Revenue	-$2.1 billion
10-Year Dynamic Revenue	-$137.5 billion
Long-run Annual Revenue, Conventional (in 2022 dollars)	+$62.8 billion
Long-run Annual Revenue, Dynamic (in 2022 dollars)	+$72.3 billion
Full-Time Equivalent Jobs	-191,000

Source: Taxes and Growth Model, May 2022

TABLE 5

The Distributional Effects of Carbon Tax Paired with Expensing for R&D/Bonus, Dividend of $445

Income Group	Long-run Conventional	Long-run Dynamic
0% - 20.0%	+4.2%	+4.3%
20.0% - 40.0%	+1.4%	+1.5%
40.0% - 60.0%	+0.6%	+0.7%
60.0% - 80.0%	+0.2%	+0.3%
80.0% - 100%	-0.1%	+0.1%
80.0% - 90.0%	Less than +0.05%	+0.1%
90.0% - 95.0%	-0.2%	Less than -0.05%
95.0% - 99.0%	-0.2%	-0.1%
99.0% - 100%	Less than -0.05%	+0.2%
TOTAL	**+0.3%**	**+0.5%**

Source: Taxes and Growth Model, May 2022

Option 3: A $50 per Ton Carbon Tax Paired with Expensing for R&D/Bonus, Deficit Reduction

Option 3 would pair a carbon tax with full expensing for R&D investment and permanence for 100 percent bonus depreciation. It excludes a taxpayer rebate and instead uses the excess revenue for deficit reduction.

Option 3 would have roughly the same GDP and employment effects as Option 2 because the policies changing economic incentives (namely, the carbon tax, expensing for R&D investment, and permanence for bonus depreciation) are the same. Option 3 would increase GNP by more than it would increase GDP as interest payments on the debt fall due to deficit reduction. The 10-year dynamic revenue is lower than the conventional revenue for the same reasons discussed in Option 2. The combination of policies raises significant revenue, especially after the short-term revenue cost of 100 percent bonus depreciation and expensing for R&D investment phase down. In the long run, Option 3 would raise $258 billion yearly on a conventional basis and $267.5 billion on a dynamic basis. The net impact on taxpayer incomes, however, is regressive.

TABLE 6

Economic Effects of $50 per Ton Carbon Tax Paired with Expensing for R&D/Bonus, Deficit Reduction

GDP	+0.2%
GNP	+0.6%
Capital Stock	+0.7%
Wage Rate	+0.5%
10-Year Conventional Revenue	$1,412.7 billion
10-Year Dynamic Revenue	$1,286.8 billion
Long-run Annual Revenue, Conventional (in 2022 dollars)	+$258.0 billion
Long-run Annual Revenue, Dynamic (in 2022 dollars)	+$267.5 billion
Full-Time Equivalent Jobs	-191,000

Source: Taxes and Growth Model, May 2022

TABLE 7

Distributional Effects of $50 per Ton Carbon Tax Paired with Expensing for R&D/Bonus, Deficit Reduction

Income Group	Long-run Conventional	Long-run Dynamic
0% - 20.0%	-0.8%	-0.7%
20.0% - 40.0%	-0.8%	-0.7%
40.0% - 60.0%	-0.8%	-0.7%
60.0% - 80.0%	-0.7%	-0.6%
80.0% - 100%	-0.5%	-0.3%
80.0% - 90.0%	-0.7%	-0.6%
90.0% - 95.0%	-0.7%	-0.5%
95.0% - 99.0%	-0.6%	-0.4%
99.0% - 100%	-0.1%	+0.2%
TOTAL	**-0.6%**	**-0.5%**

Source: Taxes and Growth Model, May 2022

A Few Notes on Modeling

We measure the distributional impact of a carbon tax as equivalent to a value-added tax, or VAT, which are broad taxes on consumption. Some research suggests the distribution of carbon emissions is more concentrated among low-income households than consumption is, which would suggest a carbon tax is slightly more regressive than we have modeled.[40] Conversely, the revenue cost of full expensing is frontloaded, heavily concentrated in earlier years, while carbon tax revenue is relatively stable (the tax base, emissions, shrinks, while the tax rate increases). Outside of the budget window, the packages would raise more revenue, thus allowing for larger transfer payments and further mitigating the regressive impact of the tax.

Additionally, the policies we modeled are optimized, designed to get the best bang for the buck for various policy goals. A carbon tax paired with less efficient revenue-recycling options would lead to less favorable results.

Lastly, full expensing for capital investments could enhance the efficacy of carbon taxes in reducing emissions.[41] In the case of energy efficiency investments, under current law, operating costs, like energy bills, are deducted immediately, but the purchase of new capital is not always fully deductible. As a result, the tax code is biased in favor of relatively less efficient capital goods with lower upfront investment costs but higher energy costs and emissions, and biased against relatively efficient capital goods with higher upfront investment costs but lower energy costs and therefore emissions.[42]

The model results come from the May 2022 version of Tax Foundation's General Equilibrium Model, and does not incorporate the Congressional Budget Office's newest baseline forecast.

40 Corbett A. Grainger and Charles D. Kolstad, "Who Pays a Price on Carbon," *Environmental Resource Economics* 46 (2010), https://link.springer.com/content/pdf/10.1007/s10640-010-9345-x.pdf.

41 Alex Muresianu, "How Expensing for Capital Investment Can Accelerate the Transition to a Cleaner Economy," Tax Foundation, Jan. 12, 2021, https://www.taxfoundation.org/energy-efficiency-climate-change-tax-policy/.

42 Marilyn A. Brown and Sharon (Jess) Chandler, "Governing Confusion: How Statutes, Fiscal Policy, and Regulations Impede Green Energy Technologies," *Stanford Law and Policy Review* 19:3 (Summer 2008), https://smartech.gatech.edu/bitstream/handle/1853/23053/wp28.pdf.

Conclusion

Economic theory suggests carbon taxes are no-brainers, but implementation comes with practical concerns. The concerns, most prominently, the disproportionate impact on low-income households and the drag on growth, can be addressed on two levels. The first is by comparing a carbon tax to the existing policy regime, which is, if anything, less distributionally friendly than a carbon tax, and less efficient. The second is by considering revenue recycling options—the revenue a carbon tax would raise could effectively counteract both growth and distribution concerns, with room to spare, if used effectively.

The key, then, is effective design. The implementation of a carbon tax is full of uncertainties—including, but not limited to, how the tax is structured and how the revenue is used. A carbon tax should cover a broad set of emissions, rather than targeting only certain polluting activity. Additionally, the tax should be a substitute for existing regulations, particularly if the tax rate is set at a high level. And lastly, the benefits of revenue recycling will vary according to which taxes are used as offsets.

Carbon taxes can work, but design matters, and must be taken seriously.