Carbon Taxes, Trade, and American Competitiveness

Key Findings

- Carbon leakage occurs when a climate policy in one jurisdiction leads to emissions-producing activity simply shifting to a different jurisdiction.

- Leakage raises both environmental concerns—as it undermines emissions reduction efforts—and economic concerns.

- In the aggregate, leakage is relatively small, but it could have an outsized impact on specific emissions-intensive, trade-exposed (EITE) industries.

- Using a border adjustment to make a carbon tax based on consumption, rather than production, can help address this problem.

- However, measuring the carbon content of imported goods is challenging. This underscores the need to pair carbon taxes with strong domestic tax reforms.

- Pro-growth policies like expensing for R&D investment and permanence for 100 percent bonus depreciation would at least mitigate a carbon tax's impact on manufacturing and other critical industries.
Introduction

Economists tend to favor carbon taxes as an ideal policy solution to address climate change.¹ By making the market reflect the social costs of carbon emissions, such a tax would incentivize emissions reduction and innovation, without creating a specific bias for or against different technologies.

But how carbon taxes interact with a globalized economy is more complicated. For one, it is possible that a carbon tax enacted only in America could merely move polluting activity abroad rather than drive down the overall level of carbon emissions.

Furthermore, increased geopolitical tensions with China and supply chain disruptions associated with both the COVID-19 pandemic and the Russian invasion of Ukraine have increased interest in bringing manufacturing operations, particularly in high-tech or strategically important industries, back to the United States.² In that context, a carbon tax could hinder the development, or redevelopment, of the domestic manufacturing base in industries that are both strategically important and energy-intensive.

There are ways to design a carbon tax to address these issues. A border-adjusted carbon tax that uses some of the revenue for pro-investment tax reform could solve these problems and even make the U.S. more competitive than under the status quo. However, not all carbon tax packages are the same; some could harm U.S. competitiveness. The way revenue gets used and the way the tax approaches imports and exports are both consequential.

Environmental Policy and Leakages

One common concern throughout environmental policy is carbon leakage—where a policy designed to reduce domestic emissions ends up increasing carbon emissions in the rest of the world, resulting in a smaller net reduction in global emissions. Carbon leakage undercuts the end goal of the policy change.

The economic literature generally suggests the total impact of emissions reduction policy on global competitiveness is harmful but small.³ Models of the imposition of a carbon tax on manufacturing industries suggest only a sixth of the reduction in output would be due to shifting operations abroad.⁴ There is a limited share of emissions around the world embedded in global trade, and in large economies like the United States, the vast majority of emissions from domestic consumption tend to come from domestic production.⁵

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Nonetheless, leakages remain an issue to be minimized, for several reasons. Leakage, even if moderate, still undermines the efficacy of an environmental policy (carbon taxes included). Leakage also means costs for American industry and employment, which may be small for the economy in the aggregate but large for specific regions or industries, in particular manufacturing.6

There are several kinds of carbon leakage.7 The first, and most politically salient, is the competition channel: carbon taxes raise production costs in the jurisdiction in which they are implemented, leading companies to outsource production to other jurisdictions without a carbon tax or significant environmental regulations. There is also the energy market channel where, by reducing demand for fossil fuels domestically, a domestic carbon tax marginally reduces worldwide demand for fossil fuels, thus lowering global fossil fuel prices and leading to increased use of fossil fuels in unregulated jurisdictions.

There is also potential for beneficial leakage—when the tax in one jurisdiction leads to emissions reductions in other, untaxed jurisdictions. Technology spillovers are one example: a carbon tax could lead to the development of new low-emission technology, which then becomes viable even in markets without carbon pricing. While this leakage is difficult to trace, induced innovation from higher energy prices is well-documented.8 These effects take many years to become significant, so even if moderate levels of induced technological innovation and diffusion produced net negative carbon leakage, this type of leakage is less relevant when considering the immediate impacts of a policy.9

Reductions in foreign emissions could also occur through income effects and the terms of trade, though this effect is believed to be small.10 As a carbon tax reduces income domestically, domestic demand for foreign products falls, which then translates to reduced incomes abroad and therefore lower emissions.11 This effect is likely small, and its relevance to policymaking is weak for several reasons. First, the reduction in foreign emissions from this channel is likely dwarfed by the increase in foreign emissions from the competitiveness channel. Second, domestic carbon tax revenue does not disappear: if that revenue is recycled well, a carbon tax does not mean a reduction in domestic income.12

The most important channel from an economic policy perspective is the competitiveness channel. The size of the competitive disadvantage that emissions policy creates is a major topic of debate.

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10 Ibid.


There is strong evidence that carbon taxes are not especially harmful to the economy in the aggregate when looking at total employment or economic growth. The evidence for the impact of a carbon tax on the manufacturing sector is mixed. Analysis of British Columbia's revenue-neutral carbon tax found the reform raised employment in the aggregate, but also shifted employment away from trade-intensive and emissions-intensive industries and towards service industries.

Now, manufacturing employment should not be the first measure of the manufacturing sector's strength, especially for wealthy and developed economies. Productivity growth and automation mean that manufacturing output can stay flat or even grow, even as manufacturing employment declines. Singapore is one example of a high-income country whose manufacturing sector's share of the workforce has declined, even as manufacturing output has grown not only in absolute terms but also as a share of the country's GDP. In British Columbia, on the other hand, the decline in manufacturing employment mostly reflected lower sectoral output.

A look at the impact of the United Kingdom's carbon tax on the country's manufacturing sector found that it did not drive employment losses or plant closures, even though it significantly reduced energy intensity and electricity use. However, given Britain's rapid rate of deindustrialization preceding the carbon tax's introduction (even when compared to other wealthy, developed Western countries), it is perhaps a less convincing example of a manufacturing sector thriving under a carbon tax.

**Border Adjustments: The Solution?**

A carbon tax with a border adjustment means a tax on U.S. carbon consumption, rather than production, that is neutral between domestic and imported goods. In this case, that would mean placing a tax on the carbon content of imports (consumed domestically), while exempting the carbon content of exports (not consumed domestically). This is not a tariff, as it is neutral between domestic- and internationally-produced consumption.

All goods can be split into four categories: goods produced domestically and consumed domestically, goods produced domestically and consumed abroad (exports), goods produced abroad and consumed domestically (imports), and goods produced abroad and consumed abroad.
Consider a basic carbon tax on all carbon emissions in the United States. This would tax emissions from two categories of goods: goods produced and consumed domestically, and exports. However, the emissions from imports go untaxed under this example. As a result, domestic producers face a disadvantage in both the domestic and global markets: domestic goods are taxed while foreign goods are not.

**TABLE 1.** Carbon Tax with No Border Adjustment Disadvantages Domestic Production

<table>
<thead>
<tr>
<th></th>
<th>Produced Domestically</th>
<th>Produced Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumed Domestically</td>
<td>Taxed</td>
<td>Not Taxed</td>
</tr>
<tr>
<td>Consumed Abroad</td>
<td>Taxed</td>
<td>N/A</td>
</tr>
</tbody>
</table>


This problem can be solved with a border adjustment. Under the border adjustment, companies receive rebates for taxes on emissions involved in the production of exports, while imported goods face a tax on their carbon contents. As a result, the tax base shifts from domestic production to domestic consumption.

**TABLE 2.** Carbon Tax with Border Adjustment Treats Domestic and International Production Equally

<table>
<thead>
<tr>
<th></th>
<th>Produced Domestically</th>
<th>Produced Abroad</th>
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</thead>
<tbody>
<tr>
<td>Consumed Domestically</td>
<td>Taxed</td>
<td>Taxed</td>
</tr>
<tr>
<td>Consumed Abroad</td>
<td>Not Taxed</td>
<td>N/A</td>
</tr>
</tbody>
</table>


Importantly, though a border adjustment interacts with trade policy, it is not analogous to protectionist measures countries often implement. It creates a level playing field for foreign-produced and domestic-produced goods in both foreign and domestic markets. In domestic markets, both domestic-produced goods and foreign-produced goods face a tax, while in foreign markets, neither domestic-produced goods nor foreign-produced goods do.

While not itself trade policy, a border-adjusted carbon tax would avoid the problems created by some forms of climate regulation. Many regulations, such as clean energy production standards, cannot easily be border-adjusted. Consider an American car factory, powered by a more expensive, yet cleaner plant. The cars that the factory produces must compete with cars built in coal-fueled factories in China. But there’s no direct mechanism to adjust for that environmental difference on a purely regulatory basis.

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Policymakers on both sides of the aisle have considered a carbon tariff. Often called a polluter import fee or (erroneously) a border adjustment, this policy would tax carbon-intensive imports, without a corresponding domestic carbon price.

**TABLE 3.**
A Carbon Tariff with No Domestic Carbon Price Is Not a True Border Adjustment

<table>
<thead>
<tr>
<th>Produced Domestically</th>
<th>Produced Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumed Domestically</td>
<td>Not Taxed</td>
</tr>
<tr>
<td></td>
<td>Taxed</td>
</tr>
<tr>
<td>Consumed Abroad</td>
<td>Not Taxed</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>


Some advocates of this idea contend that there are ways to establish an equivalence between non-tax climate policies implemented domestically and a tax applied on imported goods. There are a few pitfalls of this idea: establishing a price equivalent for domestic carbon regulations is difficult, particularly when states and even localities have their own separate sets of emissions regulation. Without a true domestic carbon price, it could run afoul of international trade rules.

Lastly, even when counting existing emissions regulation as a domestic price, the tariff does not constitute a true border adjustment because it does not provide a rebate for exporters. Instead, it would be equivalent to a carbon tax with a tariff.

**TABLE 4.**
A Domestic Carbon Tax and Tariff without an Export Rebate Still Disadvantages Domestic Producers

<table>
<thead>
<tr>
<th>Produced Domestically</th>
<th>Produced Abroad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumed Domestically</td>
<td>Taxed</td>
</tr>
<tr>
<td></td>
<td>Taxed</td>
</tr>
<tr>
<td>Consumed Abroad</td>
<td>Taxed</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>


Despite putting a tax on imports, this policy mix would still put domestic producers at a disadvantage. While in the domestic market, both domestic and imported goods are taxed equally. But in foreign markets, American exports still face the tax, while foreign-produced goods do not.

In theory, border adjustments eliminate concerns about leakages due to a carbon tax. However, the process of determining the carbon content of imports poses practical concerns.

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Benefits and Challenges of a Border Adjustment

Reducing Leakage

An overview of several analyses of the impacts of a border carbon adjustment found an average effect of reducing leakage rates by a third, from 12 percent of the reduction in domestic emissions to only 8 percent. Another meta-analysis of 25 studies found that carbon leakages go from an average of 14 percent without a border adjustment to an average of 6 percent with a border adjustment.

Other estimates have shown about a 50 percent reduction in leakage rate, with some finding a full elimination of leakage. Furthermore, border adjustments are shown to be much more efficient at reducing leakage than other add-ons to a carbon tax, such as output-based allocation or exemptions for specific energy-intensive industries. However, a border adjustment alone likely does not fully prevent leakages.

Improvement Over Current Regulations

A border-adjusted carbon tax would also treat American industries better than regulatory approaches do on the international stage. The border adjustment is not a trade policy, as it’s neutral in both domestic and foreign markets regarding a product’s origin, and constitutes an improvement over how most regulations currently handle this issue.

Consider a U.S. widget factory that uses electricity from a renewable energy facility due to state-level power sector regulations. A Chinese factory making the same widget uses cheaper coal-generated electricity. In both domestic and foreign markets, the U.S.-produced widget bears the cost of the regulation. But with a border-adjusted carbon tax, both goods are taxed in the domestic market and neither are taxed in foreign markets.

The U.S. economy is much less carbon-intensive than many of its trade partners—which, in the context of the carbon tax debate, is sometimes termed America’s “carbon advantage.” However, it would be a mistake to think of a border adjustment as a way to advantage American industry. A border adjustment is neutral towards American industry, which is an improvement over a regulatory status quo that disadvantages American industry.

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Measuring Import Contents


Consider the chemical industry. According to a recent analysis, the Chinese chemical and pharmaceutical products industry is about 2.6 times as carbon-intensive as the U.S. chemical and pharmaceutical products industry.\footnote{Catrina Rorke, "The U.S. Carbon Advantage in Chemicals Manufacturing," Climate Leadership Council, Sep. 13, 2022, \url{https://clcouncil.org/reports/chemicals_advantage.pdf}.}

Tracking the carbon emissions of domestic chemical firms is relatively straightforward. This means the tax hits all domestic carbon dioxide emissions from the chemical industry at the same rate of $50 per ton. But for foreign firms, U.S. tax authorities would have to choose some approximation for estimating the emissions from imported chemicals from China.

One option would be to tax Chinese chemical imports based on how carbon-intensive the Chinese chemical industry is overall. If the Chinese chemical industry is 2.6 times as carbon-intensive as the U.S. chemical industry, then the taxes levied on imported Chinese chemical goods should be 2.6 times as high, meaning that the tax rate per ton of emissions is the same.

However, the Chinese chemical industry is not homogenous. Some firms are more carbon-intensive than others within the industry, so taxing imports based on the average carbon intensity of the sector means some Chinese chemical imports (namely, less carbon-intensive ones) will face a higher per-ton carbon tax than domestic goods, while the more carbon-intensive imports will face a lower per-ton carbon tax.

The approach of taxing imports at the same rate as the average equivalent domestic product also clearly falls short. In this example, where the Chinese imports are 2.6 times as carbon-intensive as domestic goods, they would effectively be taxed at an average rate of $19.2 per ton of emissions, relative to the $50 per ton emissions tax faced by domestics. Heterogeneity within importing firms would also be a problem in this circumstance, as the tax would not reflect firm-level emissions, effectively leading to comparatively fewer emission-intensive Chinese firms paying higher taxes per ton of emissions than comparatively more emission-intensive ones.
However, excluding the border adjustment issue, a carbon tax would have low administrative and compliance costs per dollar of revenue raised when compared to other taxes, especially the individual income tax. A carbon tax is similar to excise and consumption taxes, which are comparatively easy to collect. Value-added taxes, for example, raise a lot of revenue relative to their administrative costs, and they include a mechanism for exempting exports and including imports. So, even if developing more advanced ways to track foreign emissions could be difficult and expensive, the carbon tax could still be less expensive from an administrative and compliance perspective than, say, the personal income tax.

**WTO Compliance**

A carbon border adjustment exists in a gray area regarding international trade rules. World Trade Organization (WTO) conventions allow border adjustments if they impose the same taxes on imported and domestic goods. The point of uncertainty is whether a border adjustment based on carbon emissions constitutes the “same” taxes—in other words, if a border adjustment tax that placed higher burdens on more carbon-intensive imports would violate the rules. There is also a possible exemption to the WTO rules for environmental issues, but the use of this exemption is controversial.

**Reducing Emissions Abroad**

There is a deeper critique of carbon taxes in international markets that goes beyond leakage—namely that the U.S., though responsible for substantial emissions, is a comparatively small part of the global total. Therefore, an approach that focuses on U.S. emissions (like the carbon tax) will be inadequate and not worth its costs.

In response, some border adjustment advocates note that U.S. climate action, in collaboration with the European Union and other developed economies, can help pressure countries like China. However, while a border adjustment would keep a level playing field between American and foreign producers in both domestic and foreign markets, it would only have a marginal impact on foreign emissions, because even in countries like China, exports (not to mention exports to the United States alone) are a relatively small part of their emissions profile. The stronger potential for a domestic carbon tax to reduce emissions abroad is through the development of new low-emissions technology that is then later adopted abroad.

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Case Study: EU’s ETS and CBAM

In 2005, the EU implemented a domestic carbon pricing mechanism called the Emissions Trading System (ETS). This cap-and-trade mechanism sets a cap on the amount of emissions that firms are allowed to expel. The market price of carbon is then set by “cleaner” firms trading allowances to more carbon-intensive firms. Free allowances are given to EU operators with a risk of carbon leakage to reduce the ETS compliance costs. These allowances are designed to help EU operators remain competitive with producers based in other countries.

The EU has been developing a carbon border adjustment mechanism, abbreviated as CBAM. CBAM is designed to complement the ETS by placing a carbon price on certain imports into the EU from third countries such as Russia or the United States that do not tax carbon at an EU-approved level. The EU’s stated goal is to maintain the competitiveness of European producers relative to foreign producers and prevent “carbon leakage.”

The price of the border adjustment would be calculated based on the weekly average price of ETS auctions. By doing so, the price foreign producers would pay for carbon emissions would equal the price European producers pay without the administrative burden of daily calculations. CBAM will also replace free ETS allowances for EU producers after a phase-out period. The European Commission estimates CBAM revenues will be around 1 billion euros per year from 2026-2030. During the transition and information-gathering phase from 2023-2025, CBAM is not expected to raise revenue.

Currently, the Council of the European Union and the European Parliament are negotiating an amended version of the Commission’s original proposal which is likely to conclude by the end of 2022. Three key differences could affect the tax base, administrative burden, and total carbon leakage.

First, the Commission’s proposal covers five products; iron and steel, cement, fertilizer, aluminum, and electricity generation. The Commission believes this limited tax base represents the five products that are most at risk of carbon leakage. The Council supported this tax base in its adopted policy position. However, the European Parliament’s version expands the scope by including products made from organic chemicals, plastics, hydrogen, and ammonia. Furthermore, it expands the scope to include “indirect emissions” (emissions of the electricity used during the production process of the in-scope products).

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Second, the Commission’s proposal does not include export rebates for products made in the EU that are consumed abroad. The European Parliament proposed an amendment to continue giving EU producers free allocations under the ETS for products destined for export to developing countries without carbon pricing mechanisms similar to the ETS. In essence, this proposal would use the ETS to give EU operators an export rebate. The Council has yet to take a position on the idea, and it is unclear if the EU would be WTO-compliant with this policy.

Third, the Commission proposed that CBAM administration should be done at the Member State level. The European Parliament proposed the creation of a separate “CBAM Authority” at the EU level, rather than having authorities in each Member State. The Council proposed to create a central EU registry of CBAM declarants, rather than every national authority having its own register, but still with a separate authority in each Member State.

The Commission’s position represents a carbon tax with a border tariff and limited base because it does not have a mechanism to rebate EU exporters for products consumed abroad. It also only covers five main products. This would likely lead to more carbon leakage by EU producers moving their production abroad to jurisdictions with less carbon taxation.

The Council’s position also has a limited base and does not include an export rebate for EU producers. Administratively, the Council tries to have some parts at the Member State level and some at the EU level. It is unclear how burdensome this would be for producers.

The Parliament’s position has a broader base, includes a backdoor export rebate, and streamlines the administration at the EU level. However, by including indirect emissions in the calculation, the position could increase the administrative burden. Theoretically, leakage should be limited under this position because exports are rebated.

One important aspect that could significantly impact the United States is when CBAM adjustment applies. The EU has said that the border adjustment will not apply to imported products where the foreign producer has already paid an equivalent carbon tax. It is not clear, however, what criteria will be used to determine equivalency and what authority will ultimately decide if an American state or federal carbon tax is sufficient.

**Revenue Recycling and Sector-by-Sector Impacts**

Border adjustments are good policy, but they do not fully neutralize competitiveness issues, especially in the watered-down versions that would be administratively feasible. This re-emphasizes the importance of revenue recycling in the economic performance of a carbon tax.
Proponents of a carbon tax often point to the idea of the double dividend effect of a carbon tax—it can create both environmental benefits in the long run, as well as economic benefits in the short run as the revenue can be used to reduce other, more distortionary taxes. This concept usually refers to the impact of a carbon tax and accompanying tax reductions across the economy as a whole.\(^{50}\)

As Tax Foundation's Taxes and Growth model found, a carbon tax and expensing for capital investment could be a potent combination.\(^{51}\) We paired permanence for 100 percent bonus depreciation for equipment and the restoration of expensing for research and development (R&D) investment with a $50 carbon tax in two different packages (one more focused on cash transfer payments and the other focused on deficit reduction). On net, both packages had a net positive impact on economic growth and left revenue to spare for other priorities.

However, it's possible to apply a similar framework to a carbon tax and revenue recycling's impact on specific industries. Existing research is mixed on the potential for this effect.\(^{52}\) Research from economist Gilbert Metcalf has shown pairing a carbon tax with reductions in capital taxation can support manufacturing, as manufacturing’s relative capital intensity means broad reductions in taxes on investment benefit it more.\(^{53}\) When pairing a $20 per ton carbon tax with a 10 percent investment tax credit (which would take a relatively small portion of the revenue generated), around a third of manufacturing industries would see a tax cut. When carbon tax revenue was paired with a corporate rate cut of equal size, manufacturing as a whole saw a tax cut. Notably, this approach is much more beneficial to manufacturing than using the revenue for payroll tax reductions.\(^{54}\)

While Tax Foundation’s model cannot currently model a carbon tax on an industry-by-industry basis, we can compare what other studies have found regarding the carbon tax’s impact across industries with our modeling of how possible revenue recycling options would impact different industries.

For example, an EY study in 2018 considered the impact of a carbon tax across sectors, finding that the carbon tax raised costs the most for electric power generation, with transportation and manufacturing sectors lagging well behind.\(^{55}\)

We can compare these results to our sector-level analysis of revenue recycling options, namely permanence for 100 percent bonus depreciation for equipment and machinery (which will otherwise begin to phase out in 2023) and reverting to expensing for research and development investment (whereas starting this year, companies are required to amortize R&D spending over five years).\(^{56}\)

\(^{50}\) Muresianu and Li, “Carbon Taxes and the Future of Green Tax Reform.”

\(^{51}\) Muresianu and Li, “Carbon Taxes and the Future of Green Tax Reform.”


\(^{54}\) Ibid.


The analysis looks at three different years because the relative benefits of these policies vary. In 2023, shifting from R&D amortization over five years to expensing is a larger improvement than keeping 100 percent bonus depreciation permanent because, under current law, companies will still be able to immediately deduct 80 percent of their investments in equipment. As such, industries that invest more in R&D relative to equipment benefit more.

Conversely, in 2026, permanence for bonus depreciation provides a larger benefit than expensing for R&D, because in 2026 bonus depreciation is expected to phase out entirely. In 2032, meanwhile, the tax reductions from both policies shrink in scale, as the revenue cost is frontloaded.\(^57\)

These results reveal that some of the industries with large increases in production costs would also benefit significantly from expensing for R&D and bonus depreciation permanence. In particular, utilities (including electric power generation) would see a substantial tax cut under these two tax cuts enacted in concert, as would manufacturing and transportation.

We cannot combine the EY and Tax Foundation analyses for a final net impact of these policies if implemented together. The EY paper looks at industry production costs, while the Tax Foundation model looks at tax liability. Furthermore, while the EY model assumes 100 percent of the burden of the carbon tax is passed on to consumers (as does the Tax Foundation’s modeling of a carbon tax), a small portion of the tax is borne by producers.\(^58\) As such, we cannot extrapolate how much the producers themselves (rather than their consumers) will be hurt, and how that compares to the benefits they would receive from expensing for R&D and permanence for bonus depreciation. But we can see that many of the industries that would see the largest cost increases under a carbon tax would also see significant tax reductions from revenue recycling options focused on R&D and equipment investment.

**Conclusion**

Carbon taxes are an efficient way to reduce carbon emissions but create several challenges in a globalized economy. Leakage, or the offshoring of carbon-intensive economic activity, is chief among them. Imposing a carbon tax on domestic consumption with a carbon border adjustment—by exempting emissions involved in the production of American exports and taxing the emissions content of imports—can address leakage issues, though measuring emissions from imports poses administrative and legal challenges.

A border adjustment mechanism in practice would be imperfect. This underscores the importance of recycling carbon tax revenue for pro-growth tax reform, such as making 100 percent bonus depreciation permanent and canceling R&D amortization, that further helps the U.S. economy stay competitive.

**Acknowledgments**

Thank you to Cody Kallen for providing the industry modeling for this project.

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57 Ibid.

APPENDIX A:
Industry Composition for EY and Tax Foundation Analysis

<table>
<thead>
<tr>
<th>EY Sectors</th>
<th>Corresponding NAICS Codes</th>
<th>Tax Foundation Sectors</th>
<th>Corresponding NAICS Codes</th>
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<tbody>
<tr>
<td>Electric Power Generation</td>
<td>Electric power generation components of 22</td>
<td>Information</td>
<td>51</td>
</tr>
<tr>
<td>Transportation</td>
<td>48-49</td>
<td>Utilities and Agriculture</td>
<td>11, 22</td>
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<tr>
<td>Manufacturing</td>
<td>31-33</td>
<td>Professional, Scientific, and Technical Services</td>
<td>54</td>
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<tr>
<td>Agriculture, Mining, and Construction</td>
<td>11, 21, 23</td>
<td>Real Estate, Rental, and Leasing</td>
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<td>Finance, Insurance, Real Estate, and Rental and Leasing</td>
<td>52-53</td>
<td>Transportation</td>
<td>48-49</td>
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<td>Wholesale and Retail Trade Services</td>
<td>42, 44-45</td>
<td>Manufacturing</td>
<td>31-33</td>
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<tr>
<td>Information and Other Utilities</td>
<td>51, Non-electric power generation components of 22</td>
<td>Administrative and Waste Management Services</td>
<td>56</td>
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<td></td>
<td></td>
<td>Accommodation and Food Services</td>
<td>72</td>
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<td>Retail Trade</td>
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<td>Mining</td>
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<td>Finance, Insurance, and Management Services</td>
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<td>Construction</td>
<td>23</td>
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<tr>
<td></td>
<td></td>
<td>Miscellaneous Services (Education, Health, Other)</td>
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APPENDIX B:
Reduction in Tax Liability by Industry Group under Permanence for Bonus Depreciation and Return to R&D Expensing by Industry

<table>
<thead>
<tr>
<th>Bonus and R&amp;D Expensing Total Percent Reduction in Tax Liability</th>
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<th>2026</th>
<th>2032</th>
<th>Average</th>
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</thead>
<tbody>
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<td>Information</td>
<td>41.02%</td>
<td>56.6%</td>
<td>35.04%</td>
<td>44.23%</td>
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<tr>
<td>Utilities and Agriculture</td>
<td>24.73%</td>
<td>53.6%</td>
<td>42.37%</td>
<td>40.22%</td>
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<tr>
<td>Professional, Scientific, and Technical Services</td>
<td>35.97%</td>
<td>34.6%</td>
<td>12.02%</td>
<td>27.54%</td>
</tr>
<tr>
<td>Real Estate, Rental, and Leasing</td>
<td>20.32%</td>
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<td>Transportation</td>
<td>14.40%</td>
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<tr>
<td>Manufacturing</td>
<td>27.49%</td>
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<tr>
<td>Wholesale Trade</td>
<td>10.44%</td>
<td>15.4%</td>
<td>4.39%</td>
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<td>Administrative and Waste Management Services</td>
<td>7.19%</td>
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<td>Accommodation and Food Services</td>
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<tr>
<td>Mining</td>
<td>5.24%</td>
<td>10.3%</td>
<td>2.57%</td>
<td>6.03%</td>
</tr>
<tr>
<td>Finance, Insurance, and Management Services</td>
<td>4.08%</td>
<td>7.9%</td>
<td>1.97%</td>
<td>4.67%</td>
</tr>
<tr>
<td>Construction</td>
<td>5.04%</td>
<td>6.8%</td>
<td>1.47%</td>
<td>4.43%</td>
</tr>
<tr>
<td>Miscellaneous Services (Education, Health, Other)</td>
<td>3.86%</td>
<td>6.5%</td>
<td>2.05%</td>
<td>4.13%</td>
</tr>
</tbody>
</table>

Note: These numbers represent the percent reduction in tax liability when 100 percent bonus depreciation and expensing for R&D investment are kept and restored, respectively, relative to tax liability expected under current law.

Source: Tax Foundation Taxes and Growth Model, October 2022.