CLIMATE LEADERSHIP COUNCIL

THE CASE FOR AN ECONOMY-WIDE CARBON FEE

Carbon pricing policies across the world are riddled with exemptions that undermine climate progress. The answer is a uniform carbon price across the whole economy paired with a border carbon adjustment.

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ABOUT THE CLIMATE LEADERSHIP COUNCIL

The Climate Leadership Council is an international research and advocacy organization founded in collaboration with a who's who of business, opinion and environmental leaders to promote a carbon dividends framework as the most cost-effective, equitable and politically-viable climate solution.

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EXECUTIVE SUMMARY

An economy-wide price on carbon dioxide (CO_2) and/or other greenhouse gas (GHG) emissions has long been recommended as the most cost-effective climate solution. But at present, most of the carbon prices in 70 national and sub-national jurisdictions around the world are riddled with exemptions and partial rebates given to high-emitting industries due to competitiveness and leakage concerns. Many policymakers and researchers tend to overlook this problem, partly because there has thus far been a lack of standardized data.

This report assesses the persistent gaps between "nominal" and "effective" carbon prices cross-nationally and describes the extent to which they are weakening climate policy. While the *nominal* carbon price takes a jurisdiction's CO_2 fee rate (or CO_2 allowance price) at face value, the *effective* carbon price is weighted to account for the percentage of emissions actually covered by the nominal price across each fossil fuel and each sector of the economy.

This report sheds new empirical light on the striking gaps between nominal and effective carbon prices, which reach as high as 80-90% in some jurisdictions

Utilizing new data on emissions-weighted carbon prices developed at the University of Cambridge by one of the authors (Dolphin) and updated for this purpose, this report sheds new empirical light on these striking gaps between nominal and effective carbon prices. As can be seen in Tables 1 and 2 appearing on page three, these gaps reach as high as 80-90% percent in some jurisdictions. These policy holes mute carbon price signals and weaken incentives to reduce emissions in nearly every jurisdiction that prices CO_2 emissions. Plugging them is essential for achieving the emissions reductions potential of carbon pricing.

An economy-wide carbon fee paired with a border carbon adjustment would not only close the carbon price gap but pave the way for far greater global climate ambition

To make carbon pricing more effective, governments should implement a truly economy-wide price on CO_2 emissions by eliminating sectoral omissions and special treatment of high-emitting industries. But governments will only do so if they are able to overcome legitimate concerns about competitiveness and carbon leakage. The best policy mechanism to accomplish this is a border carbon adjustment (BCA) that levels the economic playing field and encourages other jurisdictions to adopt similar carbon pricing approaches.

Although a meaningful carbon price can be set by either a carbon fee or a cap-and-trade system, the former is better suited to a uniform and transparent carbon price without exemptions and is more compatible with a BCA. An economy-wide carbon fee paired with a border carbon adjustment would not only close the carbon price gap but pave the way for far greater global climate ambition.

1. THE CARBON PRICE GAP

The rapid growth of carbon pricing initiatives – from just a handful in the early 1990s to 51 initiatives today across 70 jurisdictions producing 20 percent of global greenhouse gas emissions – has not been accompanied by a comparable increase in carbon price levels.[1] There remains a substantial gap between current carbon prices and those compatible with achieving the goals of the Paris Agreement, which itself is just a starting point.

Model-based estimates of the carbon price levels needed to limit warming to well below 2°C vary widely, largely due to divergent assumptions, especially regarding future energy technology costs and structural trends in GDP and population in different economies.[2] One widely referenced example, the Stern-Stiglitz Report of the High-Level Commission on Carbon Prices, recommends that carbon prices should reach at least $40–80/tCO2 by 2020 and $50–100/tCO2 by 2030, when paired appropriately with complementary policies.[3]

> **When considering the global economy as a whole, the world's effective carbon price was only about $2.30/t$CO_2$ in 2018**

This illustrates the extent of the sociopolitical challenge. At present, less than 10 percent of existing carbon prices across 70 jurisdictions are at or above $40/tCO2.[4] When carbon prices are weighted to account for the percentage of domestic CO2 emissions they actually cover, as we describe in the next section, that number falls to less than five percent. Although the momentum is moving in the right direction, the majority of carbon prices currently remain below $15/tCO2. Not only are these carbon prices too low to elicit substantial emission reductions, but the very few that do reach considerable levels are implemented in countries and sectors (mainly electricity) that are already relatively low-carbon.[5] At the same time, approximately 80 percent of global greenhouse gas emissions still remain officially unpriced.

> **This represents the first comprehensive effort to reliably ascertain the actual stringency of carbon prices in a standardized and cross-nationally comparable format**

That is not to say that these emissions may not in some way be regulated under the more than 1,500 climate-related laws worldwide, which include mostly non-pricing policies such as product design and energy efficiency standards.[6] But regulatory approaches, while appropriate in some cases – for example, where marginal abatement costs exceed politically viable carbon price levels, where market failures cannot be better addressed by carbon pricing or where measurement of emission levels is difficult – can be as much as three times more expensive than carbon pricing per ton of CO2 avoided.[7]

Climate policymakers have learned both from basic economic theory and more complex Integrated Assessment Models (IAMs) that when it comes to effectively reducing emissions, different carbon price levels can yield very different outcomes. But what is far less noticed or candidly discussed is that not all ostensibly equivalent carbon prices are “created equal.”

Table 1: Nominal vs. Effective Carbon Prices (US$/t$CO_2$e) in Selected Jurisdictions, 2018

Jurisdiction	Nominal carbon price	Effective carbon price	% difference
Belgium	16	9.33	-41.7
British Columbia	27	25.26	-6.4
California	15	14.30	-4.7
Chile	5	0.01	-99.8
Colombia	6	1.25	-79.2
Denmark	29	26.94	-7.1
Finland	77	55.83	-27.5
France	55	23.41	-57.4
Germany	16	11.40	-28.8
Iceland	36	26.77	-25.6
Ireland	25	21.42	-14.3
Japan	3	2.02	-32.7
Netherlands	16	10.73	-32.9
Norway	64	50.29	-21.4
Quebec	15	11.15	-25.7
South Korea	21	15.96	-24.0
Spain	25	10.55	-57.8
Sweden	139	119.29	-14.2
Switzerland	101	23.28	-77.0
United Kingdom	25	19.56	-21.8

Table 1: Data for nominal carbon prices are from World Bank and Ecofys (2018) and based on the highest carbon price levied within the jurisdiction in 2018, without accounting for any sectoral, industry-specific or fuel-specific exemptions. Data for effective, emissions-weighted carbon prices are updated from Dolphin *et al.* (2016) – see References for full citation.

Table 2: Nominal vs. Effective Carbon Prices (US$/t$CO_2$e) in U.S. States, 2018

Jurisdiction	Nominal carbon price	Effective carbon price	% difference
California	15	14.30	-4.7
Connecticut	4	0.82	-79.5
Delaware	4	1.34	-66.5
Maine	4	0.39	-90.3
Maryland	4	1.25	-68.8
Massachusetts	4	0.83	-79.3
New Hampshire	4	1.03	-74.3
New York	4	0.81	-79.8
Rhode Island	4	1.11	-72.3
Vermont	4	0.01	-99.8

2. WHY THE CARBON PRICE GAP IS FAR LARGER THAN ASSUMED

Various sectoral omissions, industry exemptions and partial rebates have reduced the coverage of carbon prices and made them a lot less effective in practice than in theory. Following theoretical recommendations about "first-best" policy design, the Integrated Assessment Models (IAMs) used by the Intergovernmental Panel on Climate Change (IPCC) generally assume in their simulations that implemented carbon prices are more or less economy-wide. But actual carbon prices have varied starkly in coverage – from, for example, 34 percent of CO2 emissions in Switzerland to 91 percent in Norway in 2018.[8] To understand their actual stringency and to make them truly comparable, carbon prices need to be assessed in relation to their coverage.

> **Sectoral omissions, industry exemptions and partial rebates have reduced the coverage of carbon prices and made them far less effective**

In France, for example, emissions-intensive industries participating in the EU cap-and-trade system – chemicals, iron and steel, cement, oil refineries, electric utilities and others – are exempt from the €55/tCO2 tax that French consumers pay. What these industries do pay under the EU emissions trading system (ranging from €7-25/tCO2 in 2018) is less than half the carbon price for the rest of the country.

As the 2018 World Bank report on the State and Trends of Carbon Pricing emphasizes: "Prices are not necessarily comparable between carbon pricing initiatives because of differences in the sectors covered and allocation methods applied, specific exemptions, and different compensation methods."[9] Following standard practice, the World Bank report presents data on "nominal" carbon prices, which do not take into account these cross-national differences.[10]

In order to compare carbon pricing initiatives across countries, we use effective, "emissions-weighted" carbon prices, developed at University of Cambridge by one of the authors and updated for the benefit of this report. Effective carbon prices are novel in that they are not only weighted to discount unpriced emissions in omitted sectors of the economy, but also carefully account, with the greatest possible precision, for various industry exemptions and partial rebates that further reduce coverage and/or price. The series exist for nearly all initiatives implemented at the national level as well as in North American subnational jurisdictions over the period 1990-2018.

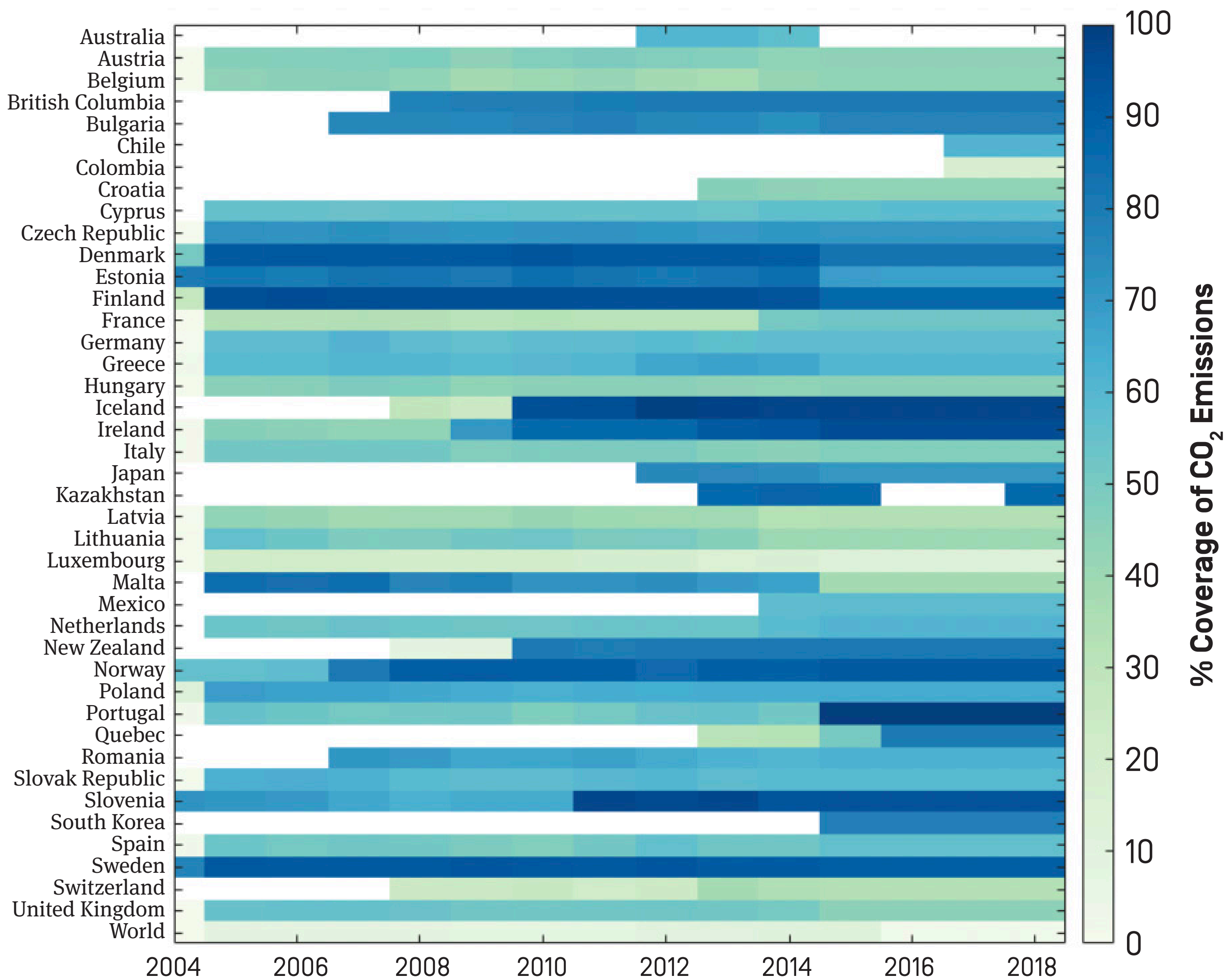
Given that carbon price exemptions, rebates and subsidies are sometimes opaquely specified or buried deep in large legislative texts, this computation exercise is bound to be imperfect. But to the best of our knowledge it represents the first comprehensive effort to reliably ascertain the actual stringency of carbon prices in a standardized and cross-nationally comparable format.

As shown in Table 1, there is a large chasm between nominal and effective carbon prices. The difference between the two metrics is greater than 50 percent in numerous jurisdictions, including Chile, Colombia, France, Spain and Switzerland. In some other jurisdictions, such as Sweden and Finland, the difference in percentage terms is relatively small but much larger in absolute terms. Moving from nominal to emissions-weighted carbon price data reduces Sweden's carbon rate in 2018 from \$139/tCO2 to \$119/tCO2, while Finland's decreases from \$77/tCO2 to about \$56/tCO2.

Other key emitters, such as India, Russia and Brazil are omitted since they have no carbon price at all – effectively pricing emissions at \$0/tCO2. China is also omitted from our analysis, due to a lack of adequate data on their various pilot cap-and-trade systems at the provincial level – but these, too, would register low coverage and prices, largely since they are restricted to the electricity sector.

As Table 2 shows, the carbon price chasm is even larger when assessing the nine U.S. states participating in the Regional Greenhouse Gas Initiative (RGGI). The difference between the nominal and effective carbon price is greater than 65 percent in all nine states. This is unsurprising given that RGGI's cap-and-trade

Figure 1: Heat Map of CO_2 Emissions Coverage Across Selected Carbon Pricing Systems Over Time



system applies exclusively to the electricity sector and is primarily operating as a revenue-generating policy to fund renewable energy initiatives and assist families with electricity bills. RGGI's effective carbon price is consistently below \$2/tCO2 across the nine states and only about one cent per ton in Vermont, where the electricity mix is already almost entirely decarbonized. California's cap-and-trade system boasts far wider emissions coverage and is nearly economy-wide, but its persistently low carbon price has contributed to very little of the state's emission reductions. Since each jurisdiction's effective carbon price is computed based on a fuel-specific and sector-specific disaggregation of the percentage of emissions covered by both carbon fees and cap-and-trade systems, one may dive deeper into the data to compare varying coverage.

As shown in Figure 1, the percentage of total CO2 emissions covered varies substantially cross-jurisdictionally and over time. Very few countries, mainly in northern Europe, have managed to implement carbon prices that are nearly economy-wide.

Figure 2 provides a similar heat map

Figure 2: Heat Map of CO_2 Emissions Coverage Across U.S. State-Level Carbon Pricing Systems Over Time

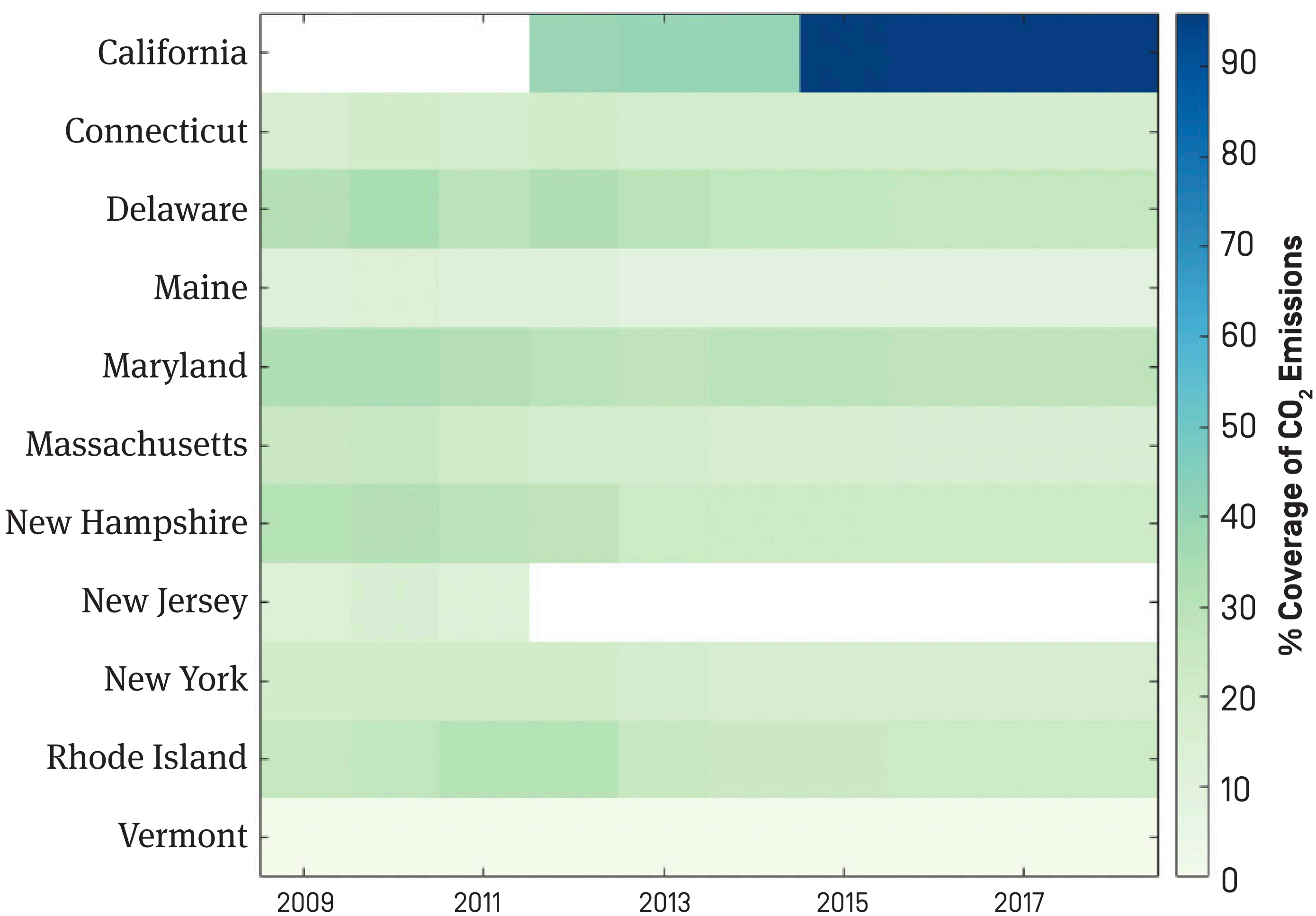


Figure 3: Choropleth Map of CO_2 Emissions Coverage Across Carbon Pricing Systems, 2018

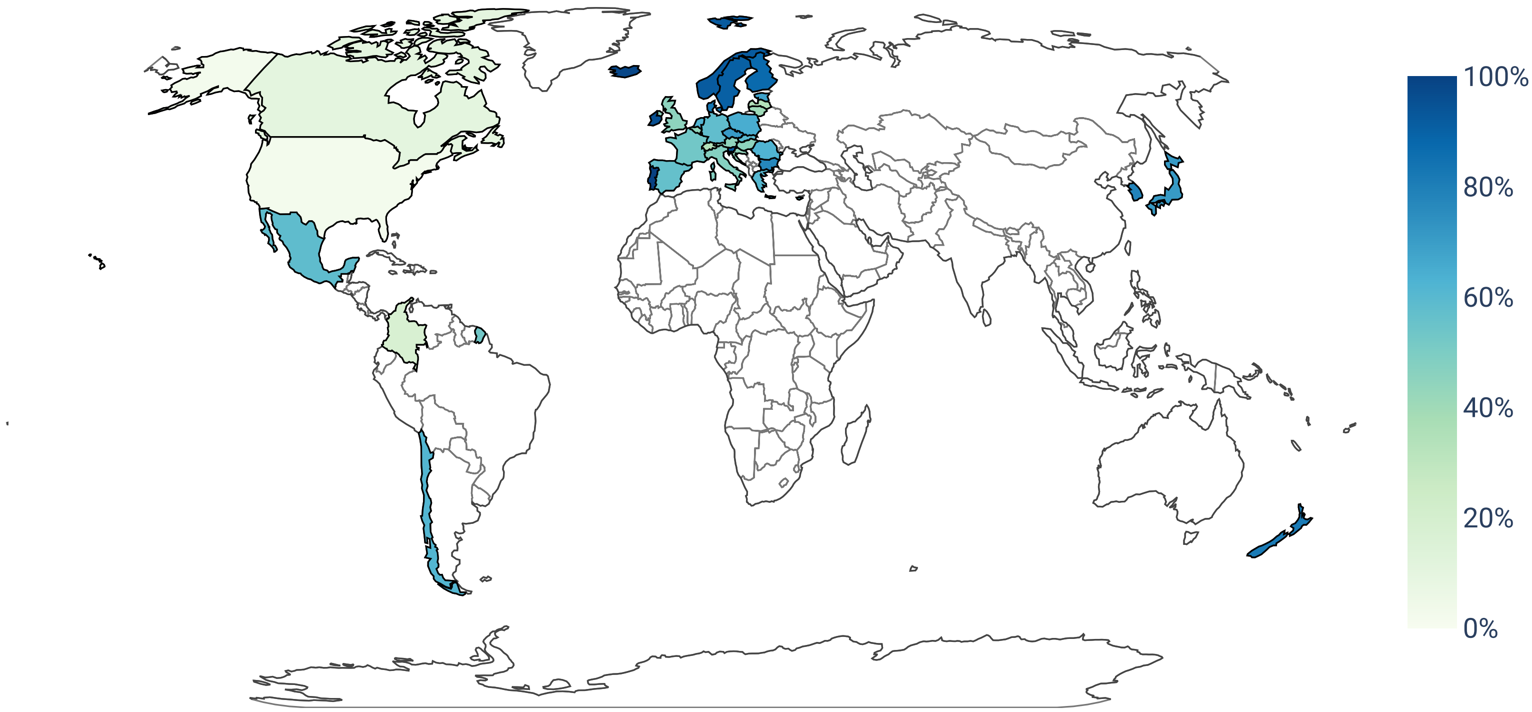


Figure 3: Based on data updated from Dolphin *et al.* (2016). Note that China's pilot, provincial emissions trading programs are not included due to missing data.

visualization of carbon price coverage in California and the ten U.S. states that have participated in RGGI (nine after New Jersey pulled out in 2012). Coverage at the U.S. state level has ranged from less than one percent of CO2 emissions in Vermont to about 95 percent in California.

There is a striking paucity of jurisdictions whose policies have been commensurate with the goal of limiting warming to below 2°C

Focusing only on the most recently available coverage data for the world as a whole in 2018, a similar picture emerges in Figure 3. Not only are CO2 emissions in the majority (65 percent) of the world's countries exempted from any carbon price, but even in Europe, where carbon pricing has a firm basis, coverage often hovers below 50 percent. When considering the global economy as a whole, the world's effective carbon price was only about $2.30/tCO2 in 2018.

As a final consideration, Figure 4 plots the statistical distributions of effective, emissions-weighted carbon prices in each jurisdiction over time, from 1990 to 2015. The box plots follow the standard interpretation, with each horizontal line indicating (from bottom to top) the minimum, first quartile, median, third quartile and maximum values of all carbon prices in each country during the time period.

The distributions for each country include only values for which the carbon price was greater than zero. The data clearly show that the only countries that have had an effective carbon price consistently above $40/tCO2 are Sweden and Norway. More strikingly, Sweden is also a stark outlier with a median effective carbon price of $100/tCO2. Norway's median carbon price is just above $40/tCO2. All other countries have had a median effective carbon price below $20/tCO2.

Taken together, the data on carbon prices show that there is a striking paucity of jurisdictions whose policies have been commensurate with the widely-agreed upon goal of limiting warming to below 2°C. Effective carbon prices, when standardized on an economy-wide basis, are even lower and laxer than generally assumed by climate researchers and policymakers.

Figure 4: Box Plot Distributions of Emissions-Weighted Carbon Prices in Selected Jurisdictions, 1990-2018

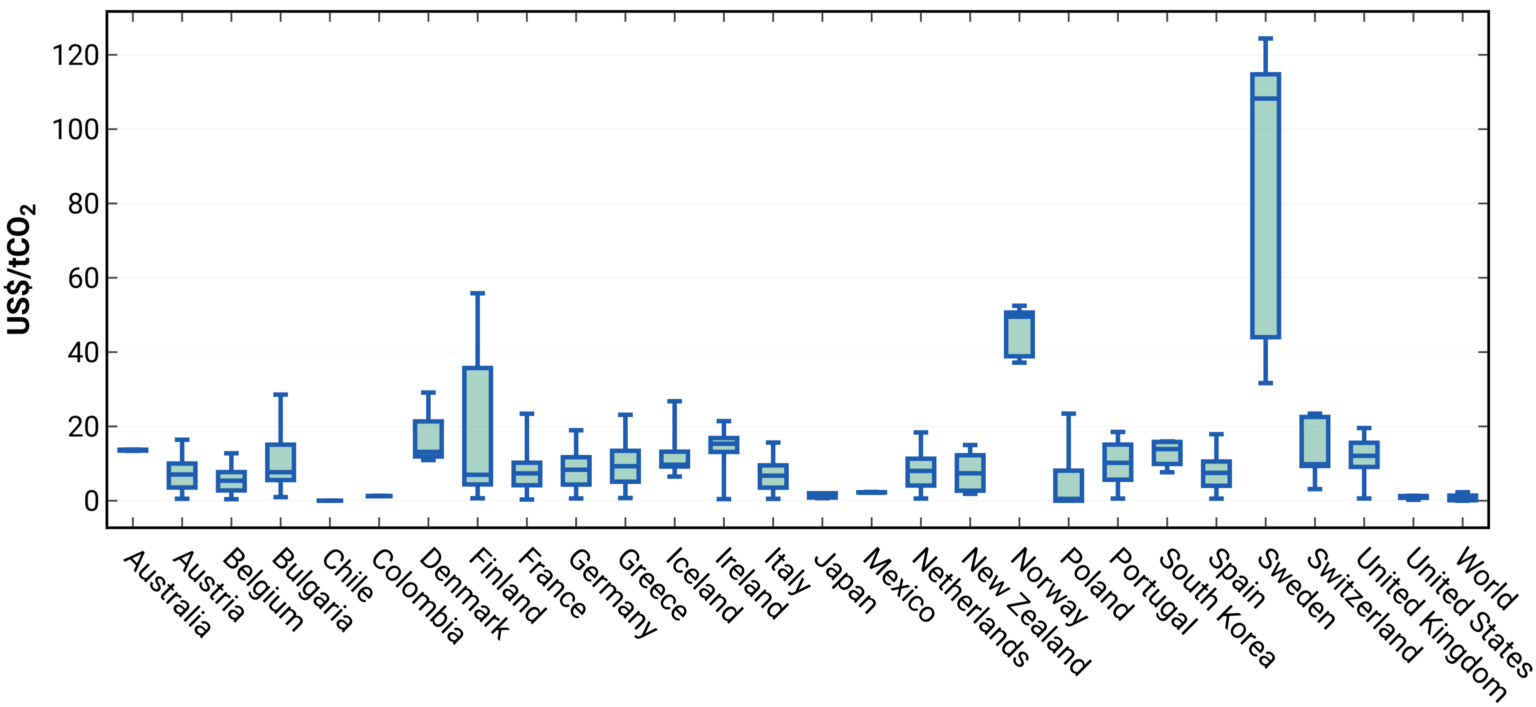


Figure 4: Based on data updated from Dolphin *et al.* (2016). Effective carbon prices are weighted according to coverage of CO2 emissions only, rather than coverage of all GHG emissions on a CO2-equivalent basis. Were effective carbon prices weighted according to total GHG coverage, prices would be considerably lower in most jurisdictions.

3. WHY THE GAP OCCURS & WHY IT MATTERS

There are four main reasons that carbon prices have been perforated and weakened relative to their theoretical potential: policy design choices (omitted sectors), competitiveness concerns (industry exemptions and rebates), the outsourcing of emissions (exemptions for internationally traded products) and practical limitations on policy.

Policy Design Choices: Omitted Sectors

The first source of the carbon price gap – limited sectoral coverage – has been a persistent issue across nearly all jurisdictions.

The omission of certain sectors and/or fuels from carbon pricing is often a product of the choice between a carbon fee or cap-and-trade. By design, and by their nature (because of the inherent administrative requirements of the allowance market), cap-and-trade systems have often been limited to large emitters in the power sector and/or industry. Cap-and-trade systems typically price GHGs midstream at the point of emission – power plants and industrial facilities – regardless of the specific fuel from which the emissions originate. Operators of power plants and industrial facilities are thereby the parties responsible for reducing their emissions or paying the carbon price by surrendering "allowances," which can be purchased through auctions. Part or all of the higher energy prices are in practice passed on to end-consumers, such as households and other businesses, but the point here is that a relatively smaller number of companies directly participate in the trading system. Under such a system, it is far simpler to focus on electric utilities and large industrial emitters, rather than tens of thousands of smaller producers or millions of end consumers.

There are exceptions (such as California and Québec), but generally, cap-and-trade systems have not covered road transport emissions (one of the most important and growing emission sources globally). The EU Emissions Trading System (ETS), for example, includes domestic aviation but excludes road transportation; to expand coverage, some countries such as Switzerland and Sweden have complemented the ETS with national carbon taxes applied to fossil fuels (and thus road transport), while avoiding double taxation by exempting the fossil fuel used in energy production already covered under the ETS.

> **Expanding sectoral coverage with cap-and-trade is more administratively cumbersome than with a simple and transparent economy-wide fee**

Meanwhile, California's cap-and-trade system pioneered the inclusion of transport fuels by requiring that fuel suppliers provide lower-carbon fuels or purchase allowances in the carbon market. The trading system in New Zealand has even included forestry and waste sectors, while South Korea's includes waste, buildings and domestic aviation. Expanding sectoral coverage with cap-and-trade is possible, but it is more administratively cumbersome than with a simple and transparent economy-wide fee. In addition, not all countries have governance standards compatible with running an allowance market.

By contrast, carbon fees apply directly to fossil fuels and are calculated using appropriate conversion factors based on the carbon content of each fuel. The sectors exposed to the fee are then specified in a second step. In principle, a carbon fee may apply straightforwardly to 100 percent of energy-related emissions from the combustion of fossil fuels, comprising the largest source (about 95 percent) of global CO_2 emissions, covering electricity and heat production, industrial plants, transportation and buildings. As we discuss later, the remaining five percent of global CO_2 emissions is generally more difficult to price, regardless of the policy choice. But overall, the sectoral coverage of carbon fees is far less constrained than for cap-and-trade. For the majority of sectors, therefore, there is no technical justification for the persistently low levels of coverage.

Competitiveness Concerns: Industry Exemptions and Rebates

The second major source of the coverage problem is special treatment of industry, particularly emissions-intensive, trade-exposed industries. There is a preponderance of full exemptions and partial rebates that effectively reduces the percentage of total emissions covered by the carbon price in a given industry and the industrial sector as a whole. For example, countries such as Australia, Denmark, France, Ireland, Norway, Sweden, Switzerland and the UK have each at various points in time granted full or partial carbon tax exemptions to all or most manufacturing industries, sometimes with specific conditions attached. These exemptions have been present since the first carbon taxes were implemented in the early 1990s, although some countries have gradually reduced them over time.

Meanwhile, governments operating cap-and-trade systems have, to various degrees over time, freely allocated tradable permits to emissions-intensive industries. The quantity of free permits a firm receives is usually based on its past emissions or product-specific benchmarks. Some analysts argue that freely allocated permits pose no problem, since as long as the carbon price is strictly positive, firms receiving free allowances are still incentivized to reduce their emissions in order to sell any surplus allowances for a profit in the carbon market. However, when an excessive quantity of permits is freely allocated and the carbon price is fairly low, many firms have no incentive to invest in low-carbon substitutes – for example, switching steel production methods from blast furnaces to far more CO_2-efficient electric arc furnaces.[11]

A carbon fee may apply straightforwardly to 100 percent of energy-related emissions from the combustion of fossil fuels

Empirical evidence based on interviews with company managers has shown that EU firms receiving permits for free invest significantly less in low-carbon innovation than firms without free allowances.[12] Not only has free allocation reduced decarbonization incentives, but in some cases it has also resulted in billions of dollars in windfall profits for a small number of large firms.[13] A far more cost-efficient and environmentally effective approach is to auction all permits, but policymakers have been slow to make the transition.[14]

The primary rationale for these exemptions, rebates and free allowances relates to concerns about competitiveness and carbon "leakage." These concerns are powerful political motivators. In a world of unequal carbon prices, a jurisdiction that unilaterally prices emissions from domestic emissions-intensive industries such as steel or cement may put its companies (and jobs) at a competitive disadvantage, relative to producers in foreign countries without a carbon price. All else equal, domestically manufactured products would lose ground competitively relative to equivalent products produced abroad.

> **The primary rationale for these exemptions, rebates and free allowances relates to concerns about competitiveness and carbon "leakage"**

Were the competitiveness losses large enough to threaten market shares, businesses could decide to close plants and move production – and more importantly, future investment – to countries with lower environmental standards. The carbon price would thus fail to reduce emissions, since they would "leak" to other countries while the home country would lose valuable industrial capacity in the process.

Concerns about competitiveness and leakage are valid, but the scope of the likely impact is often misunderstood or exaggerated. Most industries and companies, comprising the majority of value added to GDP, face limited impacts; they may simply adapt to a carbon price through relatively minor improvements in energy and material efficiency. In other cases, companies may over time adopt resource substitution and low-carbon innovation across supply chains. Such has been the case in the UK, for example, where firms exposed to a carbon price floor have seen gains in productivity, without any evidence of losses to employment or revenue.[15]

Meanwhile, persistently low carbon prices, together with various factors favoring local production, have meant that there has been limited empirical evidence of carbon leakage.[16,17] At low carbon price levels, leakage impacts are typically less significant than they are often painted.

If carbon prices rise to levels commensurate with the goals of the Paris Agreement, competitiveness and leakage *will* become more serious economic and environmental concerns, particularly for highly-traded, emissions-intensive commodities that would be hit hardest by a robust carbon price: cement, refined petroleum, aluminum, iron and steel, inorganic basic chemicals, paper and some others.[18] Reducing emissions in these industries will require additional R&D and capital investments – but neither will occur if businesses are effectively incentivized to move jobs and investment dollars outside the country pricing carbon.

Outsourcing of Emissions: Exemptions for Internationally Traded Products

Despite these efforts to limit carbon leakage with sector omissions and industry exemptions, large quantities of emissions have nevertheless 'transferred' overseas with the outsourcing of emissions-intensive industry. This trend began before carbon pricing and is related to the effect of relative prices (including exchange rates) on production location, but it has gathered steam since the Kyoto Protocol in 1997. The rapid growth of industrial production in economies with low or no carbon pricing, such as China and India, has significantly reduced the coverage of carbon pricing worldwide. As a result, many developed economies that price carbon domestically now import a sizeable amount of CO_2 emissions, making the carbon 'embodied' in internationally traded goods one of the largest gaps in carbon pricing globally.

The scale of this gap is revealed by a recent study on embodied carbon in traded products, entitled the "The Carbon Loophole in Climate Policy."[19] The study estimates that approximately 25 percent of global CO_2 emissions are embodied in internationally traded goods. It also estimates that since 1990, even as wealthier economies such as Germany, France and the United Kingdom have cut domestic emissions, they have increased the amount of embodied carbon they import from China and other economies. For example, in the case of the United Kingdom, if one includes the carbon embodied in the goods it imports, then the UK has actually increased its carbon footprint over time.

> **If the amount of carbon imported were taken into account, U.S. CO_2 emissions would be 14 percent greater than the reported number**

The study found the U.S. to be the world's leading importer of embodied carbon. If the amount of carbon imported were taken into account to measure its actual carbon footprint, U.S. CO_2 emissions would be 14 percent greater than the reported number, which measures only domestic production of CO_2 emissions.[20]

A similar problem of importing embodied carbon exists at the sub-national level in the United States. Among U.S. states, California is recognized as having the most comprehensive set of policies designed to curb GHG emissions, including an emissions trading system. Yet its success in reducing emissions has coincided with growing imports of embodied carbon. For example, California imports roughly one-third of its electricity from neighboring states with more carbon-intensive power. A recent study estimates that California's carbon footprint is over 25 percent larger when accounting for consumption of embodied emissions.[21] California has taken important steps to price emissions embodied in imported electricity and transport fuels, but as an individual state, it has limited ability to prevent further carbon leakage as its carbon price increases over time.

The fundamental reason for this trade-related carbon loophole is that carbon pricing is applied directly to production and only indirectly, if at all, to consumption. In many cases, consumption of carbon embodied in traded goods escapes carbon pricing or comparable regulation altogether. This in turn reduces the effective global price on carbon, exacerbating the problem. If carbon pricing is to reduce CO_2 emissions globally and not just in the jurisdiction where a carbon price is applied, this design flaw will need to be addressed. Since applying carbon pricing to upstream production is more administratively feasible and cost-effective than downstream consumption, trade-related measures such as border carbon adjustments, which will be detailed in the next section, are best suited to close these gaps.

Practical Design Issues

There are, however, exceptions that may in practice make 100 percent coverage suboptimal. As mentioned earlier, a carbon fee can straightforwardly apply to all energy-related emissions from fossil fuel combustion, which account for about 95 percent of global CO_2 emissions. About four percent of remaining CO_2 emissions are caused by chemical processes during cement production; while both fee and cap-and-trade policies can also apply to these direct emissions from cement, doing so accurately requires detailed and regularly updated plant-level data.[22]

Less straightforward is the inclusion of the roughly one percent of global CO_2 emissions from gas flaring and venting, referred to as "fugitive emissions." There are similar measurement issues with applying a broader CO_2-equivalent fee to GHG emissions from agriculture and forestry, waste and landfills. But assuming it were administratively feasible and cost-efficient to accurately verify such emissions, they could also be subject to the carbon fee.

If the marginal cost of monitoring and verifying each additional metric ton of emissions exceeds the marginal benefit of those additional reductions, then optimal coverage may be less than 100 percent.[23] In such cases, emission reductions may be best achieved by policies other than a simple carbon price. Notwithstanding these caveats, most sectoral omissions, industry exemptions and rebates that have reduced coverage (and free allocations that have reduced decarbonization incentives) are attributable to suboptimal design and political choices rather than such practical problems.

Most sectoral omissions, industry exemptions and rebates that have reduced coverage are attributable to political choices rather than practical problems

4. SOLVING THE PROBLEM WITH BORDER CARBON ADJUSTMENTS

Fortunately, the primary source of the carbon price gap – the competitiveness and leakage concerns that lead governments to exempt or freely allocate permits to certain industries – are all solvable with well-designed policy.

Eliminating the gap with a truly economy-wide carbon fee becomes politically feasible and economically sound when paired with a border carbon adjustment (BCA). BCAs address the issues of competitiveness and leakage by applying the domestic carbon price on emissions-intensive imports and rebating the carbon price on emissions-intensive exports. It also addresses the problem created by the outsourcing of emissions and the importation of embodied carbon by subjecting imports to a carbon price. The relevant trade authority in the importing country would administer the BCAs, while the relevant firms in the exporting country would be liable for paying the BCA associated with their products at the border.

> **Eliminating the gap with a truly economy-wide carbon fee becomes feasible when paired with a border carbon adjustment**

In practice, four key pieces of information are required to set the appropriate rates for BCAs: (1) the products to which the BCA should apply; (2) the volume of carbon-intensive material in the product; (3) the carbon intensity of the production process in the exporting country; and (4) the extent to which the exporting country's carbon price (and potentially, other climate policies) should be considered. There are policy design decisions and administrative challenges to be made in addressing all four categories of information, but it is entirely feasible to design an effective system.

The practical effect of a BCA is to level the playing field between domestic companies exposed to a carbon price and foreign companies in countries that do not price carbon, while encouraging these trading partners to adopt a carbon price of their own.[24] For U.S. industries that are less CO_2-intensive than their counterparts overseas – for example, U.S. steel relative to Chinese steel – BCAs would shift relative prices such that the most CO_2-efficient products stand to benefit.[25] Unlike the current system, which gives special treatment to the most CO_2-inefficient companies, BCAs would enhance climate action with a firm, legally defensible environmental justification.

For these reasons, BCAs are a central pillar of the Climate Leadership Council's Carbon Dividends plan, which would effectively cover 100 percent of energy-related CO_2 emissions in the U.S. A BCA would thus help close the gap in carbon price coverage that has been created by the outsourcing of emissions-intensive industrial activity as well as prevent further leakage.

It is important to consider the global implications of BCAs. Non-OECD economies (including China and India) export about 1.8 billion more metric tons of CO_2 annually than they import (as embodied in traded products).[26] Meanwhile, OECD economies *import* about 1.8 billion more metric tons of CO_2 than they export. Since 1990, for example, Switzerland reduced its domestic CO_2 emissions by 12 percent but increased its consumption-based emissions (accounting for CO_2 embodied in imports) by about 57 percent.[27] Even Germany, with a trade surplus of nearly eight percent, imports more in CO_2-intensive goods than it exports. The coverage gap therefore presents a double whammy of climate damages: from emissions unpriced due to exemptions and emissions unpriced due to neglect of international trade.

> **Border Carbon Adjustments could trigger a positive feedback loop whereby an increasing number of countries join the "club" of jurisdictions pricing carbon**

By putting a price on CO_2 embodied in energy-intensive imports, BCAs would not only strengthen carbon pricing policies by building the political support required to phase out exemptions and rebates, but would also do far more to stimulate CO_2 reductions globally. Foreign countries and firms would have three options: (1) pay the BCAs associated with the carbon-intensive products they export; (2) reduce their emissions in order to pay a lower rate; and/or (3) adopt a comparable carbon price of their own and a parallel BCA system in their own country. The third option would better adhere to their international climate commitments while retaining carbon price revenues onshore. In this way, BCAs could trigger a positive feedback loop whereby an increasing number of countries join the "club" of jurisdictions pricing carbon. In any case, foreign countries and firms would have every incentive to reduce emissions at home.

Ironically, the same industry exemptions and rebates that are weakening carbon prices cross-nationally are also preventing countries from adopting the sensible BCAs that would render them unnecessary. WTO rules permit well-designed BCAs on environmental grounds under Article XX of GATT (General Agreement on Tariffs and Trade), but only if relevant imports are liable for a carbon price equivalent to the one levied on equivalent domestically produced goods.[28] So, for example, BCAs on imports of steel products could only be legally imposed once the carbon price exemptions for domestically produced steel were eliminated.

Carbon Fee vs. Cap-and-Trade: Implications for BCAs

Although carbon fee and cap-and-trade systems each have their relative advantages as the two main forms of carbon pricing, the former is better suited to overcoming the coverage problem for two reasons.

> **Carbon fees, by their nature and design, are simpler to administer, more transparent and more easily applied without exemptions**

First, carbon fees, by their nature and design, are simpler to administer, more transparent and more easily applied without exemptions to all energy-related CO_2 emissions. Cap-and-trade systems dominate current carbon pricing regimes, covering about three quarters of all explicitly priced emissions worldwide.[29] Yet they are prone to exemptions, often for entire sectors (due to the aforementioned administrative requirements of emissions trading). Some jurisdictions, such as California, South Korea and New Zealand, have expanded coverage to additional sectors. But such modifications have been exceedingly slow and the exception rather than the rule. Moreover, sub-national cap-and-trade policies such as California's, RGGI's or the Canadian provincial systems cannot be accompanied by BCAs since domestic laws prohibit internal trade restrictions. This is a significant constraint on their ultimate ability to cover all emissions (both territorial and trade-related) and a strong argument for national policy.

Second, it is undoubtedly easier to pair BCAs with a carbon fee (where prices are fixed on an annual basis and known in advance) rather than with a cap-and-trade system where prices can and do vary daily. In 2018, for example, allowance prices in the EU ETS ranged from \$7.78/tCO_2 in January to \$24.81/tCO_2 in December. Given such volatility in the allowance price, it would be difficult to adopt a BCA under cap-and-trade. Ensuring that domestic and foreign companies are exposed to an equivalent carbon price throughout a given year would require constantly updating the border adjustment rate.

The other option, more commonly advocated, is to require foreign companies to surrender allowances for their emissions-intensive products at the border, similar to requirements for domestic companies participating in emissions trading.[30] But while this would ensure a level playing field, it would also flood the cap-and-trade system with tens of thousands of additional carbon market participants, many of which may resist the added administrative burden. Since emissions trading systems were originally designed to cap *territorial* emissions, incorporating BCAs through the allowance option would introduce substantial administrative complexity.

The path towards sensible, economy-wide carbon pricing is clear. For countries currently without any carbon price and for those that levy a carbon fee with exemptions, the simplest and most transparent approach is to adopt an economy-wide carbon fee on the carbon content of fossil fuels. Exemptions and rebates for emissions-intensive industry should be phased out in parallel with expanding the fee and implementing BCAs.

> **The time to get serious about practically implementing Border Carbon Adjustments is long overdue**

For countries currently committed to a cap-and-trade system, policymakers can switch to full auctioning of allowances and introduce a carbon price floor, thereby creating a hybrid system that incorporates some of the advantages of a carbon fee within a cap-and-trade model. This would create more investment certainty around carbon price levels, make it easier to cover more sectors of the economy and make it simpler to adopt a BCA. It would also reduce more emissions: the United Kingdom, a participant in the EU ETS, introduced its own carbon price floor in 2013, which contributed to its per capita CO_2 emissions falling to levels below what they were in 1860, at the height of Britain's industrial renaissance.[31]

The essential point that applies to both carbon fee and cap-and-trade policies is that they should be paired with BCAs in order to better incentivize decarbonization in high-emitting, trade-exposed industrial sectors.

5. CONCLUSION

The world's most difficult challenges when tackling climate change – cutting emissions from cement, chemicals, iron and steel, aluminum, refined petroleum, plastics and other industries at the center of the global economy – are likely to be impossible without a robust, economy-wide price on carbon. But it is in these same industries that carbon prices have long been muted by exemptions, rebates, omitted sectors and suboptimal policy design.

As this report has shown, the gap between nominal and effective carbon prices is substantial and larger than assumed, with few signs that countries are taking the necessary steps to close it. The problem is stifling climate efforts around the world.

> **The problem will only be solved if policymakers resolve to increase effective carbon price levels**

The problem will only be solved if policymakers resolve to close the gaps in coverage and increase effective carbon price levels. But to assemble the political support required to do so, appropriate measures must be taken to address concerns about industrial competitiveness and carbon leakage – concerns that will only grow stronger and more valid if carbon prices are to reach levels commensurate with the world's climate objectives.

> **Pairing an economy-wide carbon price with Border Carbon Adjustments is the most viable way to overcome climate gridlock**

The proposal we outline – pairing an economy-wide carbon price with well-designed BCAs – is the most viable way to expand carbon price coverage and overcome the climate gridlock posed by international trade competition. Its effectiveness will ultimately depend on how well BCAs are designed, to which products they apply and how trade relations are managed in the process. For these reasons, the time to get serious about practically implementing BCAs is long overdue.

ENDNOTES

1. These figures include not only implemented carbon prices but also several scheduled for implementation up to 2020, most notably China's national emissions trading system. For further details, see: World Bank and Ecofys. 2018. *State and Trends of Carbon Pricing 2018*. Washington, DC: World Bank. Available at: https://openknowledge.worldbank.org/handle/10986/29687
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APPENDIX

The analysis in this report covers carbon prices across 51 jurisdictions worldwide, for which detailed policy data could be obtained. They include: Austria, Belgium, British Colombia, Bulgaria, California, Chile, Colombia, Connecticut, Croatia, Cyprus, Czech Republic, Delaware, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Kazakhstan, Latvia, Lithuania, Luxembourg, Maine, Malta, Maryland, Massachusetts, Mexico, Netherlands, New Hampshire, New Jersey, New York, New Zealand, Norway, Poland, Portugal, Quebec, Rhode Island, Romania, Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, United Kingdom and Vermont. Due to missing data, carbon prices in Alberta, Lichtenstein, Saitama, Ukraine, Tokyo's municipal cap-and-trade system and China's pilot provincial cap-and-trade systems could not be computed.

Appendix Table: Nominal vs. Effective Carbon Prices (US$/t$CO_2$e) Across Jurisdictions Globally, 2018

Jurisdiction	Nominal carbon price	Effective carbon price	% difference
Austria	16	9.33	-41.67
Belgium	16	7.26	-54.60
British Columbia	27	25.26	-6.44
Bulgaria	16	15.16	-5.28
California	15	14.30	-4.67
Chile	5	0.01	-99.80
Colombia	6	1.25	-79.17
Connecticut	4	0.82	-79.50
Croatia	16	9.28	-42.00
Cyprus	16	11.24	-29.73
Czech Republic	16	14.00	-12.52
Delaware	4	1.34	-66.50
Denmark	29	26.94	-7.10
Estonia	16	16.31	1.92
Finland	77	55.83	-27.49
France	55	23.41	-57.44
Germany	16	11.40	-28.75
Greece	16	13.43	-16.05
Hungary	16	8.83	-44.79
Iceland	36	26.77	-25.64
Ireland	25	21.42	-14.32

Jurisdiction	Nominal carbon price	Effective carbon price	% difference
Italy	16	9.24	-42.22
Japan	3	2.02	-32.67
Latvia	16	7.86	-50.86
Lithuania	16	9.30	-41.89
Luxembourg	16	3.07	-80.84
Maine	4	0.39	-90.25
Malta	16	14.01	-12.41
Maryland	4	1.25	-68.75
Massachusetts	4	0.83	-79.25
Mexico	3	2.22	-25.94
Netherlands	16	10.73	-32.94
New Hampshire	4	1.03	-74.25
New York	4	0.81	-79.75
New Zealand	15	14.99	-0.08
Norway	64	50.29	-21.42
Ontario	15	10.03	-33.12
Poland	16	12.95	-19.06
Portugal	16	16.89	5.59
Quebec	15	11.15	-25.67
Rhode Island	4	1.11	-72.25
Romania	16	12.39	-22.57
Slovak Republic	16	11.62	-27.40
Slovenia	21	20.63	-1.75
South Korea	21	15.96	-24.00
Spain	25	10.55	-57.80
Sweden	139	119.29	-14.18
Switzerland	101	23.28	-76.95
United Kingdom	25	19.56	-21.76
Vermont	4	0.01	-99.75
World		2.30	

Notes: Data for nominal carbon prices are from World Bank and Ecofys (2018) and are based on the highest carbon price levied within the jurisdiction as of April 2018, without accounting for any sectoral, industry-specific, or fuel-specific exemptions. Data for effective, emissions-weighted carbon prices are updated from Dolphin *et al.* (2016).

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