STAFF

CLIMATE

NOTES

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Abstract

This Climate Note discusses the rationale, design, and impacts of border carbon adjustments (BCAs), charges on embodied carbon in imports potentially matched by rebates for embodied carbon in exports. Large disparities in carbon pricing between countries is raising concerns about competitiveness and emissions leakage, and BCAs are a potentially effective instrument for addressing such concerns. Design details are critical, however. For example, limiting coverage of the BCA to energy-intensive, trade-exposed industries facilitates administration, and initially benchmarking BCAs on domestic emissions intensities would help ease the transition for emissions-intensive trading partners. It is also important to consider how to apply BCAs across countries with different approaches to emissions mitigation. BCAs are challenging because they pose legal risks and may be at odds with the differentiated responsibilities of developing countries. Furthermore, BCAs provide only modest incentives for other large emitting countries to scale carbon pricing—an international carbon price floor would be far more effective in this regard.

Introduction and Summary

Carbon pricing is widely accepted as an economically efficient mitigation instrument but concerns over trade effects is a key factor hampering its use and international cooperation over climate mitigation. Carbon pricing—charges on the carbon content of fossil fuels or their emissions and implemented through carbon taxes or emissions trading systems (ETSs)—provides across-the-board incentives to reduce energy use and shift to cleaner fuels. Containing global warming to below 2 degrees Celsius—the central goal of the 2015 Paris Agreement—will require phasing in measures equivalent to a global carbon price of around $75 per ton by 2030. Although carbon pricing schemes have been proliferating, in some cases with carbon prices above $40 per ton (see following), the global average carbon price is still only $3 per ton. In part, this slow progress reflects strong political resistance to unilateral increases in carbon prices above levels in trading partners, not least because the impacts on trade patterns raise concerns about industrial competitiveness and carbon leakage (when an increase in domestic carbon pricing leads to a shift of carbon-intensive production abroad, offsetting the domestic emissions reductions). Acknowledging the trade effects and finding appropriate tools to address them may be necessary before many countries will price carbon at the levels needed.

Large and growing disparities in carbon pricing across countries and regions has heightened interest in border carbon adjustments (BCAs) to address competitiveness and leakage concerns. A BCA is a charge on embodied carbon in products imported into a jurisdiction with carbon pricing, potentially matched by rebates for embodied carbon in exports. Almost all existing carbon pricing schemes covering the industrial sector are accompanied by measures (for example, free allowance allocations, partial exemptions from pricing) to alleviate competitiveness impacts, but these measures become less effective with deeper industrial decarbonization, may blunt the domestic demand effects of carbon pricing, and forgo revenue from carbon pricing. Prospective BCAs in Canada and the European Union have catalyzed discussion about the instrument, not least as countries revise their climate strategies in the run up to the 2021 United Nations Climate Change Conference, also known as COP26, in November 2021. Pressure for BCAs will likely intensify as some countries and regions move ahead aggressively with carbon pricing while others do not.

A (pragmatically designed) carbon price floor among large emitting countries would ultimately be the most effective way to scale up global mitigation and would benefit from the collective acceptance and buy-in from all parties to the agreement. Such a price floor could largely avoid competitiveness and carbon leakage issues and would avoid division in the sense that all potential participants would voluntarily join. This coalition might itself adopt a BCA to avoid carbon leakage in trade with nonparticipating countries.

A well-designed BCA could nonetheless help to address competitiveness and "carbon leakage" concerns in the interim for countries moving ahead unilaterally with ambitious carbon pricing. BCAs could also provide some, perhaps modest, incentives for trading partners to scale up their own carbon pricing. However, there is little consensus on the scale of competitiveness or leakage effects of carbon pricing, and there is a risk that without careful design and upfront dialogue with trading partners, BCAs could spur retaliation or disputes that would impact climate and trade policies. BCAs imposing uniform carbon pricing across trading partners may also be difficult to reconcile with the "differentiated responsibilities" of developing countries under the Paris Agreement.

Designing a BCA requires choosing multiple features (coverage, measurement of embodied carbon, treatment of exports, adjustments for mitigation abroad, use of revenues, exemptions for low-income countries) while trading off environmental, legal, administrative, and other considerations. BCAs for indirect taxes are compatible with international trade law, but there are lingering legal uncertainties over whether carbon pricing is an indirect tax and whether alternative approaches for assessing embodied carbon might violate nondiscrimination principles. Limiting coverage to energy-intensive, trade-exposed industries, and using industry rather than firm-level measures of embodied carbon, simplifies administration but does not comprehensively address leakage. The trading partner's level of development also needs to be considered.

While BCAs can be more efficient than other presently used instruments to address competitiveness and leakage concerns (for example, free allowance allocations), BCAs are more complex to administer and could face legal challenges. The incidence of BCAs is expected to be partly passed forward to domestic consumers but—depending on how embodied carbon is assessed—charges on emissions-intensive imports could be significant, potentially fueling trading partners' concerns and highlighting the importance of careful design. Global cooperation over practices for measuring embodied carbon, resolving legal uncertainties, and understanding administrative aspects of BCAs could enhance the functioning of BCAs and make them less contentious. Recent discussions about border measures on countries with laxer climate policies heighten the need for dialogue and cooperation to avoid trade tensions. BCAs may also need to adapt to countries pursuing regulatory approaches that are similarly ambitious to carbon pricing, while such countries may also themselves seek BCA-equivalent mechanisms for leveling the playing field, raising distinct legal issues.

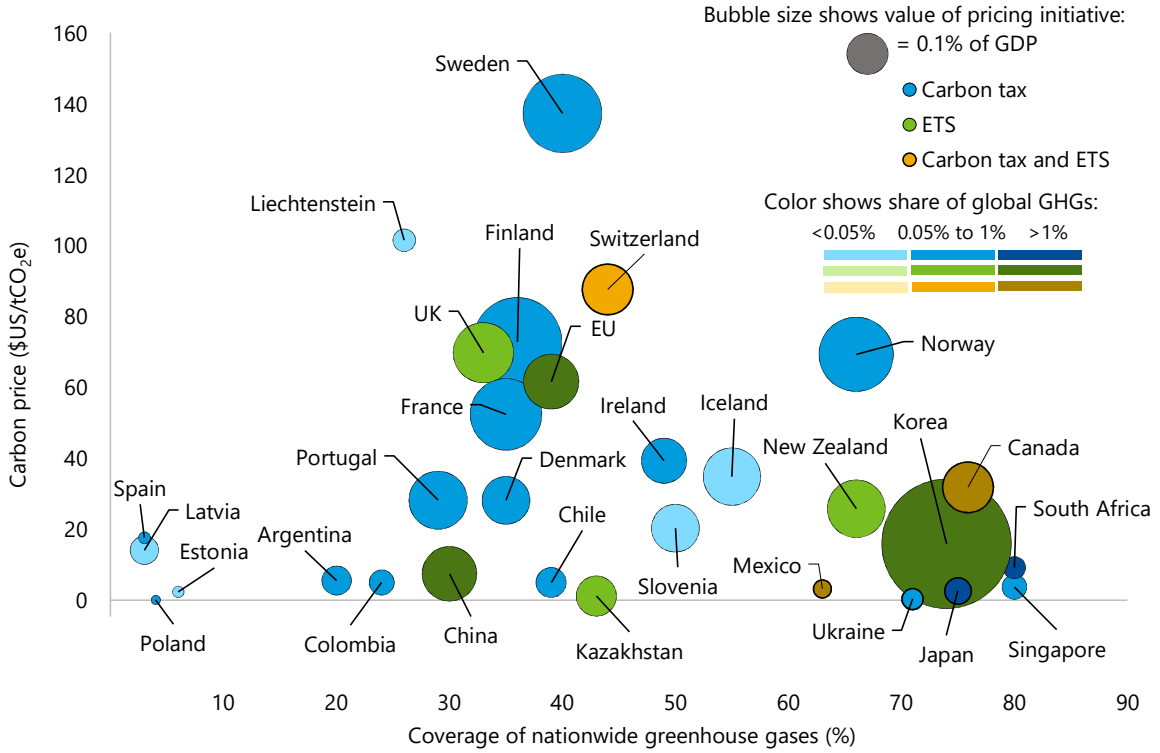
This note examines the rationales for BCAs, design options, and their impacts. It considers design choices from the perspectives of promoting mitigation objectives, consistency with relevant aspects of global trade policy, and limiting administrative complexities. The following sections discuss rationales, legal aspects, design issues, the choice of BCAs versus other instruments, impacts of BCAs on developing countries, and the role of the international community.

Rationale for Border Carbon Adjustments

Carbon pricing is seen as critical for emissions mitigation, but implementation is uneven, reflecting insufficient global cooperation to mitigate climate change and differentiated responsibilities across countries. Some 30 carbon pricing schemes have been implemented at the national and EU levels, with CO_2 prices mostly below $40 per ton, though substantially higher in a few cases (Figure 1). Most countries still have no carbon pricing at all. The dispersion in prices promises to widen in the future, as countries implement differing commitments in Nationally Determined Contributions under the Paris Agreement—not least because developed countries have differentiated responsibilities—and by differing means (Box 1).

Growing cross-country dispersion in carbon prices has prompted policymakers in some countries to consider BCAs. Most notably, the European Union has recently announced proposed plans for a BCA to be gradually implemented starting from 2023 (see Box 2). A well-designed BCA could enable early mover countries to implement higher carbon prices than their trading partners in a manner that (1) limits losses in competitiveness, (2) addresses carbon leakage, and (3) possibly incentivizes mitigation actions in other countries. These three rationales are discussed in Keen, Parry, and Roaf (2021).

Figure 1. Selected Carbon Pricing Schemes, 2021



Sources: WBG (2021); EMBER (2021); Climate Watch (2021); IMF staff calculations.
Notes: Carbon prices are from April 01, 2021 from WBG (2021). EU ETS price is from July 19,2021 from EMBER. GHGs are from 2018. EU includes Norway, Iceland, Liechtenstein. Values less than 0.005 percent of GDP are of equal size for illustrative purposes. The value of the UK's ETS is an estimation for 2021 based on a £50/tCO_2e price. China's value estimate and price is based on the opening pricing of \$7.40/tCO_2e. Finland's transport fuels are priced at \$73/tCO_2e. Ireland's F-gases are priced at \$20/tCO_2e . Norway has a reduced rate on natural gas for EU ETS installations of \$4/tCO_2e. Norway and Mexico prices represent carbon price upper bounds. Lower bounds are \$3.9/tCO_2e and \$0.37/tCO_2e respectively. Switzerland's price is a weighted average between carbon price and ETS by emissions covered.

International Competitiveness

Carbon pricing increases industrial production costs, but the magnitude of competitiveness impacts is unclear. First, firms will incur a direct tax payment, or allowance purchase requirement, for emissions they continue to emit directly. Second, firms will incur abatement costs to the extent they cut emissions, for example, by switching to cleaner (but costlier) technologies and fuels. Third, they incur an indirect payment for carbon charges on emissions embodied in their inputs, especially electricity. At more modest abatement levels, the direct tax payment would be expected to be much higher than the abatement costs, though this is less likely at deeper levels of decarbonization.[1] Through these impacts on production costs, significant carbon price differentials across countries may distort production, consumption, and trade decisions (relative to common carbon pricing across countries) and especially for energy-intensive, trade-exposed (EITE) industries.[2] However, the empirical literature mostly finds very small impacts of carbon pricing on competitiveness (relative to other factors), though sometimes this is attributed to the limited scope of carbon pricing schemes adopted during the period of investigation (for example, Dechezleprêtre and Sato 2017; Joltreau and Sommerfeld 2019; Venmans, Ellis, and Nachtigall 2020).

Carbon Leakage

Carbon pricing disparities also create the risk of carbon leakage, whereby reductions in domestic emissions are partially offset by higher emissions from increased production abroad. Carbon leakage is most relevant for EITE industries—CO_2 emissions from domestic transportation, buildings, and power

[1] See Keen, Parry, and Roaf (2021) for a graphical explanation.

[2] Typical examples of EITE industries include aluminum, steel, cement, iron, chemicals, plastics, and refined petroleum.

generation are generally less mobile, while services have relatively low carbon intensity. Leakage can also occur when mitigation actions reduce global fossil fuel prices, raising fossil fuel demand in other countries, but this channel of leakage is not addressed by BCAs (or related instruments) and applies regardless of whether carbon pricing or alternative mitigation instruments are used. While in principle the Paris Agreement may address leakage (if leakage induces stronger mitigation policies in foreign countries to maintain mitigation commitments in those countries), in practice pledges under the Paris Agreement are voluntary and there is no mechanism for ensuring they are fully achieved (Box 1).

Box 1. Main Principles of the Paris Agreement in Relation to Border Carbon Adjustments

A total of 195 parties signed the 2015 Paris Agreement, which seeks to contain future global temperature increases to **1.5–2 degrees Celsius** above preindustrial levels. Parties submit voluntary climate strategies in Nationally Determined Contributions (NDCs), which are revised (preferably with greater ambition) every five years. Ahead of COP26, many countries have made emissions neutrality pledges for mid-century (International Energy Agency 2020). Countries also have intermediate emissions targets, but at the global level current pledges for 2030 fall well short of what is needed for consistency with warming targets (Parry, Black, and Roaf 2021; UN Environment Programme 2020).

Under the Paris Agreement, countries are responsible for domestic production emissions released within their own borders rather than consumption emissions—the latter would include embodied carbon in imports and exclude embodied carbon in domestic exports. In a sense, therefore, a border carbon adjustment (BCA) would be imposing the domestic jurisdiction's carbon pricing on emissions that are really the responsibility of trading partners. BCAs are not relevant for international aviation and maritime emissions as responsibility for mitigation strategies lies with the United Nations bodies overseeing these industries.

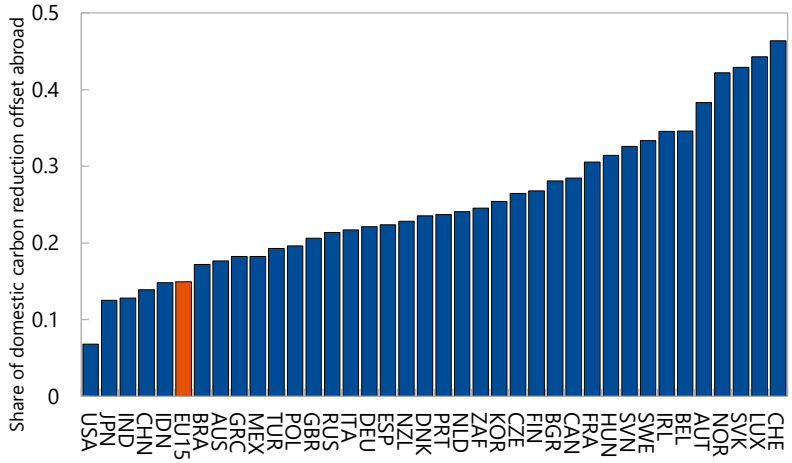
Developing countries have "differentiated responsibilities" for mitigation, given their lower per capita income and smaller contribution to historical emissions (United Nations 1992). This could imply that appropriate carbon prices would be lower in developing countries than in advanced countries. Given that some parties might be unable to fulfill their NDCs due to financing and technological constraints, developed countries collectively are required to mobilize $100 billion a year (through public and private sources) to help developing countries (Article 9).

As countries are responsible for greenhouse gases emitted within their borders, potential emissions leakage to foreign countries might be neutralized if foreign countries honor their own binding targets on nationwide emissions (as increased emissions due to leakage in foreign countries would have to be offset by reductions elsewhere in those countries). However, not all pledges are set in level terms, and there is also no mechanism, like legal sanctions, for ensuring that countries will meet their mitigation commitments (Bullock 2018). Instead, the legally binding aspects of the Paris Agreement are largely procedural. The "ambition mechanism" requires the contracting parties to assess collective progress on mitigation, adaptation, and support measures, and communicate new NDCs (Articles 4 and 14)—they must also report publicly on how they are implementing climate action and track progress toward their commitments through a transparent system. Given that no sanction system was established (Mehling and others 2019), not surprisingly there is considerable cross-country dispersion in the emissions prices implicit in mitigation pledges (IMF 2019a, 2019b). This reflects differences in the ambition level, nature, timing, and scope of NDCs; differences in abatement opportunities and costs (for example, because of access to renewables); and that under the Paris Agreement developing countries have differentiated near- to medium-term responsibilities relative to advanced countries. In addition, the domestic political receptivity to carbon pricing varies widely across countries, and some rely more on other mitigation instruments.

In view of the soft nature of obligations under the Paris Agreement, implementation of a BCA may not pose legal concerns as such. At the same time, there are tensions between the BCA and the Paris framework, due to the effective application of domestic carbon pricing to emissions produced abroad.

In the existing modeling literature, there is little agreement on carbon leakage rates. Most empirical literature finds modest or no evidence of leakage, though in part this may reflect the limited scope of carbon mitigation policies adopted so far and methodological limitations.[3] One recent study[4] suggests higher leakage rates—although the absolute figures should be treated with caution, the study also provides insight on the pattern of leakage across countries. On average in this study (Figure 2) carbon leakage amounts to 25 percent (that is, increased emissions abroad are 25 percent of the domestic emissions reductions due to carbon pricing) with rates varying from 20 to almost 50 percent in individual European countries, but less than 15 percent in China, an EU14+UK aggregate, India, and Japan, and 7 percent in the United States. Overall, leakage rates are larger for small open economies, such as most individual EU countries.

Figure 2. Carbon Leakage Rates, 2005–15 Average



Sources: Organisation for Economic Co-operation and Development (2021); Sato and others (2019); and Misch and Wigender (2021).
Note: The figure uses International Organization for Standardization (ISO) country codes.

Promoting Carbon Mitigation in Other Countries

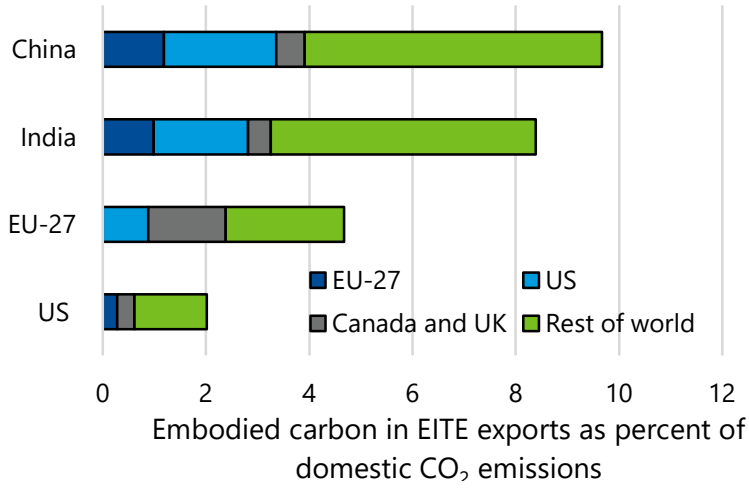
BCAs might incentivize carbon mitigation in other economies. A BCA could encourage trading partner countries to adopt domestic carbon pricing if that would reduce charges on their exports—in this case, the trading partner government would effectively transfer tax revenue to itself. In addition, foreign producers might choose to use less carbon-intensive methods if doing so would reduce the tax on products they export. And more broadly, a BCA could promote pricing in other countries if it helps to demonstrate the economic and political feasibility of carbon pricing. Indeed, even if BCAs are initially introduced unilaterally, countries may subsequently coordinate to create border free trading zones with a common external tariff, which may ultimately lead to more formal and comprehensive arrangements for coordinating over carbon pricing.

However, the financial incentives from BCAs by themselves may not be large. Figure 3 illustrates that carbon embodied in EITE exports from China and India to the European Union and United States are about 3 percent of China and India's domestic carbon emissions, respectively, suggesting only a very modest incentive for these countries to scale up carbon pricing throughout the wider economy in response to EU or US BCAs. The incentive would be somewhat stronger if a broader range of countries were to impose BCAs—embodied carbon in EITE exports to all trading partners from China and India is 10 and 8 percent of their domestic carbon emissions, respectively. In contrast, embodied carbon in the EU-27 (i.e., without the UK) and US EITE industry exports to the world are only 5 and 2 percent of domestic emissions, respectively. Overall, it seems unlikely that any of these shares would be large enough to impact a decision on domestic carbon pricing.

[3] A review by Ellis, Nachtigall, and Venmans (2019) attributes these findings to low carbon price levels, carbon tax exemptions for industry, and generous free allowances under ETSs. See Misch and Wingender (2021) and Verde (2020) for further detail on the literature.

[4] See Misch and Wingender (2021). Their approach employs a simple accounting framework to derive leakage rates from estimates of energy price elasticities of cross-border carbon flows using panel data on carbon in trade flows for advanced countries from Organisation for Economic Co-operation and Development (2021).

Figure 3. Fraction of Domestic Carbon Emissions Embodied in EITE Exports to Trading Partners, 2015



Source: Organisation for Economic Co-operation and Development (2021).
Note: EITE = energy-intensive, trade-exposed.

The Legal Background

While not fully tested, the legal principles and obligations reflected in trade laws arguably allow countries to adopt *nondiscriminatory harmonizing measures* to reduce the competitive disadvantage of domestic industries subject to carbon pricing, or alternatively allow *potentially justifiable discriminatory measures* with coherent environmental objectives (for example, Flannery and others 2020). The BCA design choices should align with the legal policy approach being pursued. The main goal of World Trade Organization (WTO) rules including the General Agreement on Tariffs and Trade (GATT) is to ensure a transparent, rules-based, and nondiscriminatory global trade system that reduces trade barriers and avoids trade distortions and protectionism.[5] Analysis by legal scholars suggests that, in principle, BCAs can be designed to be compatible with these rules (Organisation for Economic Co-operation and Development 2020; Kendall 2012; Mehling and others 2019; Kaufmann and Weber 2011). This is because WTO rules should allow countries (before needing to justify measures under the general exceptions under GATT Article XX) to apply import charges and export rebates not exceeding indirect domestic taxes on "like" domestic products or their inputs—though BCAs must be consistent with the National Treatment principle (equal treatment of domestic and foreign trade participants).[6] Further, the principle of most-favored nation treatment grants the same advantages accorded by any WTO member country to any product originating in or destined for any other country. These principles have not yet been tested in a BCA context however, leaving many legal uncertainties unsettled, not least because no country has implemented a BCA to date.[7] Countries establishing BCAs to reduce emissions leakage that are found to breach these principles could still invoke the general exceptions in order to justify their measures (discussed further in the following) but should have extensive prior discussions with trading partners to ensure a fair, transparent, and inclusive process with affected countries prior to implementing such measures.

One key legal uncertainty is whether domestic carbon taxes and ETSs can be viewed as indirect taxes. Taxes on tangible inputs can be border adjusted, but there is some lingering uncertainty whether a tax on inputs (like carbon) that are not physically incorporated into a final product (and which may vary greatly across plants and countries) can be adjusted at the border (for example, Bacchus 2018). Nevertheless, case law and legal discussions appear to support the idea that BCAs can be applied to carbon taxes imposed on products (both

[5] See www.wto.org/english/docs_e/legal_e/gatt47_01_e.htm.

[6] GATT Article III:2 in combination with GATT Article II:2 (a) allows for the imposition of internal taxes or charges of any kind on imported products as long as they do not exceed those applied to "like domestic products" or in respect of any "article from which the imported product has been manufactured or produced in whole or in part."

[7] The only BCA implemented so far is at the subnational level applying to electricity imported into California (Pauer 2018).

domestic and imported) as long as objective methods are used to measure embodied carbon.[8] ETSs are more complex to characterize than carbon taxes—they could be either indirect taxes or internal regulations—with both potentially border adjustable, especially for import charges. If ETSs are viewed as indirect taxes, the adjustments could take a similar form to carbon taxes; however, if viewed as internal regulations, the border adjustment might instead need to take the form of an equivalent regulation such as a requirement to purchase allowances for embodied carbon.

Another key legal uncertainty is whether alternative approaches to measuring embodied carbon in different countries are consistent with nondiscrimination obligations. In principle, a BCA based on externally verified firm- or plant-specific emissions should be least likely to raise WTO concerns as this would enable all (domestic and imported) products to be taxed using the same methodology. A BCA based on country-specific industry benchmarks should also be possible as an objective alternative, though it might still violate like treatment of products[9] and cross-border cooperation may also be needed to facilitate data collection, which could raise discrimination concerns if methodologies and procedures are not entirely consistent. Mechanisms allowing rebates for individual foreign exporters demonstrating their emissions are lower than implied by an industry benchmark—so-called rebuttability provisions—could improve the legal compatibility of benchmark-based BCAs. Using a common industry benchmark for all countries, such as a domestic industry benchmark or international average where firm- or plant-specific emissions cannot be provided by the importer, should guarantee greater uniformity of treatment, meaning less risk of WTO inconsistencies (although the use of average benchmarks for BCAs ordinarily creates an exposure to traditional "like" product violations, especially for any below average carbon-intensive imported products, although in this case GATT Article XX could be invoked to justify the use of appropriate averages). Use of a more specific domestic industry benchmark (for instance, assuming the carbon content of the imported product is equal to the carbon content of the "like" product produced domestically under certain production assumptions) has the advantage from a legal perspective that it would similarly be nondiscriminatory between trading partners while also better serving the purpose of assuring that both import charges and export rebates do not exceed the amount of indirect domestic taxes on "like" domestic products or their inputs.

On the export side, the key trade principle is whether there is a WTO-illegal export subsidy. The WTO Agreement on Subsidies and Countervailing Measures contains disciplines for two main types of subsidies: actionable subsidies and prohibited subsidies. An actionable subsidy may be countervailed or ruled illegal in a dispute if it causes adverse effects to the interests of another WTO member. A prohibited subsidy is one that is contingent upon export performance (export subsidies) or upon the use of domestic rather than imported products in production (domestic content requirements). Exemptions for exports from indirect taxes borne by "like" products sold domestically, or rebates of such taxes not exceeding amounts paid, are not deemed to be a subsidy.[10] This should enable carbon taxes imposed on products to be rebated when those products are exported. For ETSs viewed as regulations, rebates may not be permissible, but it might still be possible—although legally this is highly uncertain—for an ETS to be likened to a tax program such that the cost of allowance purchases could be capable of being refunded as export rebates or otherwise enabling other equivalent export measures to be adopted.

GATT Article XX provides exceptions for environmental (and health) purposes, and countries establishing BCAs to reduce emissions leakage could invoke these exceptions to justify their measures. This article provides exceptions for environmental (and health) purposes and arguably would apply to BCAs designed to reduce emissions leakage—limiting the BCA to EITE industries (see following discussion) might enhance the prospects of permissibility within this exception.[11] The Article XX chapeau, however, precludes disguised trade restrictions and arbitrary or unjustifiable discrimination between countries where the "same conditions" prevail (see Ghaleigh and Rossati 2011; Mehling and others 2019, 464 onwards). In this regard, countries establishing BCAs to reduce emissions leakage could invoke these exceptions in order to justify their measures, provided they do not result in arbitrary discrimination or disguised trade restrictions (historically, those measures found to be unjustified had protectionist and unjustifiable elements, which operated against the

[8] Mehling and others (2019, 457 onwards); Hillman (2013, 6–8). Some commentators raise the unsettled legal issue that applying BCAs to "like" products based on the carbon intensity of their production processes would result in a differing treatment between physically indistinguishable products (see, for example, Kendall 2012, 71–73), which would then automatically need to be justified under GATT Article XX.

[9] For example, Kendall (2012, 71–73).

[10] Note to GATT Article XVI; and fn. 1 to Article I of ASCM. See also Flannery and others (2020, 17), and Pauwelyn and Kleimann (2020, 8).

[11] GATT Article XX (b) allows measures (in conjunction with restrictions on domestic production or consumption) necessary to protect human, animal, or plant life or health and GATT Article XX(g) allows measures relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption.

environmental objective). Although well-designed BCAs could meet these requirements (for example, adopting "rebuttability provisions" for benchmark-based BCAs could defend against suggestions that the benchmark is arbitrary), to be justified under GATT Article XX, BCAs would have to coherently focus on the climate objective that the broader policy is trying to achieve. In this regard, the design choices made should be consistent with—and reinforce—the central climate objective being pursued (for example, addressing carbon leakage), even if some differentiation of treatment occurs (for instance, adjustments to reflect carbon pricing policies abroad).

There is also the key question of how the "differentiated responsibilities" of developing countries could be considered in the legal design of BCAs. This is because the Paris Agreement embodies the principles of equity and "common but differentiated responsibilities and respective capabilities" (Box 1). On the one hand, treating a broad class of countries more favorably (for example, through exemptions from BCAs) irrespective of their action to reduce carbon emissions may be seen as undermining the central climate objective. On the other hand, distinctions for low-income countries—especially least developed countries—may still be justified on the basis that the "same conditions" do not prevail in those countries as they do in advanced countries.

BCAs should be outside the scope of tax treaties. BCAs that are levied on products are likely to be characterized as something other than an income tax or a "substantially similar" tax and therefore should be outside the scope of tax treaties. This also means that parties would have no access to bilateral dispute mechanisms in existing tax treaties regarding the operation of the BCAs.[12]

Design and Implementation

In designing a BCA there are multiple objectives to consider and multiple features to decide. Besides addressing competitiveness and leakage concerns, and promoting pricing elsewhere, other potential objectives include preserving domestic mitigation incentives, raising revenue, and limiting administrative burdens and legal risks. Table 1 summarizes the implications of major design features for various outcomes, while the following discussion elaborates on the main points. The discussion does not distinguish between BCAs in the form of an import tax versus a requirement to purchase emissions allowances, as the latter can be designed to largely mimic the former (Box 2).

Table 1. Main Design Choices for Border Carbon Adjustments and How they Affect Multiple Objectives

	Design Feature				
		Measuring Embodied Carbon			
Metric	**Sectoral Coverage: EITE Industries vs. Broader**	**Domestic vs. Country-Specific Benchmarks**	**Rebuttability**	**Rebates for Domestic Exporters**	**Adjusting BCA for Carbon Pricing Abroad**
Competitiveness of EITE Industries	Same protection with both approaches	Domestic preserves competitiveness for all trading partners	Little relevance	Preserves competitveness of exports	Can preserve level playing field
Leakage	Broader addresses leakage more comprenshively but extra benefit may be modest	Country-specific addresses leakage more efficiently	Little relevance	Reduces leakage	May reduce leakage
Promoting Carbon Pricing/Mitigation Abroad	Broader increases incentives but only modestly	Country-specific provides stronger incentives on foreign producers and governments	Incentive for foreign firm to reduce emissions	Little relevance	Promotes pricing but direct incentives may be modest
Mitigation for Domestic EITE Industries	Both approaches preserve incentives	Both approaches preserve incentives	Little relevance	Preserves incentives if appropriate design	Little relevance
Administrative	Broader may be very complex	Country-specific is more complex	Small if third parties provide verification	Modest additional burden	Increases burden
Legal	Leakage rationale more questionable for broader	Domestic might help by reducing tariff and showing like treatment	Should help with WTO	Could be challenged as a subsidy	May increase legal risks if not applied equally and equivalently across countries

Source: IMF staff.
Note: BCA = border carbon adjustment; EITE = energy-intensive, trade-exposed; WTO = World Trade Organization.

[12] There have, however, been recent suggestions for the adoption of a Multilateral Carbon Tax Treaty (see Falcao 2019).

Box 2. Current Initiatives for Border Carbon Adjustments

The European Union

The European Commission has recently presented (European Commission 2021) a series of options for a border carbon adjustment (BCA), which it calls a carbon border adjustment mechanism (CBAM), as part of a broader legislative package (including a review of the emission trading system (ETS)) for consideration by the European Parliament and European Council. Under the preferred approach, the CBAM would be gradually phased in beginning with a pilot phase during 2023–25, and then a 10-year transition period (during which the ETS free allowances would be gradually phased out). This effort originated in 2019 as part of the European Union's "Green Deal" (European Commission n.d.; Lamy, Pons, and Leturcq 2020).

The European Commission has stressed the importance of compliance with WTO rules, and that any BCA will first and foremost be an environmental measure, though it notes that revenues generated could be a source of "own resources" to help service debt relating to the NextGenerationEU. The proposed CBAM focuses on sectors deemed most at risk of carbon leakage (iron and steel, aluminum, electricity, cement, fertilizers, possibly other sectors). Operationally, importers would buy emissions certificates at the ETS price to cover the embedded emissions in products being imported into the European Union. The scheme would run in parallel to the current ETS and be operationally equivalent to an import tariff, though the price would be linked to market conditions rather than set exogenously. During the 2026–35 transition period, the free ETS allocations would be gradually phased out for the sectors included in the CBAM (the CBAM would be reduced proportionally to the amount of free allowances in a given sector). Under the proposal, importers can deduct, based on verified information from third country producers, the amount of any carbon price that has already been paid during the production of the imported goods.

Other Countries

In its Fall Economic Statement, the Canadian government stated that it was exploring the potential of BCAs and intended to discuss with like-minded economies on how they could fit with a strategy for meeting climate objectives while ensuring a fair environment for businesses.

The US administration's view on a BCA is unclear, although it has recently announced that it would explore carbon border taxes as part of its trade policy agenda. Prior to the election, the Biden campaign signaled support for imposing a BCA on imports from countries that are failing to meet their climate and environmental obligations.[13]

Product Coverage

Limiting the BCA to EITE industry products may be the most practical, at least initially. Competitiveness and leakage concerns should generally be less severe for other sectors like services and non-EITE manufacturing given their relatively low carbon intensity, although this may not be the case for all sectors and industries. Pricing schemes for agriculture have not yet emerged, and as long as this persists this sector will remain beyond the scope of BCAs. A narrow focus limits administrative burdens (for example, assessing embodied carbon is relatively straightforward for EITE industries many of which produce raw materials) and may limit legal risks (the environmental motivation based on leakage may be more transparent for EITE products than products with low embodied carbon).

Measuring Embodied Carbon

Broader product coverage over the longer term could comprehensively address competitiveness and leakage, and possibly provide stronger incentives for carbon pricing elsewhere, but the near-term administrative challenges are severe. Extending the BCA coverage to include charges on imported non-EITE manufacturing, services, mining, and electricity, combined with corresponding export rebates, would address competitiveness and leakage issues for a broader range of sectors, and avoid incentives to shift imports of embodied carbon further along the value chain, to finished products. However, these benefits may be small where carbon intensities are low. The biggest question about broad BCAs is their practicality, at least for the near term. Besides the additional administrative and compliance burdens of collecting charges from multiple

[13] See https://joebiden.com/climate-plan. Recent legislative proposals for carbon taxes in the United States have also contained BCAs (see www.carbontax.org/bills).

trading partners on a much broader range of sectors, there are also considerable challenges to measuring embodied carbon (for example, for services and for non-EITE goods which are further down the value chain and use materials purchased from other firms perhaps in other countries).

How carbon embodied in traded goods is measured for the purpose of calculating the BCA will influence a BCA's effectiveness and burdens on trading partners, but choices depend on data availability, administrative burdens, and legal considerations. In principle, to efficiently meet the potential for BCAs to address carbon leakage, data on embodied carbon would be calculated under an internationally agreed methodology on a product- and plant-specific basis (Box 3), though in practice such systems add to administrative costs and data constraints would currently preclude their implementation. In the meantime, using industry-level benchmarks may be a practical option. These benchmarks only partially exploit the potential of a BCA, however, as they may overtax imports from a foreign firm with below-average emissions intensity (overcorrecting for leakage) or undertax firms with above-average emissions intensity (allowing leakage); likewise, on the export side, benchmarks may need adjustment to avoid excessive rebates to low-emitting firms. And (especially in the absence of rebuttability) they provide no incentives for foreign producers to cut their emission.

Box 3. Border Carbon Adjustments Using Firm-Specific Data

In principle, there are several attractions to basing border carbon adjustments (BCAs) on embodied carbon at the firm or plant level.

- *Familiarity.* Firm-specific BCAs closely resemble border adjustments to excise taxes, which are familiar and have a clear World Trade Organization (WTO) legal status (for example, border adjusting an excise tax on the alcohol content of liquor parallels, conceptually, border adjusting the carbon content of goods).
- *WTO consistency.* Firm- or plant-level BCAs could reduce legal uncertainty because the amount of carbon that went into the specific production of particular products could be determined to enable all (domestic and imported) products to be taxed using the same methodology.
- *Carbon leakage.* Using firm-specific data would avoid undertaxing foreign producers with relatively higher emissions, better addressing carbon leakage, which can be important given the heterogeneity of production methods within many energy-intensive, trade-exposed industries (see, for example, van Ruijven and others 2016).
- *Mitigation incentives abroad.* Firm-specific BCAs would encourage individual foreign exporters to reduce emissions.

At the same time, firm- or plant-level BCAs would magnify administrative complexities. The number of potentially different product charges is given by the number of foreign suppliers within a particular industry, aggregated over all trading partners, and over all industries covered by the BCA. Moreover, all these different charges would need to be regularly updated as new data on embodied carbon becomes available. There could be strong incentives for gaming if firms can reduce reported emissions by shifting production from emissions-intensive plants to trading partners that do not apply BCAs or domestic markets. There might also be strong incentives for lobbying efforts as firms claim their emissions are lower than in official estimates. At the least, however, better micro-level data on embodied carbon could increase the effectiveness of the rebuttability provision.

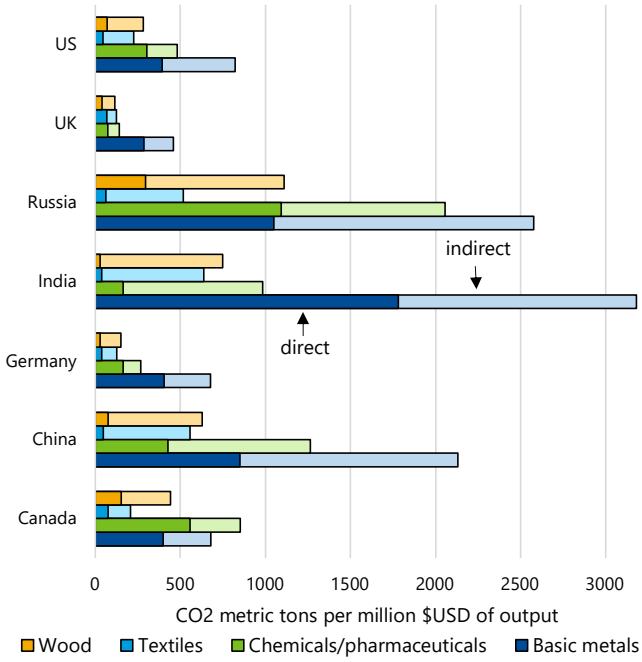
Industry-level benchmarks could use country-specific data. Using emissions-intensity data specific to the foreign exporting country[14] would imply consumers and businesses on average face the right set of relative prices across imported products with different carbon intensities. This helps preserve the relative prices of domestic and foreign products despite carbon pricing, while trading partners for whom leakage risks are greater (due to higher embodied carbon) are accordingly subject to higher charges and have stronger incentives to adopt their own pricing.

[14] For example, based on cross-country input-output tables and data on emissions factors which is reasonably reliable for power generation and EITE industries (see Organisation for Economic Co-operation and Development 2021).

The alternative of using an emissions-intensity benchmark common to all countries would be less effective in achieving BCA objectives. Assessing imported products based on a common benchmark (for example, domestic or global average emission intensities) would not account for cross-country differences in emissions intensities, over- or undertaxing the imports and providing little incentive to foreign producers or governments to reduce emissions. And as domestic industries cut emissions in response to carbon pricing, a domestic benchmark would reduce charges on competing imports, even though their emissions may not have changed.

Common benchmarks have important pragmatic advantages, however, and may be appropriate initially. Administration is more complex under country-specific benchmarks, as a different BCA rate needs to be calculated for each foreign exporter and applied by the customs agency. In addition, emerging market economies (EMEs) would tend to face stiffer charges under country-specific BCAs—for example, embodied CO_2 in basic metals is over 2,000 tons per $million output in China, India, and Russia and less than 1,000 tons in Canada, Germany, the United Kingdom, and the United States (Figure 4). Using domestic or global benchmarks would therefore reduce the burden on (emissions-intensive) foreign exporters and may aid political acceptability of the BCA, with the use of appropriate average benchmarks capable of being justified under WTO rules. A pragmatic approach may be to use a domestic embodied carbon benchmark initially while the BCA is being established, with a view to transitioning to country-specific BCAs over time.

Figure 4. Embodied Carbon by Sector and Country, 2015



Source: IMF staff calculations based on Organisation for Economic Co-operation and Development Input-Output Tables.

Adjusting the Border Carbon Adjustment to Reflect Foreign Mitigation Efforts

Proposals differ on whether to adjust the import BCA to reflect carbon pricing policies in the country of export. Attempting to do so requires the government applying the BCA to differentiate among trading partners and perhaps to judge the equivalence or adequacy of other countries' carbon pricing systems, relative to its own. The legal trade-offs and risks under WTO rules are complex. In this regard, some proposals (for example, Flannery and others 2020) would not adjust for policies of the exporting country, noting that other governments may use export rebates to offset the effect of their domestic carbon pricing policies on exported products (as is typically done for excise taxes or value-added tax), though this mutual approach eliminates any incentive for BCAs to encourage carbon pricing in trading partners. Similar considerations apply in considering whether to adjust BCA export rebates for carbon pricing in the country of destination.

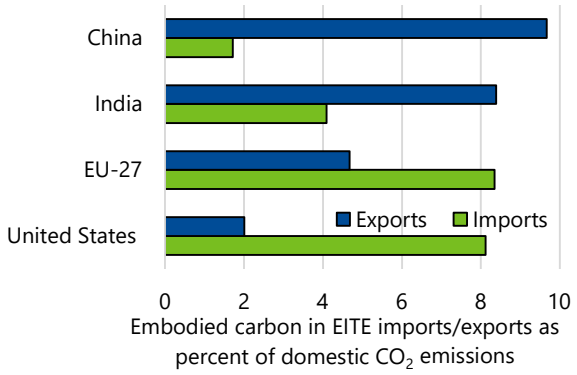
Carbon mitigation by other countries that rely on regulatory approaches rather than carbon pricing would raise additional and complex issues, heightening the need for cooperative solutions. Measuring carbon price equivalents, or "shadow prices," for regulations (for example, energy efficiency and vehicle emission rate standards) can be conceptually difficult and would add to the list of contentious issues. For example, it can be difficult to agree on a methodology to estimate shadow prices, to gauge whether and to what extent regulations are binding, or to assess what costs they impose on firms. In practice, cooperative solutions among trading partners and, eventually, at the multilateral level would be critical to find an agreement on the "equivalence" between price and regulatory approaches to carbon mitigation which may reduce the need for a

BCA. In turn, BCAs may not be considered appropriate to address competitiveness and leakage concerns for countries that rely on regulatory mitigation. Global discussion would need to include agreeable mechanisms for leveling the playing field of countries that rely on regulatory mitigation, equivalent to a BCA for carbon pricing.[15]

Export Rebates

Export rebates are a potentially important complement to an import BCA, much as with an excise tax or value-added tax. In the absence of such rebates, an increase in domestic carbon prices would lead to reduced output and exports of the products of EITE industries, in turn encouraging increased production and emissions elsewhere. Export rebates should be based on firm-wide emissions, or industry-wide or "global good-practice" benchmarks, to avoid firm incentives to use more emissions-intensive production methods for export. Export rebates would offset 25 and 60 percent of the revenues from import charges on EITE products in the United States and EU-27, respectively (as can be inferred from embodied carbon in imports and exports shown in Figure 5—on current trade and emissions patterns, before accounting for any behavioral responses induced by the policies), while in the case of BCAs imposed in China or India, revenue losses from export rebates would substantially outweigh revenues from import charges (reflecting the generally larger share of industrial products in EME exports and their generally higher emissions intensity of production). As noted previously, WTO rules should permit a full rebate of carbon taxes consisting of indirect taxes imposed on a product when that product is exported, but rebates for ETS allowance purchases may not be permissible.

Figure 5. Embodied Carbon in EITE Imports and Exports, 2015



Source: Organisation for Economic Co-operation and Development (2021).
Note: EITE = energy-intensive, trade-exposed.

Revenue Use

Possibly, legal risks for BCAs might be reduced if revenues are earmarked for domestic green investment and just transitions or financial and technological assistance for mitigation and adaptation in developing countries. Such earmarking could enhance the credibility of the BCA as an environmental measure and demonstrate that the BCA is part of a good faith effort to achieve an international response to climate change (both being important considerations when seeking to invoke the general exceptions under WTO rules). Revenue collections would generally be modest, however—a $50 per ton BCA on manufacturing imports would have raised revenues of 0.1–0.2 percent of GDP in China, India, EU-27, and the United States in 2015, and this excludes potential revenue losses from export rebates (from Keen, Parry, and Roaf 2021, Figure 13).

Exempting Least-Developed Countries

Country exemptions can create unintended administrative issues but should be strongly considered for least-developed countries (LDCs). Exempting certain countries can promote relocation and circumvention of the BCA. There is a good case to exempt imports from LDCs, however, because of their small economic size, well-defined international status (including in the WTO), and very small contributions to historical CO_2 emissions.

[15] See Keen, Parry, and Roaf (2021) for exploration of economic aspects of these issues.

Alternatives to BCAs

The case for BCAs depends on their pros and cons relative to alternative instruments. These other instruments might include (Keen, Parry, and Roaf 2021; Fischer, Morgenstern, and Richardson 2015):

- Exempting all, or some, EITE industry emissions from carbon pricing (in a downstream pricing program), as in South Africa, or rebating them for carbon prices implicit in fuel and electricity inputs (in an upstream pricing program).
- Allowing EITE industries to participate in a tradable emissions rate standard (that is, where firms can fall short of the standard if they buy credits from firms exceeding the standard) in lieu of carbon pricing, as in Canada, which is another way of limiting charges on firms' remaining emissions after they meet the standard.
- Granting free allowance allocations (related to past emissions) for EITE industries under an ETS, as in California, the European Union, Korea, and New Zealand.
- Recycling carbon pricing revenues from EITE industries in output-based rebates for these industries (this policy has been proposed but not yet implemented).

Table 2 summarizes how selected instruments perform against certain metrics.

Table 2. The Choice of Border Carbon Adjustments versus Other Instruments

Metric	BCAs	Exemptions for EITE Industry Emissions From Pricing	Tradable Emission Rate Sandard/Output-based Rebate for EITE Industries	Free Allowances Under ETS
Protecting Competitiveness of EITE Industries	Yes	Full exemption is less effective (if it does not apply to indirect emissions)	Partially	Partially
Limiting Leakage	Yes	Full exemption is less effective (if it does not apply to indirect emissions)	Partially	Partially
Promoting Mitigation and Carbon Pricing in Other Countries	Modest incentive	No incentive	No incentive	No incentive
Mitigation Incentives for Domestic EITE Industries	Promotes all incentives	Remove mitigation incentives for direct emissions	Reduces emissions per unit of production but not production levels	Promotes all incentives
Revenue Implications	Preserves carbon pricing revenue	Forgoes revenue	Forgoes revenue	Forgoes revenue
Administrative Burden	Significant if coverage beyond EITE products	Modest	Modest	Modest
Risk of Legal Challenge Under WTO	Depends on design features	N/A	N/A	Could be challenged as subsidy but has not been

Source: IMF staff.
Note: BCA = border carbon adjustment; EITE = energy-intensive, trade-exposed; ETS = emissions trading system; WTO = World Trade Organization.

Well-designed BCAs are a more natural instrument for maintaining the integrity of carbon pricing schemes and ultimately can be more effective than other instruments at addressing competitiveness and leakage. This is especially the case if the BCA varies across trading partners according to embodied carbon and includes export rebates. The alternative instruments mostly reduce costs on domestic producers to

help them compete with foreign producers and therefore diminish domestic price signals from carbon pricing. On the other hand, the BCA leaves the domestic carbon pricing scheme intact, while leveling the playing field by increasing costs of imports. Full exemptions for EITE industries from carbon pricing (for direct and indirect emissions) would be as effective at maintaining a level playing field and partial exemptions less so. Tradable emission rate standards, free allowance allocation under ETSs, and output-based rebates are partially effective. In these cases, firms are either not charged for (all or a large portion of) their remaining direct emissions, or are compensated for charges on these emissions, but they are charged for indirect emissions and they incur abatement costs.

To varying degrees, most other instruments reduce mitigation incentives for domestic EITE industries, and they forgo revenue. Full exemptions remove all mitigation incentives for EITE industries, at least for direct emissions, and tradable emission rate standards and output-based rebates promote reductions in the emissions intensity of production but do little to reduce output levels of emissions-intensive products. Free allowance allocations largely preserve mitigation incentives as they are largely a lump-sum transfer—domestic firms still face higher unit production costs and will cut back production (whereas under the BCA imports will tend to fall). Other instruments either have no revenue-raising potential (emission rate standards) or forgo the potential for general revenue raising (exemptions, free allowance allocation, output-based rebates).

Impact of BCAs on Trading Partners

Trading partners are understandably nervous about the prospect of new charges on their exports. Two common concerns are that (1) their firms' exports will be disadvantaged in countries adopting BCAs, and (2) BCAs could appropriate government revenues at their expense. Therefore, a dialogue with trading partners is important to limit risks of disputes or retaliation.

Competitiveness assessments should account for both the BCA and the underlying carbon pricing. The BCA is intended to address a trade distortion arising from disparities in carbon pricing. When a country unilaterally raises carbon prices it gives its trading partners without similar pricing a competitive advantage in EITE industries—levying carbon charges on imports aims to restore a level playing field.

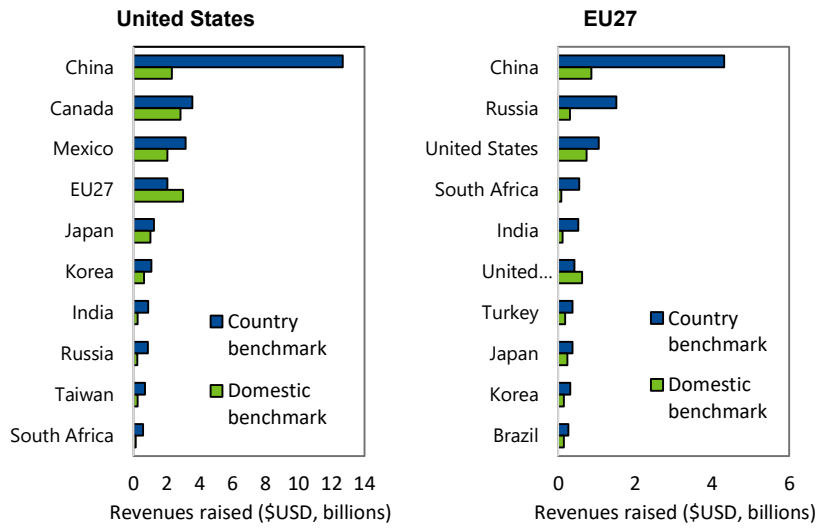
Competitiveness impacts will be highly sensitive to the benchmark for assessing embodied carbon (given the large cross-country differences in the emissions intensity of production—see Figure 4).

- If the benchmark is emissions intensity of the domestic industry, the BCA charges imports the same cost per unit of output that domestic firms are paying. The combination of carbon pricing and the BCA should not put foreign firms at a competitive disadvantage in this case—indeed, to the extent carbon pricing causes domestic firms to use cleaner and more expensive technology than foreign firms, the latter could gain a competitive advantage.
- In contrast, if the benchmark is emissions intensity of the foreign industry, the BCA could impose substantially higher charges on imports than domestic firms are paying. The data in Figure 4 gives a sense of how costs for some emerging market producers could increase relative to carbon pricing payments in an advanced country implementing carbon pricing with a BCA—for some industries EME emissions intensities are a multiple of those in advanced countries. In principle, this approach puts foreign firms in the same position as domestic firms: provided there is "rebuttability," foreign firms can adopt cleaner technology to reduce the charge. Such technology may be more costly or unavailable, however (for example, there may be no opportunity to purchase clean electricity), especially in a short timeframe. And developing countries may question whether applying an advanced-country carbon price to their emissions is consistent with their "differentiated responsibilities" under the Paris Agreement (Box 1).

Competitiveness impacts of BCAs should be gauged against alternatives countries are already using. As discussed earlier, these alternatives operate by reducing the costs on domestic producers, while BCAs raise costs on imports. It is not entirely clear that moving from one mechanism to another will put trading partners in a better or worse position, but most existing alternatives are likely similar in effect to BCAs based on a domestic benchmark, rather than on foreign emissions intensity.

The cross-border revenue implications of BCAs are expected to be relatively minor. Figure 6 shows potential revenues under the two benchmarking methods (again, on current trade and emissions patterns). There are large differences between the two methods, especially for countries with higher emissions intensity such as China and India. Either way, the total revenues may not be that large—under a $50 per ton BCA imposed by the European Union, for example, annual revenues formally collected on imports from China would be $4 billion or $1 billion under the country-specific and domestic benchmarks, respectively (or 0.03 and 0.007 percent of China's GDP, respectively). Net BCA revenues will be even lower if export rebates are included.

Figure 6. Potential Revenues from Border Carbon Adjustments on Energy-Intensive, Trade-Exposed Imports with $50 Carbon Price, 2015



Source: IMF staff estimates using Organisation for Economic Co-operation and Development (2020).

The effective incidence of the BCA is expected to fall partly or mainly on domestic consumers. In contrast to free allowances or exemptions, the BCA allows carbon pricing (on both domestic production and imports) to be passed on in higher domestic product prices. This may help alleviate concerns about countries with BCAs "appropriating" carbon pricing revenues from trading partners. However, the degree of passthrough and share of BCA incidence borne by trading partners will depend on a range of factors, including BCA design—especially the measurement of embodied carbon.

Role of International Coordination

International cooperation can facilitate the use of more effective forms of BCAs, while also helping to avoid disruption from legal disputes and promoting policy stability. There are at least three key areas where international cooperation could help.

Investing in data and data standards. The most effective forms of BCAs exploit data on the carbon emissions embodied in traded goods. Although data is available at more aggregate levels (see previous discussion), governments, industry groups, and other entities are collaborating to establish detailed sector-, firm-, or plant-specific data and advances in artificial intelligence and machine learning could improve data quality (Smith 2020; World Green Building Council 2019). Building on existing efforts to develop data standards, such as the International Organization for Standardization and the Greenhouse Gas Protocol, there remains a strong need for joint efforts toward common international standards for measuring embodied carbon in traded products.[16] Along with greater experience with carbon pricing, better data should also help empirical studies to identify the scale of competitiveness and leakage effects, helping inform the policy debate.

Clarifying trade rules. Resolving in advance some of the key legal uncertainties surrounding BCAs could reassure governments that they can formulate WTO-consistent BCAs, guide the development and implementation of BCAs in positive directions, and avoid lengthy disputes. A key first step would be to clarify that an indirect tax on embodied carbon or equivalent internal regulations can be border-adjusted, with

[16] See Bacchus (2016) and World Resources Institute (2020). Flannery and others (2020) and Mares and Flannery (2018) discuss methodologies for measuring embodied at the plant and product level for goods produced by 35 EITE industry classifications imported into the United States using existing international standards.

supporting guidance on the use of alternative approaches for measuring embodied carbon. WTO members can adopt binding interpretations by consensus.[17]

Customs cooperation. Any trade measure presents circumvention and avoidance opportunities that could pose challenges for a BCA exempting certain countries, or that otherwise differentiates among trading partners. Cooperation among national customs administrations can help to elaborate the practical application of BCAs and establish important data- and information-sharing mechanisms that can help to minimize these opportunities.

Conclusions

BCAs have appeal over other instruments for maintaining the integrity of carbon pricing systems and addressing competitiveness and leakage as countries move to deeper industrial decarbonization, but they need careful design and upfront dialogue with trading partners. BCA design is hampered by uncertainties over the compatibility of alternative options with trade law, the greater administrative burdens associated with more effective designs, and possible inconsistencies with differentiated responsibilities from common pricing of embodied carbon in products from different countries. There is also a risk of disputes or retaliation that could impact climate and trade policies. A pragmatic case can be made for some design features in the early stages, however, such as limiting the initial coverage to EITE industries, applying common emissions intensity benchmarks across countries (to avoid disproportionate burdens on EMEs), and allowing relatively clean foreign firms to rebut industry-level benchmarks. The motivation and design of a BCA in legislation should be based on environmental (rather than protectionist, revenue-raising, or punitive tariff) considerations. In any case, strong upfront dialogue and coordination are needed between countries moving ahead with BCAs and others, in particular EMEs.

BCAs may also need to adapt to countries pursuing regulatory approaches that are similarly ambitious to carbon pricing, with a related need to clarify applicable trade rules to justify such BCAs. A recent US proposal, for example, suggests a BCA on imports to reflect the cost to domestic producers complying with emissions regulations (see Friedman 2021). Measurement of these costs will be contentious however, not least due to the absence of a counterfactual for what production and costs would have been in the absence of regulation. This also raises distinct trade law issues given that the ability to border adjust regulatory measures can be more limited under WTO rules (for instance, applying import charges that are not equivalent to the regulatory measure would likely need to be justified under the general exceptions in GATT Article XX; export rebates may not be permissible at all).

Pressure for BCAs will likely rise as some regions and countries adopt more aggressive carbon pricing, and this may ultimately focus attention on international carbon price floors which would be far more effective at scaling up global mitigation. Especially in the early stages of carbon pricing, the scale of competitiveness and leakage effects may not be large enough to warrant the administrative, political, and legal complexities of a BCA, but this may change over time with deeper decarbonization. Experience with BCAs should help to clarify some of the methodological and policy uncertainties described in this note. Eventually, if enough large-emitting countries adopt BCAs, this might increase interest in the possibility of formal coordination mechanisms like price floors covering all emissions (rather than the small portion of emissions in trade flows), which may ultimately hold the key to effective and efficient mitigation of climate change. BCAs might still be retained to provide some incentive for participation in comprehensive price floors, though this would complicate negotiation over price floors.

[17] An interpretation of any of the multilateral trade agreements can be adopted by a majority of three-quarters of WTO members according to Article IX and X of the Marrakesh Agreement, but in practice there has never been any instance where any decision has been adopted without consensus.

References

Bacchus, James. 2016. “Global Rules for Mutually Supportive and Reinforcing Trade and Climate Regimes: Synthesis of the Policy Options.” Paper for the E15 Initiative on Strengthening the Global Trade and Investment System for Sustainable Development, International Centre for Trade and Sustainable Development and World Economic Forum, Geneva.

Bacchus, James. 2018. *The Willing World: Shaping and Sharing a Sustainable Global Prosperity*. Cambridge: Cambridge University Press.

Bullock, David. 2018. “Combating Climate Recalcitrance: Carbon-Related Border Tax Adjustments in a New Era of Global Climate Governance.” *Washington International Law Journal* 27 (3): 609–44.

Climate Watch. 2021. “CAIT GHG Emissions.” https://www.climatewatchdata.org/ghg-emissions?end_year=2018&start_year=1990

Dechezleprêtre, Antoine, and Misato Sato. 2017. “The Impacts of Environmental Regulations on Competitiveness.” *Review of Environmental Economics and Policy* 11 (2): 183–206.

Ellis, Jane, Daniel Nachtigall, and Frank Venmans. 2019. “Carbon Pricing and Competitiveness: Are They at Odds?” OECD Environment Working Paper 152, Organisation for Economic Co-operation and Development, Paris.

EMBER. 2021. *Daily Carbon Prices*. Available at: https://ember-climate.org/data/carbon-price-viewer.

European Commission. n.d. “A European Green Deal.” https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

European Commission. 2021. “Establishing a Carbon Border Adjustment Mechanism.” https://ec.europa.eu/info/sites/default/files/carbon_border_adjustment_mechanism_0.pdf

Falcao, Tatiana. 2019. *A Proposition for a Multilateral Carbon Tax Treaty*. Amsterdam: International Bureau of Fiscal Documentation.

Fischer, Carolyn, Richard Morgenstern, and Nathan Richardson. 2015. “Carbon Taxes and Energy-Intensive, Trade-Exposed Industries: Impacts and Options.” In *Implementing a US Carbon Tax: Challenges and Debates*, edited by Ian Parry, Adele Morris, and Roberton C. Williams, 159–77. London: Routledge.

Flannery, Brian, Jennifer A. Hillman, Jan Mares, and Matthew C. Porterfield. 2020. “Framework Proposal for a US Upstream GHG Tax with WTO-Compliant Border Adjustments: 2020 Update.” Report 20-14, Resources for the Future, Washington, DC.

Friedman, Lisa. 2021. “Democrats Propose a Border Tax Based on Countries’ Greenhouse Gas Emissions.” *The New York Times*, July 19.

Ghaleigh, Navraj Singh, and David Rossati. 2011. “The Spectre of Carbon Border-Adjustment Measures.” *Climate Law* 2 (1): 63–84.

Hillman, Jennifer A. 2013. “Changing Climate for Carbon Taxes: Who’s Afraid of the WTO?” Climate & Energy Policy Paper Series, Georgetown University Law Center, Washington, DC.

International Energy Agency. 2020. “Achieving Net-Zero Emissions by 2050.” www.iea.org/reports/world-energy-outlook-2020/achieving-net-zero-emissions-by-2050

International Monetary Fund (IMF). 2019a. *Fiscal Monitor: How to Mitigate Climate Change*. International Monetary Fund, Washington, DC, October.

International Monetary Fund (IMF). 2019b. *Fiscal Policies for Paris Climate Strategies—From Principle to Practice*. Washington, DC: International Monetary Fund.

Joltreau, Eugénie, and Katrin Sommerfeld. 2019. “Why Does Emissions Trading under the EU Emissions Trading System (ETS) Not Affect Firms’ Competitiveness? Empirical Findings from the Literature.” *Climate Policy* 19 (4): 453–71.

Kaufmann, Christine, and Rolf H. Weber. 2011. “Carbon-related Border Tax Adjustment: Mitigating Climate Change or Restricting International Trade.” *World Trade Review* 10 (4): 497–526.

Keen, Michael, Ian Parry, and James Roaf. 2021. “Border Carbon Adjustments: Rationale, Design and Impact.” IMF Working Paper, International Monetary Fund, Washington, DC.

Kendall, Keith. 2012. “Carbon Taxes and the WTO: Carbon Charge without Trade Concerns.” *Arizona Journal of International and Comparative Law* 29 (1): 49–90.

Lamy, Pascal, Geneviève Pons, and Pierre Leturcq. 2020. “A European Border Carbon Adjustment Proposal.” Europe Jacques Delors Policy Paper, Jacques Delors Institute, Paris.

Mares, Jan W., and Brian P. Flannery. 2018. “WTO-Compatible Methodologies to Determine Export Rebates and Import Charges for Products of Energy-Intensive, Trade-Exposed Industries, If There is an Upstream Tax on Greenhouse Gases.” Resources for the Future Working Paper 18-19, Resources for the Future, Washington, DC.

Mehling, Michael A., Harro van Asselt, Kasturi Das, Susanne Droege, and Cleo Verkuijl. 2019. “Designing Border Carbon Adjustments for Enhanced Climate Action.” *American Journal of International Law* 113 (3): 433–81.

Misch, Florian, and Philippe Wingender. 2021. “Revisiting Carbon Leakage.“ IMF Working Paper 21/207, International Monetary Fund, Washington, DC.

Organisation for Economic Co-operation and Development. 2020. “Climate Policy Leadership in an Interconnected World: What Role for Border Carbon Adjustments?” OECD Press, Paris.

Organisation for Economic Co-operation and Development. 2021. “Carbon Dioxide Emissions Embodied in International Trade.” www.oecd.org/sti/ind/carbondioxideemissionsembodiedininternationaltrade.htm

Parry, Ian, Simon Black, and James Roaf. 2021. “Proposal for an International Carbon Price Floor Among Large Emitters.” IMF Staff Climate Note 2021/001, International Monetary Fund, Washington, DC.

Pauer, Stephan. 2018. “Including Electricity Imports in California’s Cap-and-Trade Program: A Case Study of a Border Carbon Adjustment in Practice.” *The Electricity Journal* 31: 39–45.

Pauwelyn, Joost, and David Kleimann. 2020. “Trade Related Aspects of a Carbon Border Adjustment Mechanism. A Legal Assessment.” European Parliament, Policy Department for External Relations, Directorate General for External Policies of the Union, Belgium.

Sato, Misato, Gregor Singer, Damien Dussaux and Stefania Lovo, 2019. “International and Sectoral Variation in Industrial Energy Prices 1995–2015.” *Energy Economics* 78: 235-258.

Smith, Martin. 2020. “Achieving Robust, Science-Based Measurement, Reporting and Certification of Carbon Emissions through Artificial Intelligence and Machine Learning.” In *Counting Carbon in Global Trade: Why Imported Emissions Challenge the Climate Regime and What Might Be Done about It*, edited by Aarti Krishnan and Simon Maxwell, 56–58. London: Overseas Development Institute.

United Nations. 1992. “United Nations Framework Convention on Climate Change.” https://unfccc.int/resource/docs/convkp/conveng.pdf

United Nations Environment Programme. 2020. “Emissions Gap Report 2020.” UN Environment Programme, Nairobi, Kenya.

van Ruijven, Bas J., Detlef P. van Vuuren, Willem Boskaljon, Maarten L. Neelis, Deger Saygin, and Martin K. Patel. 2016. “Long-Term Model-Based Projections of Energy Use and CO2 Emissions from the Global Steel and Cement Industries.” *Resources, Conservation, and Recycling* 112: 15–36.

Venmans, Frank, Jane Ellis, and Daniel Nachtigall. 2020. “Carbon Pricing and Competitiveness: Are They at Odds?” *Climate Policy* 20 (9): 1070–91.

Verde, Stefano F. 2020. “The Impact of the EU Emissions Trading System on Competitiveness and Carbon Leakage: The Econometric Evidence.” *Journal of Economic Surveys* 34 (2): 320–43.

World Bank Group. 2021. “Carbon Pricing Dashboard.” https://carbonpricingdashboard.worldbank.org/map_data

World Green Building Council. 2019. *Bringing Embodied Carbon Upfront: Coordinated Action for the Building and Construction Sector to Tackle Embodied Carbon*. London: World Green Building Council.

World Resources Institute. 2020. “The GHG Protocol.” In *Counting Carbon in Global Trade: Why Imported Emissions Challenge the Climate Regime and What Might Be Done about It*, edited by Aarti Krishnan and Simon Maxwell, 41–44. London: Overseas Development Institute.

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