International Carbon Action Partnership

CARBON LEAKAGE AND DEEP DECARBONIZATION

FUTURE-PROOFING CARBON LEAKAGE PROTECTION

ALTERNATIVE APPROACHES TO ADDRESS CARBON LEAKAGE

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Alternative approaches to address carbon leakage

Here we consider alternative approaches to free allocation that offer a potentially wide scope of applicability and broad protections against carbon leakage for industrial sectors (see Table 2 for a summary). While these alternatives would incentivize abatement by both producers and consumers, additional supplementary policies are also likely needed to propel deep decarbonization across the economy. These are explored in chapter six of the full report ("Carbon Leakage and Deep Decarbonization: Future-proofing Leakage Protection". The policies explored here aim to address leakage through the output (short-term competitiveness) and investment (long-term competitiveness) channels outlined in chapter two of the full report. This is not to diminish the importance of leakage through the energy channel, which is often found to be the most persistent and intractable source of leakage (Zachmann & McWilliams, 2020). But leakage through the energy-markets channel lacks immediate policy tools to address the challenge and requires further attention.

1 Border carbon adjustments

Border carbon adjustments (BCAs) apply tariffs or other measures to imported goods from countries that do not have comparable emissions pricing requirements for their emissions-intensive goods. BCAs may also include rebates or exemptions for domestic producers when exporting to markets without comparable emissions pricing. By leveling carbon costs on embodied emissions, a BCA aims to avoid carbon leakage from vulnerable sectors while strengthening incentives for abatement across industrial value chains, both domestically and abroad.

Extensively studied but never implemented for EITE sectors, BCAs are experiencing an upswing in political attention, particularly in Europe. Growing near-term heterogeneity in climate policy, greater availability and quality of emissions data, the ratification of the Paris Agreement, and setbacks in trade liberalization have opened a window of opportunity to seriously consider BCAs as an alternative approach to free allocation for addressing carbon leakage (Mehling et al., 2019). As part of the European Green Deal, the European Commission has stated that it will propose a BCA for selected sectors "should differences in levels of ambition worldwide persist" (European Commission, 2019b), which is a likely prospect.

However, designing and implementing a BCA is complex and politically challenging. It requires careful consideration of design features ranging from scope of coverage to the selection of benchmarks to determine the levels of adjustment, as well as risks of legal challenges based on World Trade Organization (WTO) rules. Ensuring an administratively feasible and legally robust design may present a trade-off relative to the BCA's effectiveness against carbon leakage and in driving decarbonization.

1.1 Design considerations

In this section we analyze some of the key BCA design considerations.[1] Pragmatic design ultimately hinges on the sector or sectors covered by the BCA and in balancing trade-offs between the scheme's effectiveness

[1] A more comprehensive view is provided by, for example Mehling et al. (2017), Carbon Trust (2010), Cosbey et al. (2012), Mehling et al. (2019), and Cosbey et al. (2019).

against carbon leakage, administrative complexity, and risks of WTO non-compliance or diplomatic backlash. While there is no certainty on legal compliance, particularly because there is no case law on BCAs, there is extensive analysis on how to design a scheme that maximizes its chances of legal durability (see Mehling et al. (2019) and Cosbey et al. (2019) for a thorough and recent view). There may be paths to a WTO-compatible BCA through the WTO General Agreement on Tariffs and Trade (GATT), which requires equal treatment of "like" goods, or through Article XX, which grants exceptions to GATT obligations based on environmental protection and other grounds.

The key design choices facing any jurisdiction considering a BCA include:

- **Scope** — products included in the scheme and whether it applies to imports, exports, or both;
- **Emissions coverage** — whether the scheme applies only to direct emissions from the production process or indirect emissions from energy-related inputs as well;
- **Determination of embedded carbon** — calculating emissions embedded in products on a facility-by-facility basis with actual data or using standardized benchmarks; and
- **Compliance instrument and level of adjustment** — the method of compliance (e.g. purchasing allowances) and determining the level of the adjustment (e.g. accounting for foreign carbon costs).

1.1.1 Scope of the BCA

To reduce administrative burdens while still delivering an environmental benefit, which may be integral to withstanding WTO challenges, analysts widely suggest focusing a BCA on products from sectors that are the most vulnerable to carbon leakage. While a wider scope would help underscore the environmental benefit of the BCA and thereby support its legality under an environmental exception to WTO obligations, it may increase political and administrative challenges. Legally, the BCA could not be broader in sectoral scope than what is covered under the domestic carbon pricing system. Sectors often highlighted as priorities for BCA coverage include steel, cement, and aluminum (Mehling et al., 2017; Cosbey et al., 2012; Carbon Trust, 2010). Additionally, coverage of electricity imports in a future BCA has been discussed by EU officials in response to increases in cross-border power generation. Choosing sectors where products and production processes are relatively homogenous also reduces administrative and legal challenges (Carbon Trust, 2010).

Focusing on a narrow subset of EITE sectors was the approach taken by the French in a 2019 BCA proposal, which would begin with steel and cement then possibly expand to aluminum and refining (see Box 1). An earlier French proposal in 2016, which received some support in the European Parliament, would have started even more gradually, beginning with industrial sectors of lower trade intensity, such as cement (Mehling et al., 2019). The proposal focused on sectors of lower trade impact but high emissions intensity to help contain international opposition while covering significant portions of industrial emissions.

The determination of sectors should include analysis of impacts on manufacturers farther downstream and potential substitution effects, among other areas of ex-ante impact assessment. For many products the effect will be negligible, but implementing jurisdictions should determine which downstream products would be affected, their potential additional costs, and to what extent they are exported in large volumes abroad, among other factors (Monjon & Quirion, 2010). There may also be substitution effects farther downstream if materials that serve as close substitutes and are both prone to leakage are not included in the scheme. This

case may be relevant, for example, in relation to cement and steel in the construction sector. Failure to consider these factors could undermine the purpose of a BCA as consumers switch to the product(s) not covered by the BCA, and it could also lead to opposition within the covered sector(s).

Box 1: French proposal on BCA for the EU ETS (2019)

The French Ministry of Economy and Finance presented an initial proposal on the design of a BCA for the EU ETS at COP25 in Madrid. The proposal would limit the sectors in the scheme at first to steel and cement, which account for 39% of emissions among EITE sectors, with the possible future inclusion of aluminum and refining. Importers would be required to surrender special, fixed-price allowances sold outside of the EU ETS but corresponding to the previous day's EUA price to avoid disrupting the wider market. The benchmark would be set at the average carbon intensity of EU producers, but the proposal allows for the possibility of a more stringent level or the world average for the product.

Free allocation would be gradually phased out, with a transition period in which the BCA would be lowered to reflect free allowances received by EU producers. To account for impacts to downstream producers and EU exporters, the proposal includes an option for continued free allocation up to the proportion of export for each EU industry based on EU benchmark levels. Lastly, the proposal includes a one-year testing phase during which importers would be required to obtain and surrender allowances but at no cost.

Implementing jurisdictions will also need to determine whether the scheme adjusts only for overseas imports, domestic exports, or both (a full BCA). The leakage protections of a full BCA will vary sector by sector, depending on characteristics such as the degree to which domestic producers export to destinations where competitors do not face carbon costs (Fischer & Fox, 2012). However, there are numerous reasons to restrict the BCA to overseas imports. First, domestic export rebates may dampen abatement incentives in more export-oriented industries by continuing to shield a share of domestic production from carbon costs (Mehling et al., 2017; Mehling et al., 2019), though well-designed benchmarks to determine rebates could help maintain some incentives.[2] Secondly, export rebates pose greater legal uncertainty, raising potential challenges under both the WTO Agreement on Subsidies and Countervailing Measures and Article XX of GATT (Cosbey et al., 2019; Mehling et al., 2019).[3] Using rebates tied to an allowance price rather than exemptions could lead to situations where allowance price fluctuations risk overcompensation to domestic exporters that would render the rebates an illegal subsidy, as well as considerable administrative complexity (Mehling et al., 2019). Export rebates also put the legality of the entire BCA in jeopardy by conflicting with its rationale of reducing emissions, which may prove critical to achieving WTO legitimacy as an environmental exception to GATT.[4] Any exemption for domestic exports would need to be based on a sector-wide benchmark to help preserve abatement incentives, with similar trade-offs at play as benchmarks for import adjustments (Cosbey

[2] A related distortion would arise in the case that an implementing jurisdiction has multiple benchmarks for a single product depending on the production process, because export rebates would encourage producers to export products made under more emission-intensive processes while selling the more efficient one domestically (Cosbey et al., 2012).

3 Cosbey et al. (2019) and Mehling et al. (2019) have somewhat contrasting bases for their views on the legality of export rebates, but neither advises the inclusion of export rebates.

[4] While Trachtman (2016) acknowledges the potential to undermine the BCA's environmental rationale, he does see feasible routes to including a form of export rebate, though his analysis focuses on border taxes, not specifically in an ETS context.

et al., 2012).

Empirical evidence shows that most of the leakage protections offered by a BCA can be secured through an imports-only system, but this may not hold for sectors in the implementing jurisdiction that are major net exporters (ibid). This issue underscores the need for implementing jurisdictions to analyze trade flows of sectors under consideration for a BCA and suggests different models of import and/or export coverage may be appropriate depending on the sector. The option of a BCA that only rebates domestic exports or exempts those producers from obligations to surrender allowances has not been widely studied but would be possible. In combination with adjustments for overseas imports, export rebates would be more likely to raise challenges from trade partners as an effort to favor domestic producers, but exempting products destined for markets that do not pose similar regulatory burdens is already a common practice, as with value-added taxes. Overseas importers would remain unaffected under an exports-only adjustment and would be treated the same as domestic products bound for markets abroad. Such an approach, however, would present drawbacks: sectors that heavily compete with overseas importers for domestic market share would remain vulnerable to leakage, and it would potentially incentivize more emissions-intensive production for exports in the implementing jurisdiction. Still, it could provide strong leakage protections for more export-oriented sectors.

1.1.2 Emissions coverage of the BCA

In addition to the scope of the adjustment, implementing jurisdictions need to determine whether the BCA applies only to direct emissions from production or also to indirect emissions from energy inputs generated off-site. For this analysis we exclude indirect emissions from sources other than energy inputs (i.e. scope three emissions), such as transport, because of methodological and data issues that make them infeasible for a BCA (Cosbey et al., 2012). Because indirect emissions from energy use constitute a large share of emissions for key industries such as aluminum, there is a strong rationale for covering them in a BCA that includes such industries (ibid). Additionally, in many industries indirect emissions present the greatest scope for regional variation (ibid). Any implementing jurisdiction that requires covered entities to surrender allowances for indirect emissions would likely also include them in its border adjustment.

Views on the legality and method of inclusion for indirect emissions vary somewhat. Including indirect emissions in a BCA implemented by a jurisdiction that does not explicitly cover them through surrender obligations risks WTO non-compliance based on WTO rules against non-discrimination as favorable treatment to domestic producers (Carbon Trust, 2010). Both Mehling et al. (2017, 2019) and Cosbey et al. (2019) argue that indirect emissions should be included if there is a carbon constraint on the production of these emissions in the implementing jurisdiction. Alternatively, the BCA could apply different emissions coverages for different sectors.

1.1.3 Determination of embedded carbon

Ideally the level of adjustment would be grounded in actual carbon content embodied in direct and indirect emissions at the facility level to most accurately reflect the emissions intensity of production and incentivize abatement (Kortum & Weisbach, 2017). If the adjustment is based on actual emissions, the abatement

incentive is directly tied to lowering the cost of the adjustment their goods will face. This could be implemented by requiring overseas importers to submit emissions data verified by third parties in order to sell their goods in the jurisdiction implementing a BCA. However, this may prove both impractical and legally contentious, requiring implementing jurisdictions to instead establish default benchmarks to estimate the carbon content of imported goods and hence determine the adjustment (ibid). A deviation from the benchmark could be offered when in conjunction with third-party verified data demonstrating that the importer's actual emissions intensity is lower than the benchmark. Such an option could improve the efficiency of the BCA (giving some foreign producers incentives to reduce their emissions), alleviate administrative burdens (by not requiring burdensome certification in all cases), and improve legal compatibility (Cosbey et al. 2019).

Some authors have suggested multiple benchmarks for direct emissions might be needed to reflect different production technologies or processes (Mehling et al. 2019 and Cosbey et al. 2019). Importantly, the "one product, one benchmark" principle outlined in the full report's chapter on free allocation applies to rebates, where multiple benchmarks for similar products dilute abatement incentives by introducing distortions. However, for imports, multiple benchmarks that improve the accuracy of the carbon content estimate for the specific product may improve the efficiency of the price signal. Thus, there can be a tension introduced if both imports and exports are intended to be covered by border adjustments. Jurisdictions would need to weigh potential distortions and WTO implications of multiple benchmarks for the same product against the benefits of more granularity where the emissions intensity of production processes differs significantly.

Cosbey et al. (2019) suggest using country-specific default benchmarks for indirect emissions, given the availability of data from required reporting, while Mehling et al. (2017, 2019) argue that links to country-specific factors would make the proposal more risky from a legal standpoint and argue instead for using average regional grid emission factors as benchmarks. Cosbey et al. (2019) argue that more accurate, differentiated benchmarks could be supported by relying on a GATT exception based on environmental grounds. However, it is noteworthy that the rules for such exceptions still include provisions against discriminatory practices.

Table 1 summarizes the strengths and drawbacks of various options for benchmarks that have been suggested in the academic literature, drawing largely from Cosbey et al. (2012, 2019) and Mehling et al. (2017, 2019). The table speaks in general terms, as the effectiveness of benchmarks will vary by sector of the implementing country and the country of origin of that sector's major competitors. Ultimately the choice of benchmark presents a trade-off: the more closely they capture the emissions intensity of foreign production the better they incentivize efficiency and provide stronger leakage protections because of higher assumed emissions intensity, but they pose considerable administrative complexity and greater risks of WTO non-compliance. To date, however, the effectiveness of benchmark choices is an underdeveloped area of the economics literature on BCA.

Table 1: Options for benchmarks under BCA

Benchmark	Leakage protection	Ease of administration	WTO compliance
Direct emissions benchmarks			
Emissions intensity from worst practice in exporting country	Generally most effective (assuming high GHG intensity in many exporting countries)	Challenging: requires reliable data from all exporting countries and provisions to prevent export via third countries	Likely conflicts with GATT but could be granted under Article XX exception
Average emissions intensity in exporting country	Effective (though above-average producers have little incentive to improve and can still gain market share)	Challenging: requires reliable data from all exporters and provisions to prevent export via third countries	Likely conflicts with GATT but could be granted under Article XX exception
Global average sectoral emissions	Likely stronger in general than benchmark based on implementing country but less effective than one based on exporting country	Likely more challenging than benchmark based on implementing country (potentially harder to obtain comprehensive, reliable data)	Could be more likely to draw complaints than avg. emissions intensity in implementing country, as more exporters are likely to perform above it
Emissions intensity from worst practice in implementing country	Likely less effective in general than if based on exporting country (lower assumed GHG intensity)	More straightforward than for benchmark based on exporter practices	Likely compliant with GATT (all exporting countries face same benchmark)
Average emissions intensity in implementing country	Generally less effective than average based on exporting country (assuming lower GHG intensity in implementing country)	Straightforward option to implement (single benchmark with available data)	Likely compliant with GATT (all exporting countries face same benchmark)
Emissions intensity from best available technology in implementing country	Generally least effective option (lowest assumed GHG intensity)	Straightforward option to implement (single benchmark with available data)	Likely compliant with GATT (all exporting countries face same benchmark)
Hybrid (direct and indirect emissions) benchmarks			
Hybrid 1 (implementing country benchmark for direct emissions and exporting country benchmark for indirect emissions)	Fairly strong because indirect emissions often present wide regional variation and less costly mitigation options	Better than pure exporter-based benchmark on direct emissions because of better data availability for indirect emissions	Likely conflicts with GATT but could be granted under Article XX exception and likely seen as less punitive than pure exporter-based benchmarking
Hybrid 2 (global average sectoral emissions and average regional electricity grid emissions factors for indirect emissions)	Potentially as effective as Hybrid 1, depending on sector and implementing country; more effective than benchmark on direct emissions alone	More challenging than single benchmark for direct emissions based on implementing country; more research needed to determine whether this approach would be simpler than Hybrid 1	More likely to be GATT compliant than Hybrid 1 because it avoids country-specific links

1.1.4 Compliance instrument and level of adjustment

The implementing jurisdiction will need to decide whether the adjustment takes the form of a tax/duty or to require overseas exporters to purchase allowances (or other units) in proportion to the weight and carbon content of their goods. To ensure the BCA is legally sound, the instrument and price should adhere as closely as possible to obligations of producers in the implementing jurisdiction (Cosbey et al., 2019). For an ETS jurisdiction, compliance obligations would therefore involve surrendering allowances, paying a tax/duty that aligns with the market price, or purchasing international offsets up to the rate of adjustment (ibid).

If there is a requirement to purchase allowances, the implementing ETS jurisdiction will further need to decide whether these are sourced from within the cap or through a parallel system of single-purpose, non-tradable allowances. An option for the latter would be establishing special fixed-price allowances for BCA compliance that are tied to the spot allowance price but are not tradable within the wider market. Such an approach was suggested by France in a 2019 BCA proposal for the EU ETS (see Box 1).

Using allowances sourced from within the cap would help the implementing jurisdiction to ensure equal price obligations for domestic producers and overseas exporters and would potentially reduce emissions produced globally but consumed in the implementing jurisdiction (Sandbag, 2019). However, without a change in the cap, it would also push up prices for allowances, particularly as the cap declines, which may be undesirable for some implementing jurisdictions.

To accord with WTO rules, the level of the adjustment would need to account for any exemptions, rebates, or free allocation offered to domestic producers, as well as carbon pricing that overseas exporters already face in their country of origin (Mehling et al., 2019). Implementing jurisdictions could also consider exempting all overseas exporters from certain countries based on factors such as the ambition of climate policy in the country of origin or the country's level of development (e.g. least-developed countries), but this raises further complications as potentially discriminatory under WTO rules (Cosbey et al., 2012; Cosbey et al., 2019).[5]

1.2 Protection against carbon leakage

There is wide academic support for the effectiveness of BCAs to address carbon leakage through the competitiveness channel. Leakage through the energy-market channel, however, could remain. Böhringer et al. (2012a) find that BCAs are more effective than exemptions and OBA in addressing carbon leakage and minimizing the adverse effects of carbon pricing on EITE sectors' output. Summarizing 12 general-equilibrium models, Böhringer et al. (2012b) find significant reductions in carbon-leakage rates from BCA, and a meta-analysis of 35 *ex ante* studies by Branger and Quirion (2014) finds similar reductions resulting from BCAs. However, the benefits will vary based on the characteristics of the sectors included in the BCA and the design of the scheme. As previously highlighted, design choices are likely to entail trade-offs between effectiveness, legality, and ease of implementation.

Taking the example of EU steel, Dröge et al. (2009) find a full BCA (imports and exports) applied to both direct

[5] Cosbey et al. (2012, 2019) identify a number of exemption types implementing jurisdictions could consider, including for least-developed and low-income countries, but generally advise caution.

and indirect emissions would lead to a leakage rate[6] of -25.5%, meaning emissions reductions would occur in both the implementing jurisdiction and among importing countries. A narrower BCA covering only imports and direct emissions leads to a leakage rate of 9.3%, meaning there would still be small emissions increases among countries facing the BCA — significantly better than no border levelling (38.9%), but far less impactful than the comprehensive approach.

The benchmark levels in the BCA also play a critical role in leakage protections. Continuing from the example above of EU steel, using a benchmark of average emissions intensity of EU steel producers, rather than basing the adjustment on actual emissions, would reduce the effectiveness of a full BCA for EU steel from -25.5% cited above to -4.1% (ibid). To further highlight limitations, using emissions intensity from the best available technology (BAT) as a benchmark may require no foreign data and would be among the most legally robust ways to determine the adjustment but would generally be the least effective at preventing leakage or incentivizing cleaner production in exporting countries (Cosbey et al., 2012). Such a benchmark would severely limit the scope of emissions covered under a BCA and the adjustments faced by major overseas exporters with carbon-intensive production such as China, undermining the rationale for BCA (Sakai and Barrett, 2016). Studies suggest that benchmarks based on average emissions intensity or practices of producers in the exporting country are generally more effective than benchmarks based on the country implementing the BCA because of likely higher GHG intensity (Cosbey et al., 2012; Cosbey et al., 2019), though this depends on the key trading partners for a sector and the emissions intensity of the industry in the implementing country relative to major competitors.

Resource shuffling and trade distortions may also pose challenges to the effectiveness of a BCA against carbon leakage. Resource shuffling refers to efforts to shift lower-carbon exports of goods covered by the BCA to the implementing jurisdiction while consuming the more emissions-intensive materials domestically or re-routing them to markets without border adjustments. This would undermine leakage mitigation globally. However, there is little modeling to date to give a sense of the potential magnitude of the risk. Secondly, there could be distortions farther down the value chain from the products covered under the BCA. Tariffs between the US and China on steel and aluminum introduced in 2018 have led to increased Chinese imports of intermediate products containing those materials, hurting US demand for domestic production and prompting extension of tariffs farther down the value chain (Zachmann & McWilliams, 2020). However, there is little modeling on the potential magnitude of this risk for BCAs. A weaker BCA that imposes fairly low adjustments would be less prone to introduce such trade distortions but would instead raise questions about its effectiveness against leakage.

1.3 Compatibility with long-term transition

BCA provides strong incentives for decarbonization because consumers across the value chain face prices that are more consistent with the carbon content of the goods and materials they are purchasing (Dröge, 2011). However, a full BCA that also includes rebates to exporters in the implementing country will lower export prices relative to an alternative without export rebates, weakening incentives for demand side emission reductions in sectors that benefit from the rebate (Mehling et al., 2017; Mehling et al., 2019).

[6] Leakage rates refer to the portion of a jurisdiction's emissions reductions that result in increased emissions abroad, with a positive number indicating leakage and a negative number indicating a net decrease in total emissions in both the jurisdiction and abroad.

In cases where BCAs are phased into a system that maintains some level of free allocation, the calculation of the BCA must recognize free allowances or other compensation afforded domestic industry and extend the same benefits to importing firms under WTO rules (Cosbey et. al, 2012). Continuing free allocation would imply a smaller level of adjustment through the BCA and would limit incentives to reduce emissions along the value chain, undermining the rationale for adopting alternative approaches to mitigating carbon leakage in the first place. Sakai and Barrett (2016), among others, argue BCAs combined with auctioning (i.e., no free industrial allowance allocation) for the affected sectors and activities is preferable to a hybrid of partial BCAs and free allowance allocation because the former allows for stronger price signals without creating distortions (see also Fischer & Fox, 2012).

With the addition of revenue from overseas exporters and greater auctioning of allowances, BCA also generates more funding to invest in low-carbon technological innovation relative to free allocation. However, implementing jurisdictions may face pressure to return some revenue generated from border adjustments to exporting countries as refunds or climate-oriented development assistance on equity grounds or as capacity-building to ease BCA compliance (Cosbey et al., 2012).

1.4 Political durability

While BCA offers advantages over existing leakage protection measures, it faces significant implementation challenges and other risks, the most notable of which is the prospect of diplomatic tension and compatibility with WTO rules. While a BCA scheme under an ETS can be designed to increase the likelihood that it could withstand a WTO challenge, there is no existing case law on which to judge legality because border adjustments on carbon-intensive goods have never been attempted. As noted earlier, design choices that enhance a BCA's legal prospects and administrative feasibility are likely to mean curtailing the BCA's capacity to address leakage concerns and maximize abatement incentives.

There are three avenues under which a BCA implemented specifically by an ETS jurisdiction has the best prospects for complying with international trade law (Mehling et al., 2019):

- adjusting for an internal tax or other internal charge under GATT Article III.2;
- adjusting for an internal regulation under GATT Article III.4; or
- as an exception to GATT on environmental grounds under GATT Article XX.

The first two routes falling within the GATT would require that the BCA follows WTO rules of non-discrimination, which require that imports are not charged more than "like" domestic products and that any advantages or exemptions granted to domestic products are also extended to imports. The third route of seeking an exception to GATT under Article XX on environmental grounds still includes language on non-discrimination in its introductory paragraph, along with other likely constraints based on WTO case law. Based on past disputes concerning the protection of natural resources, the jurisdiction implementing BCA will likely have to demonstrate that its scheme substantively addresses climate change (Cosbey et al., 2019).

These non-discrimination provisions imply numerous trade-offs for BCA design detailed in previous sections, without any guarantees that the scheme will be WTO-compliant in the event of a challenge. Determining the adjustment based on actual verified emissions data at the facility level would be the ideal scenario, but this may prove both impractical and legally contentious. Instead adopting benchmarks to determine the adjustment represents a next-best option. The choice of benchmark further entails trade-offs: using a single

benchmark based on the implementing country's production would allow for streamlined enforcement that relies on more easily verifiable data, making application as simple as multiplying the weight of an imported good by the benchmark and the allowance price, but this would likely be less effective overall than benchmarks based on individual exporting countries. Avoiding rebates or exemptions for domestic exporters would also simplify implementation and improve legal prospects at the expense of stronger leakage protections for some sectors.

Even a well-designed BCA that could successfully navigate the trade-offs highlighted in this report might face resistance from industry. Potential reasons for opposition include familiarity with a system of free allocation that is perceived to have largely insulated industry from leakage, concerns that a BCA will not be strong enough to fully internalize carbon costs in the market, and the potential for exporters to game the system by directing lower-carbon shares of production to the implementing jurisdiction while sending more emissions-intensive materials to less constrained markets (Sandbag, 2019). Additional concerns may be the potential for trade retaliation, short-term competitiveness losses domestically from full auctioning, and competitiveness of exports from the implementing jurisdiction without rebates or exemptions. However, there is also likely a degree of recognition among the most vulnerable EITE sectors that free allocation will become increasingly scarce in many jurisdictions any ETS. Maintaining free allocation in the early stages of a BCA and gradually phasing it out as a transition period might therefore help overcome political opposition.

Concerns about equity and trade relations also need to be taken into account. Even a well-crafted BCA may prompt accusations of "green protectionism", masking an attempt to limit imports from developing and emerging economies with environmental concerns (Mehling et al., 2019). This perception will likely sour trade relations and may provoke retaliatory measures. Evidence supports these concerns: studies suggest that BCAs shift the costs of emission reductions to poorer, non-abating countries, who will experience losses in their terms of trade (Böhringer et al., 2012c), exacerbating regional inequalities (Sakai and Barrett, 2016). Concerns about equity — both in terms of treatment of developing countries and fairness towards trading partners that have already enacted comparable constraints on emissions — would be especially relevant if an implementing jurisdiction pursues BCA through an environmental exception to GATT. Addressing these concerns by exempting some countries could, in turn, undermine the legality of the scheme by increasing the likelihood that it would be viewed as discriminatory or arbitrary (Cosbey et al., 2019; Mehling et al., 2019).

Finally, sub-national jurisdictions may face additional challenges in designing and implementing a BCA because of constraints in national law or the national constitution. For example, the Commerce Clause in the U.S. Constitution grants the U.S. Congress exclusive authority to regulate economic relations between states and with foreign nations. Fowlie (2017) has noted the potential for constitutional challenges if California adopted a BCA on goods, in addition to WTO risks. However, there are legal scholars who argue that California implementing a BCA could be legally robust under the U.S. Constitution if it applied consistent benchmarks and was motivated by environmental concerns (Gamage & Shanske, 2017). Regardless, there is at least the potential that sub-national jurisdictions would need to defend a BCA on multiple legal fronts.

The challenges outlined in this section suggest the need for a cautious, transparent, and deliberative approach to designing a BCA, with a limited number of sectors covered under the initial scheme. An ETS jurisdiction considering a BCA should engage both with the WTO for greater clarity on the legal dimensions and with trading partners in bi- or multi-lateral discussions on its plans before adoption. It may also be prudent to design a BCA that could qualify under the GATT or as an exception under Article XX (Mehling et al.,

2017). Careful consideration should also go to which sectors in the implementing jurisdiction are best suited for BCA in terms of effectiveness against carbon leakage, given likely constraints on design as well as substitution effects, downstream impacts, and administrative feasibility.

2 Consumption charges for carbon-intensive goods

In broad terms, consumption charges aim to restore price signals on the use of emissions-intensive goods rather than their production. While BCAs aim to capture the cost of emissions in the production of goods, consumption charges aim to restore prices signals on the use of goods. Both mechanisms may ultimately take the form of a benchmark multiplied by the weight of material and an allowance price, but a key distinction is their respective point of application. Also known as a "Climate Contribution" or "Inclusion of Consumption", a consumption charge combined with OBA represents an alternative to BCA that would seek to maintain free allocation for EITE sectors under its scope for leakage protections while passing on costs not reflected in production farther down the industrial value chain through an additional charge. No jurisdiction has implemented consumption charges on carbon-intensive industrial materials, but consumption charges have been implemented on other emissions-intensive activities or products, such as fossil fuels and electricity generation.[7] Here we focus on consumption charges applied in a system of free allocation, where they would be designed to pass on carbon costs that are otherwise blunted through leakage provisions.

2.1 Design considerations

While consumption charges could be applied to all sectors deemed at risk of carbon leakage in the implementing jurisdiction, existing work focuses on application to basic materials that account for the largest shares of industrial emissions.[8]

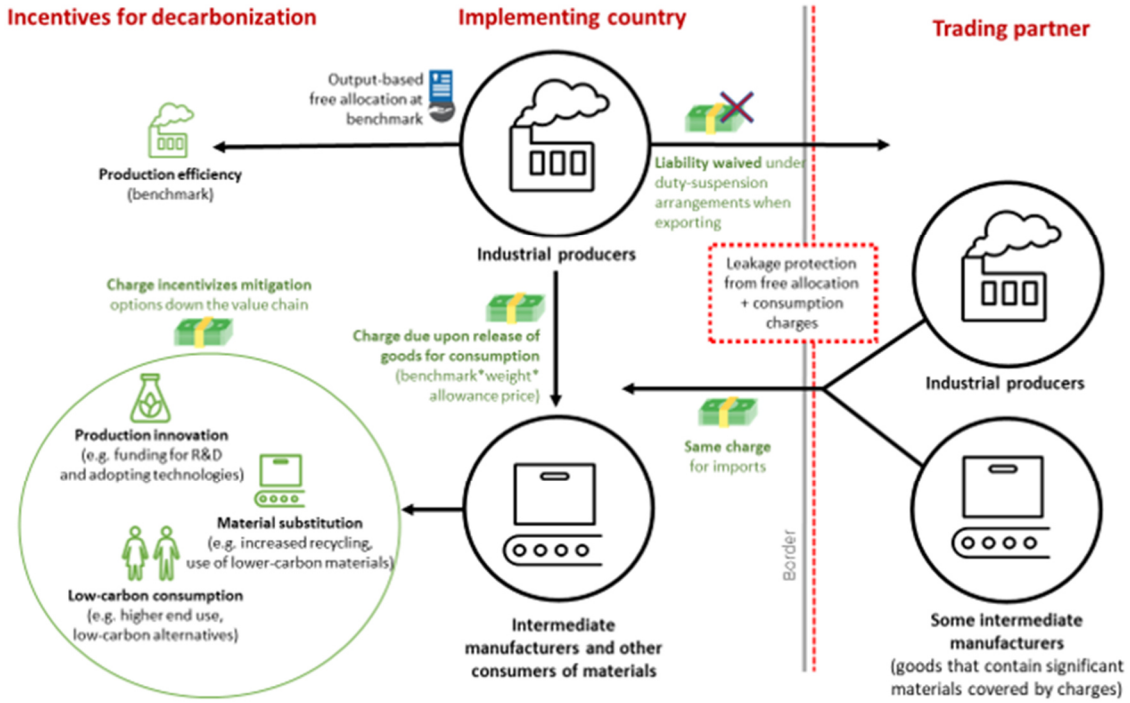
Domestic firms that produce materials under the scope of the consumption charges would receive free allowances based on recent or actual levels of output and a product-specific benchmark (see Figure 1 for an illustration of the mechanism). This would be critical to avoid double charging and to maintain leakage protections. Without free allocation to producers, consumers would face consumption charges and would be more likely to face carbon costs passed on from producers in product prices. Neuhoff et al. (2016) and Ismer et al. (2016) suggest tying allocation to intensity benchmarks calculated according to the best available technology among domestic producers in the sector, which would avoid allegations of excess subsidies to domestic producers or excess carbon levies on imports. However, the implementing jurisdiction could choose another benchmark, such as average emissions intensity of domestic producers, which would likely provide stronger protections against leakage and higher subsequent charges on consumption of the materials covered under the system. As with BCAs, selecting a single benchmark for the product that can be uniformly applied rather than a multitude based on each exporting country may be necessary to ensure the charges are not deemed discriminatory by WTO.

A consumption charge would then be levied on the intermediate or final consumption of a product, regardless of whether it was produced domestically or imported. The charge would be based on the weight of the material; the product-specific benchmark used for allocation of free allowances; and the price of an

[7] See Munnings et al. (2016) and Raffaty and Grubb (2018) for an overview of other consumption charges.
[8] For a more detailed understanding see Neuhoff et al. (2016) and Ismer et al. (2016).

allowance in the ETS, which could be updated annually or quarterly to minimize administrative burdens (Neuhoff et al., 2016). Using the same benchmark for free allocation to calculate the consumption charge would ensure the liability is proportional to the level of pricing that is not captured upstream because of free allocation.

Figure 1: Illustration of consumption charges and incentives across the industrial value chain



Source: author's own illustration based on Neuhoff et al. (2016) and Ismer et al. (2016).

Domestic firms from sectors covered by the scheme would have to report their production volumes and would be held liable for the consumption charges due. Producers would either pay the charges themselves or reflect the charges in their pricing at the point of sale for intermediate consumption. Duty-suspension arrangements provide an option for qualifying firms to forego consumption charges if their materials or the subsequent product will be exported (see Ismer et al., 2016 for a more detailed look at this aspect of administration). Such relief for exports would comply with the destination principle of international trade, which holds that indirect taxes such as value-added tax and excise duties are levied on goods where they are ultimately consumed, irrespective of where the goods were produced (Ismer et al., 2016).

The liability for imported materials subject to consumption charges would be equivalent. Ensuring compliance would require integrating the liability for relevant product categories in the implementing jurisdiction's existing tariff system and establishing accounting and reporting systems that are not overly burdensome relative to obligations for domestic producers. However, limiting the scope to only basic materials would ignore the importation of carbon-intensive goods farther down the value chain and could fail to adequately address carbon leakage given that domestic consumption would be priced along the value chain (Ismer et al., 2016). This suggests that the scope should be extended to imports that contain high levels

of materials covered by the consumption charges.

Implementing jurisdictions could limit the administrative burden by restricting charges to select product categories of the Harmonized Commodity Description and Coding System (HS). Pauliuk et al. (2016) suggest limiting charges to around 1,000 product categories, which would account for about 85% of emissions stemming from five major sectors of carbon-intensive materials. The level of administrative complexity would depend on the threshold of covered material a product may contain for inclusion in the system of consumption charges and data availability.

2.2 Protection against carbon leakage

Consumption charges that include output-based free allocation for producers of basic materials would provide strong protection against carbon leakage, at least in the near term. When tied to recent output, such a system best represents actual production levels and does not penalize growth, limiting firms' exposure to carbon costs that may put them at a competitive disadvantage. Producers would only have to purchase allowances for emissions that exceed the benchmark level. While there is limited modelling on consumption charges for basic materials, Pollitt et al. (2018) found that a scheme covering steel, cement, and aluminum to 2050 would not lead to carbon leakage. Böhringer et al. (2017) found that consumption charges paired with free allocation can lead to negative leakage, on par with or better than BCA depending on the rate of the charge. However, neither study incorporates assumptions on levels of free allocation and scenarios in which it declines.

The strength of consumption charges against carbon leakage would depend on future levels of free allocation. Many ETS jurisdictions envision steep declines in free allocation to 2030 as they pursue more ambitious reduction goals. This is only likely to accelerate to 2050. If this decline occurs alongside continued discrepancies in carbon pricing among key trading partners, domestic EITE sectors would face increasing carbon costs and thus leakage risks. Critically, this would depend on the extent to which EITE producers have decarbonized in step with declining free allocation. In the absence of sustained free allocation, jurisdictions implementing consumption charges may need to consider other means of industry compensation to fully guard against potential carbon leakage, make changes to the distribution of allowances to prioritize certain sectors, or transition to an instrument that levels differences in carbon costs among trading partners. Similar to a system of free allocation with benchmarks, there is also a chance of greater leakage exposure as benchmark stringency increases and allowance prices increase while large discrepancies in carbon prices worldwide remain.

Additionally, as stated in the previous section, leakage protections would also depend on the extension of consumption charges to imports that contain significant portions of covered materials. Otherwise, manufacturers farther down the value chain in the implementing jurisdiction could find themselves at a competitive disadvantage.

2.3 Compatibility with long-term transition

Consumption charges provide strong incentives for decarbonization. Levying consumption charges based on the carbon intensity of production restores price signals downstream that are otherwise suppressed under OBA alone, stimulating demand for low-carbon materials, more efficient use of industrial commodities, and other behavioral shifts that are needed to bring about a low-emissions, circular economy. Combined with

ambitious benchmarks for allocation to production, consumption charges can also incentivize upstream efficiency (van de Lindt et al., 2017). In this way, the carbon price incentivizes the full suite of supply and demand side abatement potential that is required to unlock decarbonization.

Like BCA, consumption charges could provide significant revenue for low-carbon technological innovation and would likely need to be applied to climate-related investments rather than redistributed among domestic producers to support WTO compliance (Neuhoff et al., 2016). Such complementary support for technology would be necessary to drive investment in deep decarbonization (Åhman et al., 2017), especially considering limitations to upstream incentives (see chapter on complementary policies in the full report). A scheme applied to steel, aluminum, plastics, paper, and cement in the EU would generate an estimated €17 billion per year in revenue at an allowance price of €30 per ton of CO_2 (Pauliuk et al., 2016). Neuhoff et al. (2019) have also suggested redistributing a portion of the proceeds on a per-capita basis to the general public, which would make the policy more progressive assuming less consumption of affected products among lower-income households. The same per-capita redistribution could be considered for BCA proceeds as well.

Unlike BCAs, consumption charges are not aimed at levelling discrepancies in carbon pricing between trading partners. This, combined with continued reliance on free allocation, may limit their potential to incentivize abatement outside of the implementing jurisdiction. Trading partners would have little reason to phase out free allocation if they would face consumption charges for their exports to a jurisdiction implementing consumption charges on top of their own domestic carbon price.

2.4 Political durability

In the area of political durability, consumption charges offer some potential advantages over BCA but with some notable uncertainties. Perhaps most significantly, as an internal charge in which both domestic production and imports face the same liability without discrimination on the point of origin, consumption charges are less likely to face WTO challenges in some cases. This would be true for any model of a BCA that includes export relief for domestic producers, differentiates benchmarks based on the importer's country of origin, or uses multiple benchmarks for the same product to reflect different production processes or technologies. However, a less ambitious BCA that only covers imports with a benchmark based on the implementing country's producers would be similar in design to a consumption charge.

Secondly, administration may be simpler than BCA depending on the scope and design of the border adjustment. Consumption-based charges — and the infrastructure to collect them — are already well-established across much of the world and typically administered by customs officials, sometimes in coordination with other relevant government entities. Value-added taxes and excise duties on tobacco and alcohol are just a few examples that are commonplace. For at least some jurisdictions, levying charges on carbon-intensive consumption would be easier than levying consumption taxes and charges on other goods that require stricter controls from a monitoring standpoint (Ismer et al., 2016). For example, quarterly instead of transaction-based reporting could be sufficient for monitoring, and companies could rely on documents and processes that are already in place for business and tax purposes (Neuhoff et al., 2016). Similarly, duty-suspension arrangements could be handled within existing structures of monitoring and compliance.

However, the extension of consumption charges to imports farther down the value chain that contain significant portions of covered materials (discussed in section 2.1) would increase the administrative

demands of the system, depending on factors such as inclusion thresholds and data availability. Ismer et al. (2016) argue this extension to intermediate and final imports would not pose risks of WTO non-compliance because these products would face the impacts of the consumption charge when domestically produced.

The need for robust and sustained free allocation for producers of industrial materials under consumption charges could present a political dilemma. Without this, domestic firms may be at risk of carbon leakage as declining budgets for free allocation expose them to greater carbon costs and a competitive disadvantage, but sustained levels of free allocation are likely incompatible with more ambitious reduction targets. As noted in section 2.2, vulnerability to leakage would depend on the extent to which EITE producers have decarbonized in step with declining free allocation. Implementing consumption charges may therefore require offering additional support to sectors at significant risk of leakage, shifting approaches to free allocation (e.g. establishing different tiers of recipients that receive different levels of allowances in order to conserve remaining budgets), or transitioning to an instrument that levels differences in carbon costs among trading partners. One way to compensate for allowance shortfalls would be to direct a portion of the revenue from consumption charges to domestic producers, but implementing jurisdictions would need to consider WTO rules when doing so.

The constraint on free allocation highlights the decarbonization challenge not only for consumption charges, but all policies aimed at reducing carbon leakage. Leakage protection is only intended as a short to medium-term measure to assist industry transition away from high-carbon products and processes towards those that will be competitive in a net-zero economy.

Lastly, cost pass-through to intermediate manufacturers will increase the price of basic materials, though the impact on final consumer goods may be generally negligible depending on the sectors subject to consumption charges. For instance, a charge of €30-50 per ton on steel and aluminum would increase the price of a car by an estimated €48-90 (Monjon & Quirion, 2010; Neuhoff et al., 2016). Pauliuk et al. (2016) find that a €30 carbon price with consumption charges on basic materials would increase prices on manufactured goods by less than 2% overall. Still, there could be a risk of public backlash where consumers feel unfairly treated and major industries continue to receive emissions allowances for free. As noted above, Neuhoff et al. (2019) suggest using a substantial portion of revenue from climate policies to reimburse the general public on a per-capita basis, as is done in Switzerland and parts of Canada to distribute carbon tax receipts.

Table 2: Comparison of BCA and consumption charges in terms of their ability to drive deep decarbonization

Alternative approach to leakage protection	Protection against carbon leakage	Low-carbon production		Low-carbon consumption		Political durability		
		Fuel-switching; efficiency improvements	**Innovation in production processes**	**Material substitution**	**Material efficiency**	**International acceptance**	**Ease of implementation**	**Other**
Border Carbon Adjustment (BCA)	Strong, depending on design, sector, and extent of resource shuffling/trade distortions	Strong	Strong (also source of revenue for low-carbon technologies)	Strong (assuming cost pass-through)	Strong	Low to medium (risks for WTO compliance and trade relations)	Moderate to very challenging, depending on design	Potential domestic opposition (e.g. industry itself); limits to incentives for trading partners to reduce emissions
Consumption charges	Strong with continued free allocation or other production support	Strong (assuming single product benchmarks)	Strong (also source of revenue for low-carbon technologies)	Strong (assuming supply-chain coverage)	Strong	Medium to high (easier path to WTO compliance than more ambitious BCA option)	Moderate (potentially easier than BCA depending on design/thresholds for inclusion)	Continued reliance on OBA; potential domestic opposition (e.g. industry and the general public)

3 Conclusion

Adjustments to the carbon leakage risk criteria may prolong the period for which enough allowances are available for leakage protection. However, it does not assist those sectors to decarbonize in a pathway consistent with net zero. Therefore, the time may be right in some jurisdictions to consider alternative approaches to maintain leakage protections that are compatible with the long-term transition to carbon neutrality. This is especially salient for ETS jurisdictions that face declining allowance budgets, where sectors considered at risk of carbon leakage make up a larger proportion of the allowance budget and there are divergences in carbon pricing across key trading partners in the near -to-medium term. Two options are BCAs and consumption charges combined with OBA. Both would present new administrative and political challenges relative to the status quo, but both would likely better incentivize abatement.

Designing and implementing a BCA involves trade-offs between the scheme's effectiveness against carbon leakage and both its chances of meeting legal requirements under WTO rules and its administrative feasibility. That border adjustments have never been applied to carbon-intensive goods and lack WTO case law as a precedent underscore the need for a process that includes close engagement with the WTO for clarity on a legally robust design. This paper's analysis of the academic literature and existing proposals suggests some guidelines for jurisdictions considering a BCA.

- **A BCA that is narrow in scope – at least at the beginning – is likely more administratively and legally feasible**: Limiting an initial BCA to only the most vulnerable EITE sectors and only imports may help balance the trade-offs inherent to BCA design while delivering environmental impact. Further products could be added later as budgets for free allocation decline and the scheme proves politically durable. This expansion could rely on analysis of the sector's characteristics and could include additional metrics explored in chapter four of the full report, such as abatement potential/cost and market structure.
- **Different scopes of coverage may be appropriate for different sectors**: Leakage protections will vary sector by sector, depending on factors such as trade intensity. For some, an imports-only BCA will capture much of the benefits. An exports-only BCA offering rebates or exemptions for domestic production to overseas markets could be appropriate for some sectors in terms of leakage protections but remains relatively unexplored in the academic literature and would present significant drawbacks.
- **Covering both direct and indirect emissions would improve the scheme's effectiveness and may be administratively and legally feasible**: Including both direct and indirect emissions would require multiple benchmarks and greater clarity from the WTO about legal ramifications if the implementing jurisdiction does not explicitly cover indirect emissions in its carbon-pricing system.
- **Benchmarks on direct emissions based on the implementing jurisdiction's production are likely more administratively and legally feasible**: Administrative and legal challenges likely preclude setting benchmarks based on the average emissions intensity of each exporting country individually or basing the adjustment on the actual verified emissions of each importer.
- **It may be advisable to avoid country-specific benchmarks on indirect emissions as well**: For similar reasons, benchmarks for indirect emissions that avoid country-specific determinations are

likely easier administratively and legally. Region-specific benchmarks might help in these regards and offer a more effective response than a benchmark based on the implementing jurisdiction, but some authors have suggested the possibility of country-specific benchmarks for indirect emissions, and this could be further explored through engagement with the WTO.

- **Phasing out free allocation is critical to unlocking the abatement incentives of BCA, but a transition period may be advisable, especially to help secure industry support**: Continuing free allocation would mean removing the value of allowances granted freely from the adjustment importers face, but a transition approach may help assuage concerns of the industries covered under the scheme. It may also mitigate concerns of trade partners by reducing the adjustments they would face at the beginning.

Consumption charges paired with OBA may offer a promising alternative to BCA that would significantly improve abatement incentives on the demand side of the industrial value chain compared with current approaches. As an internal charge resembling a value-added tax that would be assessed on domestic production and imports alike using the same product benchmark based on the implementing jurisdiction's emissions intensity, consumption charges may prove more robust to WTO challenges than BCA, depending on the BCA's design. The WTO advantage over BCAs would likely hold, for instance, in the case of a BCA that includes export relief for domestic producers or benchmarks based on each importing country.

Consumption charges may also be administratively simpler, given that many jurisdictions already have extensive experience with value-added and excise taxes, along with the infrastructure to collect them. However, the extension of consumption charges to imports farther down the value chain that contain significant portions of covered materials would increase the administrative demands of the system, depending on inclusion thresholds and data availability. This potential for trade distortions farther down the value chain in response to unilateral leakage measures is a risk for BCA as well.

The need for continued, robust OBA to maintain leakage protections under consumption charges may present another challenge as jurisdictions phase down free allocation, particularly if this reduction occurs alongside continued discrepancies in carbon pricing abroad and EITE abatement has not kept pace with the decline in free allocation. Jurisdictions pursuing consumption charges would therefore need to consider measures to maintain leakage protections under consumption charges, such as reforms to allocation that would prioritize certain sectors for the remaining free allocation budget, or to transition to a mechanism that levels differences in carbon costs among trading partners. Similar to a system of free allocation without benchmarks, there is also a chance of greater leakage exposure as benchmark stringency increases and allowance prices increase while large discrepancies in carbon prices worldwide remain.

Lastly, unlike BCAs, consumption charges are not aimed at levelling discrepancies in carbon pricing between trading partners. This, combined with continued reliance on free allocation, may limit their potential to incentivize abatement outside of the implementing jurisdiction. Trading partners would have little reason to phase out free allocation if they would face consumption charges for their exports to a jurisdiction implementing consumption charges on top of their own domestic carbon price.

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