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An Evaluation

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Border Carbon Adjustments and Alternative Measures for the EU ETS

An Evaluation

Roland Ismer, Karsten Neuhoff, Alice Pirlot[1]

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As part of its Green Deal, the European Commission is considering the introduction of border carbon adjustments and alternative measures. The measures, which would primarily apply to basic materials like steel and cement, pursue a double objective: they are aimed at enhancing the effectiveness of carbon pricing for the transition to climate neutrality but also at avoiding carbon leakage risks. When implementing carbon adjustment mechanisms and alternative measures, various design options might be considered to reform the EU Emissions Trading Scheme (EU ETS). In this paper, we have decided to focus on three main models, which help to highlight the main differences between the available options. Under the first model, importers of basic materials would be required to surrender carbon allowances at the level of a product benchmark or, where lower, at the verified level of foreign carbon intensity. In parallel, allocation of free allowances would be phased out. Under the second model, a symmetric adjustment mechanism for exports and imports would be adopted, including refund to exporters for the carbon costs incurred on basic materials embodied in products. Finally, under the third model, the EU ETS would be complemented with a climate contribution charged for materials sold in the European Union (EU) at the product benchmark level related to the carbon intensity of each material. The free allowance allocation regime would then be modified to be directly linked to the volume of material production at the product benchmark level. In order to contribute to the current policy debate, we evaluate for each of these three models, their legality, coherence with EU climate objectives, effectiveness in carbon leakage prevention, potential international implications, as well as their administrative complexity and compliance costs.

Key Words: Carbon pricing, Climate policy, International trade, WTO
JEL Codes: F18, K33, L61, Q58

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1. Introduction

The European Commission has called for a European Green Deal to make the EU climate neutral by 2050.[1] In its Communication on the European Green Deal, the Commission states that it will propose a carbon border adjustment mechanism for selected sectors by 2021, to reduce the risk of carbon leakage, should differences in levels of ambition worldwide persist.[2] This mechanism would be a novelty. Border carbon adjustments (and alternative measures) have been proposed in the past, both in the EU and elsewhere, such as in the US.[3] However, in contrast to the established border tax adjustment mechanisms that are part of VAT and excise duties systems, they have never been adopted for carbon pricing schemes.[4] Therefore, uncertainties remain as to the design of such adjustment measures. Indeed, there is no single universally accepted form of border carbon adjustments. Instead, various design options exist for border carbon adjustment mechanisms and alternative measures.[5] The present article distinguishes between three main models that represent the key design options for the European Commission's proposal. Informed by discussions with policymakers and stakeholders, and taking account of the most actively discussed proposals, we see three basic models that could support future implementation: the inclusion of imports into the EU ETS (Model 1), the adoption of symmetric border carbon adjustments into the EU ETS (Model 2) and the adoption of a climate contribution combined with a move towards a dynamic free allowance allocation as part of the EU ETS (Model 3).

We confine our analysis to measures that would be complementary to the EU Emissions Trading Scheme (EU ETS)[6]. Although adjustments could also complement potential carbon taxes or potential carbon components of existing taxes – for example as part of the EU Energy Taxation Directive, which the Commission plans to review in accordance with its new climate objectives[7] – the EU ETS is the EU's main carbon pricing instrument. The question as to how border carbon adjustments or alternative measures can be implemented for the EU ETS is therefore the most relevant question to be answered at the moment. Adjustments for the EU ETS also have the advantage that they can be adopted under the qualified majority voting rules (Article 192(1) of the TFEU).[8] By contrast, the adoption of tax provisions would require unanimity, which would arguably make such option politically less realistic.[9]

Our analysis concentrates on carbon-intensive basic materials, including steel, cement clinker, aluminium, pulp paper and plastic. Whilst border adjustments might also be applied in other fields, such as electricity, several reasons justify our focus on basic materials. First, carbon-intensive basic materials cause 25% of global and 16% of European greenhouse-gas emissions, roughly two thirds of all industrial emissions.[10] Basic materials are highly commoditized and therefore strongly responsive to price signals. Their carbon intensity is far higher than that of any other industrial product. As a result, their production is particularly exposed to carbon leakage risks. At the same time, they are produced with capital-intensive processes, and therefore require effective investment frameworks for a transition to climate neutrality. From an administrative viewpoint, the limitation of the scope of the adjustments to carbon-intensive materials reduces compliance costs. Administrative requirements can be further reduced with de-minimis thresholds. Imported products that do not contain a sufficient share of basic primary materials would not be covered. Moreover, a focus on carbon-intensive basic materials allows making use of the emissions benchmarks that have already been established for these sectors at the EU level. Finally, from a political viewpoint, solutions for basic material

production processes, which are often politically contentious to regulate, may allow for more technical discussions on other sectors.

The main goal of this article is to contribute to the current policy debate by providing an overview of and evaluating these three simplified categories of measures. Section 2 will present the basic features of each of the three basic models. Section 3, which represents the core of this paper, then tests the three models against key evaluation criteria (legality, coherence with EU climate objectives, effectiveness in carbon leakage prevention, potential international implications, as well as administrative complexity and compliance costs). Section 4 concludes.

2. Basic Models

The EU ETS currently does not include any adjustments for imports or exports, but solely applies to EU installations,[11] reducing its potential for helping achieve climate neutrality. A diversity of measures could be used to extend the scope of the EU ETS to a range of basic materials that are sold in the EU. For the sake of clarity, we have grouped these measures under three models. Model 1 extends the EU ETS only to imported basic materials (and, to the extent they contain basic materials, possibly also semi-manufactured and final products). Model 2, which applies to basic materials, semi-manufactured and final products, provides for adjustments both for imported and exported products. Model 3 complements the EU ETS by means of a climate contribution on basic materials sold in the EU. The climate contribution would also be levied on semi-manufactured and final products to the extent they contain basic materials. This section presents the basic features of each of these three models.

2.1. Model 1: Inclusion of imports in EU ETS

Model 1 provides for the inclusion into the EU ETS of imported carbon-intensive materials originating outside the EU. Adjustments would be made in respect of imported carbon-intensive products. The adjustments would seek to reflect the burden borne by products produced in the EU. There would be no adjustments in respect of exports from the EU to third countries. Technically, the inclusion could take the form of an obligation on importers to surrender allowances.[12] The EU ETS Directive used to explicitly mention this option as one of the proposals that Member States might consider in order to "support certain energy-intensive industries in the event of carbon leakage".[13]

We assume in the following that there would be no immediate transition to full auctioning under the EU ETS. This is because free allocation arguably limits the disadvantages faced by exporters when the EU ETS does not include a relief system for exports. We further assume that free allowance allocation would, for political, environmental and economic reasons, continue to be calculated in the same way as in the past.[14] Under the current rules, the number of allowances to be freely allocated is based on historic production volume multiplied by a benchmark level for the specific product. This would, in the coming years, limit the carbon cost passed to domestically produced materials and products and would limit potential distortions to exports. The number of free allowances for an installation would be reduced where production volume falls below a threshold.[15] Moreover, the level of free allowance allocation would continue to be gradually reduced in accordance with an annual benchmark adjustment factor[16] (between 0.2% and 1.6%) as well a cross-sector reduction factor linked to overall emission cap reductions.[17]

Importers would thus be required to surrender allowances corresponding to the difference between the benchmark and the level of free allowances allocation. They could, however, reduce their liability by demonstrating that their specific production process was more carbon efficient than the benchmark. The reduction over time of free allocation would lead to an increase of the effective burden borne by domestic producers.

The scope of the adjustments on imported products would be limited to primary carbon-intensive basic materials, such as steel, pulp paper, aluminium, cement clinker or plastics (Model 1A). Materials as part of imported manufactured and semi-manufactured products would then remain outside the system. In principle, an alternative variant (Model 1B) would be conceivable with a broader scope than Model 1A. The adjustment on imports would then extend to semi-manufactured and final products made of a quantity of primary product that exceeds a certain threshold (e.g. based on specific PRODCOM categories). Such a broader scope would reflect the fact that the limitation to basic materials, namely primary products under Model 1A would be likely to discourage the import of basic materials into the EU while encouraging the import of semi-manufactured and final products that are not subject to any adjustment mechanism. Yet, such extended approach would face two objections. First, goods that are part of integrated value chains and cross the European external border several times during the production process could become subject to the adjustment multiple times, unless account was taken for the charge paid at earlier stages. This would create particular problems for integrated value chains criss-crossing frontiers.[18] Second, even absent such a risk, the fact that the mechanism would apply to imports only would extend the competitive disadvantage to exporters of manufactured goods from the region. For these reasons, we do not consider Model 1B in the following.

2.2. Model 2: Symmetric border carbon adjustment for exports and imports

Model 2 represents a symmetric border carbon mechanism that would apply both to imports and to exports.[19] It would cover basic materials as such as well as the basic materials content of semi-manufactured and final products, provided this content exceeds a certain relevance threshold. On the import side, Model 2 would operate in the same way as Model 1B. On the export side, Model 2 would differ from Model 1B. Exporters of primary, semi-manufactured and final products from the EU and EEA to third countries would be entitled to relief, either by not being subject to the EU ETS or by benefitting from a refund for the costs associated with the EU ETS. To obtain a refund in respect of exported products, the exporters would need to submit evidence of the carbon intensity of the produced material – and therefore the carbon cost paid in the EU, either at the time of production or at the time of earlier imports. This would avoid potential distortions from asymmetric carbon costs and also prevent the cascading effects of carbon pricing for supply chains where goods cross borders several times.

Such a symmetric border carbon adjustment would be applied in combination with full auctioning of allowances under the EU ETS. Indeed, the addition of symmetric adjustments to the EU ETS would no longer require that allowances be allocated for free. The symmetric adjustment implies that the risk of carbon leakage – which justifies the free allocation of allowances under the current regime – is mitigated. The adjustment level for imports would be set at the same benchmark level as under Model 1. It would be based on the 10% best installations. As under Model 1, importers could choose to demonstrate that the production

process of their products was less carbon intensive than the benchmark. Actual carbon intensity would then determine the adjustment level. Importers of semi-manufactured and final products would have to involve the producers of the primary products used during the production process.

2.3. Model 3: Climate contribution combined with dynamic free allowance allocation

Model 3 provides for the adoption of a climate contribution in combination with a reform of the free allocation regime. The climate contribution is a charge levied on selected carbon-intensive basic materials, such as steel, pulp paper, aluminium, cement clinker or plastics. The charge would apply to primary products, but also to semi-manufactured and final products, reflecting their content of the basic materials.[20] In line with long-established excise duties, the charge would be imposed at the stage of 'final' consumption. For example, steel for a car would be subject to the charge when the car was sold in the EU rather than when the steel was produced. The level of the climate contribution would be set irrespective of actual emissions in the production process, whether lower or higher than the benchmark. Neither would the origin of the product be relevant. Instead, the contribution would be fixed per ton of basic material at the product benchmark level used for determining the number of free allowances multiplied by the carbon price of the preceding year. The climate contribution would only be imposed on products sold in the EU, not on exported products. This mechanism is very similar to any destination-based market-based regulation or tax, whose scope of application is limited to products sold in the jurisdiction ("at destination").

The free allowance allocation regime would be modified to a dynamic allocation. The allocation of free allowances would be based on the current year's or preceding year's production volume of the installation concerned. Primary producers would hence obtain free allowances for every additional ton of material, for example steel, that they produce at the product benchmark-level. Though producers of basic materials would receive allowances for free, they would face full incentives to improve their carbon efficiency. Indeed, producers with carbon efficiency better than the benchmark would be able to sell some of their free allowances, those with carbon efficiency below the benchmark would have to buy additional allowances. The carbon price signal from the upstream emission trading scheme would, however, be largely muted in the value chain as producers could not pass carbon cost to product prices.[21] As already explained, such price signal would be reinstated along the value chain by the climate contribution.

Summarising table

	Model 1	Model 2	Model 3
Free allocation	Free allocation unchanged	No free allocation	Free allocation modified (dynamic model)
Treatment of imports	Imports of basic materials (and, possibly, semi-manufactured and final products) included into the EU ETS		Climate inclusion mechanism: domestic and imported products subject to the charge (including basic material, semi-manufactured and final products)
Treatment of exports	No adjustment on exports	Adjustments on exports (relief or reimbursement of the charge)	No charge on exports

3. Evaluation of the Models

Each of the three models is assessed under five key evaluation criteria. Criterion 1 concerns the legality of the measure, which could also affect its political feasibility and stability. Criteria 2 and 3 are linked to the main objective of any climate policy, mitigating climate change. Criterion 2 focuses on the EU objective of decarbonisation whereas Criterion 3 focuses on carbon leakage, which could have a detrimental effect on the overall environmental effect of the EU ETS. Criterion 4 stresses the potential international implications of the measure. Given the global scale of the effects of climate change, the measure should be assessed negatively if it is likely to discourage worldwide action on climate change. Conversely, if the measure is likely to encourage worldwide action on climate change, it should be evaluated positively. Finally, Criterion 5 focuses on the administrative feasibility and compliance costs for business.

3.1. Criterion 1: Legality

A first evaluation criterion is the legality of the measure. With regard to EU law, we see no reasons for major doubts. Each of the measure proposed is a reform of the EU ETS, which suggests that they could all be adopted under the same legal basis as the EU ETS, namely Article 192(1) of the TFEU. In particular, the climate contribution does not represent a measure primarily of a fiscal nature. It could therefore be adopted with qualified majority voting rather than unanimity.[22] Thus, the main legal issues arise with respect to public international law, and in particular with respect to world trade law.

Although European Union laws can in principle be valid even if they are inconsistent with WTO obligations,[23] compliance with existing[24] world trade law is nevertheless important for two main reasons. First, the respect of the conditions of the international rules-based order allows for the building of the trust that is necessary to foster international climate negotiations. Second, as already explained above, the effectiveness of the EU's climate action necessarily depends on the robustness of the carbon price mechanism to legal and political challenges. A measure that has a high probability of being incompatible with international law provisions would create uncertainty for investors as it could lead to trade disputes. This would impact upon the effectiveness of the EU's climate policy and limit its effect on the mitigation of climate change. Although the WTO dispute settlement procedures have recently been called into question by the United States, WTO law remains an instrument that is being called upon against measures that distort international trade as a justification to adopt retaliatory measures.[25] Moreover, a group of WTO members, including the EU, have agreed to put in place measures to replace the WTO Appellate Body for the time that it is not functional.[26] All this implies that WTO law remains fully relevant. Thus, it is key to assess each of the models described above under international trade law.[27]

Non-discrimination under GATT

In this respect, the highest risk for border carbon adjustments or alternative measures is to be found incompatible with WTO law non-discrimination principles.[28] Unless they can claim that their measure fall under an exception to the WTO law agreements, WTO members are not allowed to discriminate between products from other WTO members (this principle is referred to as the "most-favoured-nation principle", see Article I of the GATT (General Agreement on Tariffs and Trade)). Moreover, they are not allowed to discriminate between domestic and imported products (this principle is referred to as the "national treatment

principle", see Article III of the GATT). Both principles cover de jure and de facto discrimination.[29] They thus go beyond situations where the domestic measure explicitly distinguishes between products based on their origin and also cover situations where the domestic measure produces a disproportionately disparaging effect on foreign products. De facto discrimination hence depends on the factual circumstances at stake.[30]

Although none of the models above seems to constitute a de jure discrimination, the Models could possibly amount to a de facto discrimination against imported products. First, when the Models are modified so as to differentiate according to whether the products come from jurisdictions with a carbon price. In particular, under Models 1 and 2, the adjustment on imports from such jurisdictions could be less than from jurisdictions without a carbon price. Such differentiation could lead to a violation of the MFN principle if importers are allowed to rely on domestic carbon policy of third countries to be exempted or granted relief from the border measures on imported basic materials (and eventually semi-manufactured and final products). Indeed, such possibility in favour of importers from countries that have adopted climate measures would discriminate against the products from countries without such climate policy. It would then be questionable whether such differentiation could be justified on the basis of Article XX of the GATT, which provides general grounds of justifications for measures that would otherwise violate this agreement, including grounds related to environmental protection (see Article XX, (b) regarding "measures necessary to protect human, animal or plant life or health" and Article XX, (g), regarding "measures relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption").

Second, the inclusion of imports in Models 1 and 2 could, depending on their specific design, be seen as a way to "afford protection to domestic production" (Article III:1 of the GATT). This risk of incompatibility can be explained by the difficulty of imposing the exact same liability on domestic and imported products under these two models. For domestic products, the liability would arise at the production level and the costs of the EU ETS on domestic producers would be passed on to domestic products. For imported products, the liability arises at the product level. Nevertheless, it would be hard to ensure that the liability imposed on imported products exactly replicated the liability that was passed on to domestic products under the EU ETS. It is unclear whether these differences would transform the liability on imported products into either a discriminatory measure on imports (contrary to Article III of the GATT) or to an excessive charge imposed in connection with the importation (contrary to Article II of the GATT). If either were the case, Models 1 and 2 would need to be justified under Article XX GATT.

In contrast to Models 1 and 2, Model 3 does not seem particularly problematic under the GATT. In principle, the non-differentiated application of the climate contribution implies a non-discriminatory treatment between domestic and foreign producers and manufacturers and thus avoids concerns under the GATT. Similar destination-based measures, such as product regulations and consumption charges such as excise duties, have been adopted in the past and not been found problematic.[31]

Subsidies under the ASCM

Besides the GATT, WTO members also need to respect the provisions of the Agreement on Subsidies and Countervailing Measures (ASCM). This agreement regulates subsidies, including tax subsidies (Article 1.1(a)(1)(ii) of the ASCM, with the reference to the cases where "government revenue that is otherwise due is foregone or not collected"). Two main aspects of the models presented above could, allegedly, be assimilated to subsidies, namely (i) the relief for exports under Models 2 and 3 – there would be no relief for exports under Model 1 – and (ii) the free allocation of allowances under Models 1 and 3, whereas there would be no free allocation under Model 2.

Regarding the relief for exports, the ASCM is relevant in that it prohibits the adoption of export subsidies, namely "subsidies contingent, in law or in fact, (…) upon export performance" (Article 3.1 (a) of the ASCM). The question therefore arises whether Model 2 and Model 3 could be assimilated to such export subsidies. Regarding Model 3, there does not seem to be any problem under the ASCM as the non-application of the climate contribution to exported products is very similar to the treatment of exports under traditional destination-based taxes. The ASCM explicitly rejects the assimilation of excise duties or value added taxes, when they are not imposed to exported products, to export subsidies.[32] By contrast, Model 2 might be more problematic because the adjustments would be made in respect of the EU ETS, which is being imposed on domestic producers rather than on domestic products. This distinguishes Model 2 from traditional adjustment measures and, therefore, makes it somewhat more controversial. Indeed, there is disagreement in the legal scholarship as to the treatment of exemptions (or refunds) of exported products in respect of carbon taxes, charges and regulations that apply to producers.[33] Model 1, which does not include adjustments in respect of exports, would not present any risk under the ASCM, except if the free allocation regime is questioned, which is analysed in the next paragraph.

Concerning the free allocation regimes, there has been a long debate in the literature on their compatibility with the ASCM.[34] Arguably, the allocation of free allowances to certain sectors could be assimilated to an export subsidy (prohibited under the ASCM) or to an actionable subsidy (not prohibited as such under the ASCM but potentially opening the door for other WTO members to adopt countervailing duties or countermeasures). Although the free allocation regime is not directly linked to exports, it could be seen as a measure aimed to help certain sectors export the materials they produce.[35] If it were not assimilated to a prohibited export subsidy, the regime could still be seen as an actionable subsidy if it "causes adverse effects to the interests of other Members" (Article 5 of the ASCM). The analysis, which is made on a case-by-case basis, could take account of the costs imposed on domestic producers (e.g. for allowances that need to be surrendered). The absence of disputes against such regimes seems to indicate that they are not problematic under the ASCM. Although it is ultimately impossible to predict whether the free allocation regimes under Models 1 and 3 would be problematic under the ASCM, we therefore consider the risk of violation of the ASCM to be very limited.

Further principles of public international law

Finally, two further principles of public international law in particular need to be considered. First, there is the territoriality principle. All Models would not comprise extraterritorial measures, i.e. the application of a measure triggered by something other than a territorial

connection with the regulating state. To the extent importers under Models 1 and 2 would demonstrate that their actual emissions were better than the benchmark, circumstances abroad would need to be taken into account, a situation which has been aptly described as a territorial extension.[36] While such a territorial extension is not illegal under public international law, it would give rise to monitoring and verification needs. Such needs could, so as not to infringe the sovereignty of the state where the materials are produced, not be fulfilled without its assent by officials of the EU or its Member States. In practice, this would imply the need to involve private agents as independent verification agents, a strategy that has been adopted under the Kyoto Protocol's Clean Development Mechanism.

Moreover, the principle of common but differentiated responsibility (CBDR) that is mentioned in Article 3 of the United Nations Framework Convention on Climate Change[37] could encourage the EU to grant favourable treatment to products from developing or least-developed countries. It is being discussed to (partially) exempt importers from jurisdictions with a carbon price from their EU liability or to give a credit for carbon pricing paid in other jurisdictions.[38] Yet such differentiated application of border carbon adjustments could lead to additional problems under WTO law as it could be seen as a violation of the most-favoured-nation principle,[39] given that uncertainties remain as to how domestic measures that are aimed at implementing the principle of CBDR would be analysed under the GATT. Moreover, it would involve difficult judgements including about foreign carbon leakage protection mechanisms. It would also further increase the administrative requirements to not only track carbon intensity but also jurisdictions along the value chain. Therefore, the measures should preferably be designed in a neutral way with no reference to specific countries, giving importers the possibility to demonstrate the carbon neutrality of the goods they import, regardless of the climate legislation in place in the country of origin.[40]

<table>
<tr><th></th><th>Model 1a
Inclusion of imports in EU ETS combined with continued free allocation</th><th>Model 2
Symmetric border carbon adjustment combined with full auctioning (no free allocation)</th><th>Model 3
Dynamic free allocation combined with climate contribution</th></tr>
<tr><td>Under EU law (legal basis</td><td colspan="3">Qualified majority (QMV)</td></tr>
<tr><td>Under International trade law (GATT)</td><td colspan="2">Possibly in violation of Article III GATT; possibly justified under Article XX GATT</td><td>In principle, in line with Article III GATT</td></tr>
<tr><td>Under International trade law (ASCM)</td><td colspan="3">Very limited risk regarding ASCM</td></tr>
<tr><td>Others (territoriality principle; CBDR principle)</td><td colspan="3">Depending on the design of the measure</td></tr>
</table>

3.2. Criterion 2: Coherence with EU climate objectives

The second evaluation criterion assesses the consistency of the measure with the EU's climate objectives. Border carbon adjustments or alternative measures should contribute to the EU's achievement of its decarbonization objectives (namely, its 2030 emission targets, its objective of climate neutrality by 2050, with its potentially additional targets for the shares of activities that should become carbon neutral by 2030). We have identified three interrelated requirements against which we test the three models.

First, incentives are needed to improve the carbon efficiency of production processes so as to achieve climate neutrality. All Models seem to meet this requirement. Although free auctioning could reduce the incentives to improve carbon efficiency, this does not seem to be the case for the Models presented above. Model 2 is characterised by full auctioning, which means that incentives for carbon efficiency improvements are necessarily preserved. Under Model 1 and 3, the free allocation of allowances is based on benchmarks, which also implies that incentives for carbon efficiency improvements are preserved. Indeed, efficiency improvements allow producers to save buying additional allowances or may even sell surplus allowances if they beat the benchmark. In Model 1, however, the allocation mechanism is distortive. The allocation is not directly linked to production volumes, and hence firms in some sectors and years will likely profit from reducing production volumes and selling free allowances. To avoid excessive windfall profits, activity thresholds have been introduced in free allocation mechanisms, which in turn undermine efficiency and can trigger excessive carbon emissions.[41]

Second, full carbon cost internalization is required in order to encourage users of materials such as manufacturers and the construction sector to shift to alternative materials with lower carbon content and enhance material efficiency. Model 2 achieves full carbon cost internalization through exposing producers and importers to full carbon costs. Model 1 limits the exposure to carbon costs for domestic producers (free allowance allocation, which means that only partial internalisation of the carbon price will take place) and importers (liability limited to the benchmark level used for the allocation of free allowances, which also means that the carbon price will only be partially internalised). Therefore, Model 1 only results in partial carbon cost pass through and does not achieve full carbon cost internalization. In Model 3, the free allowance allocation based on a common benchmark to conventional and climate neutral producers also reduces the carbon cost internalization at the level of the benchmark. However, this benchmark is subsequently charged on all products delivered to final users. Hence, the carbon cost is internalized in all decision processes.

Third, full carbon cost internalization is also required by investors in climate neutral production processes so as to allow them to recover incremental costs. In Model 2, the cost of conventional material production or its import increases with the carbon price, thus allowing carbon neutral producers of basic materials to achieve a correspondingly higher sales price to cover incremental cost. In Model 1, domestic producers with conventional processes continue to receive a significant share of free allowances, while imports are only charged a fraction of the carbon cost. Hence domestic material prices will only partially reflect carbon

costs – inhibiting investors in clean material processes from recovering investment costs. In Model 3, both climate neutral and carbon-intensive material producers receive free allowances at the benchmark level. Carbon-intensive material producers need the allowances to cover their emissions, while climate neutral producers can sell the allowances and can thus cover their incremental costs.

<table>
<tr><td>Incentives to achieve climate policy objectives</td><td>Model 1A</td><td>Model 2</td><td>Model 3</td></tr>
<tr><td>Incentives for existing assets to improve carbon efficiency of production</td><td colspan="3">Full effect achieved in all models</td></tr>
<tr><td>Full carbon cost internalization for material efficiency/substitution and climate neutral processes</td><td rowspan="2">Only partial</td><td colspan="2" rowspan="2">Yes</td></tr>
<tr><td>Full carbon cost internalization for the recovery of incremental costs</td></tr>
</table>

3.3. Criterion 3: Effective carbon leakage prevention

The third evaluation criterion concerns the robustness of each Model to carbon leakage. Carbon leakage refers to the phenomenon where the reduction in emissions (relative to a benchmark) in the implementing jurisdiction is cancelled out by an increase of emissions in third countries.[42] Carbon leakage undermines the achievement of the objective of global emission reductions. Given the worldwide effects of climate change, there is no point in reducing carbon emissions in one country if domestic policy measures have a negative global effect. Admittedly, existing European climate policies have so far not resulted in demonstrable carbon leakage.[43] Free allowance allocation under the EU ETS as well as its relatively low carbon prices have limited – or even avoided – cost increases on EU producers in comparison to international competitors. Consequently, the incentives to relocate production to third countries remained modest or non-existent. However, the situation might change with the gradual phase-out free allowances allocation post-2020.[44] Simultaneously, the EU Commission proposes as part of the Green Deal to raise the overall emission reduction target from 40% relative to 1990 levels to at least 50%.[45] This will likely also lead to a tightening of the EU ETS cap and therefore to an increase of the allowance price. Climate neutral material production processes will involve incremental costs exceeding current carbon price levels, which explains the debate on whether the current approach to carbon leakage prevention will suffice.

When it comes to the risk of carbon leakage, five dimensions need to be distinguished: their effect on the sale of materials in the EU (i) and foreign markets (ii) as well as their effect on manufacturing industries selling in the EU (iii) and abroad (iv). Finally, opportunities for resource shuffling could trigger carbon leakage (v).

(i) Regarding the sale of materials in the EU, all three models ensure that domestic and foreign material producers face (almost) similar carbon costs and thus avoid any incentives that may – if sufficiently large – contribute to production relocation and thus carbon leakage.

(ii) With respect to the sale of materials in foreign markets, Model 1 leads to the gradual increase of carbon costs for European material producers due to the declining free

allowance allocation levels. Should third countries not impose a similar policy and should cost difference reach sufficient scale, then exports by European material producers could decline and corresponding production and emissions could be relocated abroad. This potential effect is avoided in Model 2 (given that carbon costs are refunded by means of border carbon adjustments in respect of exports) and in Model 3 (given that free allowance allocation is maintained, and the climate contribution is imposed only on domestic consumption by final consumers).

(iii) With respect to manufacturing industries selling in domestic markets, Model 1 gives rise to risks of carbon leakage. It increases prices for materials in domestic markets. This would create incentives to relocate the manufacturing of semi-finished products. Manufacturers could import semi-finished or final products not subject to the border carbon adjustment and thus access materials free of carbon cost. If this effect were to reach sufficient scale it could also contribute to a relocation of production of basic materials to potentially less efficient foreign sites. Such incentives are neither present in Model 2, as the border carbon adjustment applies to the entire value chain (both basic materials and manufactured products), nor in Model 3, as the climate contribution applies both to domestic and imported basic material and manufactured products.

(iv) With respect to manufacturing industries selling in foreign markets, Model 1 results in a gradual increase of carbon costs on basic materials bought by European producers. If the cost increase is of sufficient scale and if other regions do not impose similar carbon costs, sales of manufactured products with large shares of carbon intensive materials in foreign markets may decline. This would likely imply a shift of production and emissions abroad. Such an effect would be avoided in Model 2 as carbon costs are refunded for the entire relevant value chains and in Model 3, as free allowance allocation levels avoid significant incremental carbon costs for European producers compared to international producers. Moreover, under Model 3, the climate inclusion mechanism would not lead to carbon leakage with respect to sales of semi-manufactured and final products in foreign markets given that the charge applies only to domestic sales.

(v) Resource shuffling would be incentivised in Model 1 and 2 as importers pay zero import charges for materials produced with zero emission, e.g. through the (deemed) use of zero carbon electricity. This creates incentives to export such materials to the EU and consume more carbon intensive materials domestically or export them to jurisdictions with no adjustment mechanism. In other words, if only some regions implement import charges, existing plants will then profit even though actual production patterns remain unchanged. This may even result in an increase in production volumes of electricity-based materials that can claim (contracts with) carbon neutral electricity. However, in most power systems, additional power demand would, at least in the short-term, be met by fossil fuel power generation. The adjustment mechanism may thus trigger a relocation of moderately carbon efficient domestic power and material production towards foreign, potentially less efficient material and fossil fuel-based power generation.

The risk associated with these effects is highly uncertain and would likely trigger highly controversial debates.

Effective carbon leakage prevention	Model 1	Model 2	Model 3

<table>
<tr><td>Domestic sales of basic materials</td><td colspan="3">Overall effective carbon leakage prevention</td></tr>
<tr><td>Exports of basic materials</td><td rowspan="3">Gradual increase of carbon costs could result in carbon leakage risk</td><td colspan="2" rowspan="3">Overall effective carbon leakage prevention</td></tr>
<tr><td>Domestic sales of manufactured products</td></tr>
<tr><td>Exports of manufactured products</td></tr>
<tr><td>Resource shuffling</td><td colspan="2">Allocating carbon neutral electricity to materials exported to EU incentivises production increases even in countries with significant coal power generation.</td><td>None</td></tr>
</table>

3.4. Criterion 4: International implications

The fourth evaluation criterion concerns the international implication of each of the Models presented above. Border carbon adjustments and alternative measures might not actually lead to trade disputes, but they might remain controversial and undermine international cooperation. We need to consider this risk by analysing which of the three models described above would support, rather than undermine, climate action at the international level. Each of the Models could have an impact on third countries: (i) favouring international cooperation and/or (ii) the introduction of domestic climate measures. Moreover, each of the Models could have an indirect impact on foreign producers (iii) and manufacturers (iv).

(i) Border related measures could, in some occasions, undermine international climate cooperation if they were used as a means of pursuing the tactical objective of signalling a clear EU stance on multilateral concerns relating to trade and/or climate.[46] To achieve such leverage, a border related mechanism is often proposed as a reprehensive measure against non-cooperative countries. As this would inherently violate the WTO most-favoured-nation principle, such proposals would create an inherent tension between the use of a tactical instrument and the goal of providing long-term investment security through carbon leakage prevention. None of the three models described above follows this logic, which is commendable. Depending on their design, the Models could, however, lead to the singling-out of certain countries if importers were allowed to rely on domestic carbon policy of third countries to be exempted from the border measures on imports. Such design, favouring certain countries and disfavouring others, would likely undermine international climate cooperation.

(ii) In addition to their potential negative effects on international climate cooperation, climate policies, in certain cases, can act as a disincentive for third countries to adopt climate measures. For example, the (albeit partial) carbon cost internalization, under the current ETS system and under Model 1, implies that European manufacturing industries face higher material prices than their foreign competitors. This could be perceived by third countries as a disincentive to implement similar measures. By contrast, Models 2 and Models 3 do not suffer from such deficiency.

(iii) Climate policies can have an impact on foreign producers of basic materials, encouraging or discouraging them to improve the carbon efficiency of their production processes. Models 1 and 2 reduce the import charge on basic materials, if foreign producers can

demonstrate that their production process is better than the product benchmark. Conversely, improvements of installations that remain worse than the product benchmark are irrelevant and thus not incentivized. In Model 1,47 the incentives are further limited, because it covers only imported basic materials and not semi-manufactured and final products. In practice, the incentives provided for foreign material producers are therefore rather restricted and may thus have, if any, a moderate impact on investments. By contrast, Model 3 does not create such incentives. The climate contribution is to be imposed on basic, semi-manufactured and final products sold in the EU/EEA, indistinctively of the production process of the products. 48

(iv) Climate policies may also create incentives for supporting efficient material use by foreign manufacturers (rather than efficient material production, as analysed supra under (iii)). Models 2 and 3 create such incentives for foreign manufacturers exporting to the EU. By contrast, Model 1[49] does not have such an impact, due to the lack of adjustments for semi-manufactured and final products.

International incentives	Model 1	Model 2	Model 3
for international cooperation	Negative, if singling-out of non-cooperative jurisdictions		
for third countries to implement carbon pricing	negative	neutral	
for foreign material producers for carbon efficient production	Very limited	Limited	None
for foreign manufacturing industry for efficient material use	Limited	Full	Full

3.5. Criterion 5: Administrative complexity and compliance costs

The fifth and final evaluation criterion concerns ease of administration. Ideally, the measure should be easy to administer, and compliance costs for business should be low. Models 1 and 2 are likely to be more burdensome than Model 3, which is fully based on benchmarks and therefore does not require specific data on the carbon intensity of domestic and imported materials.

Model 1 would require data on the carbon intensity of production processes taking place abroad, when importers show that actual emissions were better than the benchmark level. The public international law principle of territoriality as an emanation of sovereignty implies that the EU or its Member States could not undertake control checks outside their territories without the consent of the respective State. Such data would therefore most likely require additional verification procedures by private actors. While this is in principle feasible and has been adopted under the Clean Development Mechanism under the Kyoto-Protocol, it would give rise to additional administrative complexity.

Model 2 would be more cumbersome than Model 1 when importers would show that actual emissions were better than the benchmark level. As under Model 1, this would require the EU to verify the data provided by foreign producers on the carbon efficiency of their production methods. There would be a significant difference, however: such verification would have to

trace the carbon intensity of products along the value chain. Moreover, under Model 2, the EU will also need to assess data on domestic primary, semi-manufactured and final products in order to apply the adjustments on exports. This would not only require the tracking of materials, but also of their carbon intensity. If exporters were to receive refunds in cash or allowances, additional administrative costs would likely apply to Model 2. Refunds could be expected to lead to fraud, as it has been the case under traditional VAT systems. Consequently, more stringent reporting and monitoring mechanisms would be necessary.

Model 3, by contrast, is fully based on benchmarks and therefore does not require specific data on the specific production process of materials and materials contained domestic and imported products. This, in addition to the absence of refunds, would limit administrative and compliance costs.

Administrative feasibility and cost	Model 1A	Model 2	Model 3
Requirements	International tracing of carbon intensity of production required, where there is no reliance on benchmarks	Domestic and international tracing of carbon intensity along entire value chain, where there is no reliance on benchmarks	Only reporting of weight of material of different types required

4. Conclusion

As part of its Green Deal, the new EU Commission has announced that it will table a proposal for the adoption of a border carbon adjustment mechanism aimed at reducing the risk of carbon leakage, should differences in levels of ambition worldwide persist. This approach is in line with the basic tenets of the Paris Agreement, which recognises that countries are responsible for the definition of their own national climate policy regimes and encourages them to cooperate at the international level in order to support national climate action, including through financial means. As there are various design options for border carbon adjustment mechanisms and alternative measures, we have condensed the key options into three basic models: the inclusion of imports in the EU ETS (Model 1), the adoption of symmetric border carbon adjustments into the EU ETS (Model 2) and the move towards a dynamic free allowance allocation under the EU ETS in combination with a climate contribution (Model 3). We have sought to contribute to the current policy debate by providing an overview of and evaluating the three models against the criteria legality, coherence with EU climate objectives, effectiveness in carbon leakage prevention, potential international implications, as well as their administrative complexity and compliance costs.

Model 1 extends the EU ETS to imported carbon-intensive materials (and, to the extent they contain basic materials, possibly also semi-manufactured and final products) from third countries. The adjustments would seek to reflect the burden borne by products produced in the EU. There would be no adjustments in respect of exports from the EU to third countries. The evaluation indicates that this model scores the lowest on the evaluation criteria. Regarding legality, there is a risk that it be found to violate WTO law. It is also not fully coherent with regard to the EU climate objectives: it is unlikely to support sufficient carbon price levels to achieve climate neutral production processes. Indeed, once the level of free allowances allocation will start to decline and carbon prices will increase, Model 1 will create

incentives for the import of semi-finished products (not subject to the charge). Furthermore, with competition from imports, carbon cost internalization along the value chain will be limited and so will the incentives for resource efficiency, material substitution and the business case for climate neutral production processes. Moreover, it does not effectively address risks of carbon leakage and might have adverse implications for international cooperation by discouraging third countries to introduce or strengthen carbon pricing. Model 1 would also entail significant administrative effort and compliance costs, as it would require international tracing of carbon intensity of production required, where there is no reliance on the benchmarks.

Model 2 represents a symmetric border carbon mechanism that would apply both to imports and to exports. It would cover basic materials as such as well as the basic materials content of semi-manufactured and final products, provided this content exceeds a certain relevance threshold. Overall, Model 2 scores better against the evaluation criteria. Regarding the legality, the same issue as under Model 1 arises with respect to world trade law. It seems preferable to Model 1 when it comes to the coherence with EU climate objectives, as the adjustment mechanism would cover most of the value chain and exports should be relieved of the carbon costs. It would contribute to full carbon cost internalization. While it may appear effective at addressing carbon leakage, it is vulnerable to resource shuffling, which would reduce its effectiveness. It would avoid the adverse implications for international cooperation that characterize Model 1. Finally, it would imply administrative complexity, where importers want to demonstrate that actual emissions were lower, due to the need for data on the carbon intensity of all the components of the products subject to the adjustment and for monitoring compliance abroad.

Model 3 complements the EU ETS by means of a climate contribution on basic materials sold in the EU. The contribution would also be levied on semi-manufactured and final products to the extent they contain basic materials. Free allocation of allowances would be directly linked to the volume of material production at the product benchmark level. All in all, the Model scores best against the evaluation criteria. Model 3 is in principle in line with world trade law. It is coherent with EU climate objectives, as the adjustment mechanism would cover most of the value chain and exports should be relieved of the carbon costs. Moreover, this model would contribute to full carbon cost internalization and it is effective at addressing carbon leakage. It is free from adverse implications for international cooperation. As it builds on established mechanisms of free allowance allocation (for example in Korea, China, California) and of consumption charges (such as excises on fuel), it is also more likely to be found acceptable by the international community. Finally, Model 3 offers an approach with limited administrative complexity and costs.

Nevertheless, neither of the Models – not even Model 3 - is a panacea. In particular, encouraging firms with conventional production processes to shift to climate neutral options requires additional support in all Models.[50] Carbon pricing alone is unlikely to be sufficient particularly given political and distributional concerns about very high carbon prices. The adoption of complementary measures, including public procurement, products and sustainable finance regulations, will be key to support the shift towards a climate neutral Europe. First, public procurement regulations could lead to an obligation of "climate neutrality" for the purchase and use of specific products (e.g. public transport or publicly

procured buildings). This would give an additional push for material producers to engage with climate neutral processes and for material users to enhance material efficiency and explore substitute materials. Second, countries may also support their citizens in taking responsibility for the carbon footprint of their consumption and investment choices. This may initially involve better information on the carbon costs of products and activities and latter lead to the adoption of additional measures such as product carbon requirements. Product carbon requirements could be implemented requiring that from the 2030s all products sold in the EU be based on materials from carbon neutral production.[51] Such license to operate and sell into the internal market would lead to a de facto requirement to use climate neutral technologies and supply chains. Third, sustainable finance informs investors about their exposure to climate policy risks (transition risks). Companies would thus aim to demonstrate how quickly they can secure climate neutral produced materials and would therefore further enhance their cooperation with material producers to achieve this objective. All this means that Border Carbon Adjustments and Alternative Measures or only one of several tools in the tool box, but they certainly have a key role to play to ensure the low carbon transformation in the materials sector.

[1] European Commission, Council, the Council, the European Economic and Social Committee and the Committee of the Regions, The European Green Deal, Brussels, 11 December 2019, COM(2019) 640 final [hereafter "The European Green Deal"]. See also Ursula von der Leyen, A Union that strives for more. My agenda for Europe, Political Guidelines for the Next European Commission 2019-2024, available at https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf

[2] European Commission, 'The European Green Deal', supra n. 1, p. 5.

[3] Among the many contributions to the legal and economic literature see Carol McAusland and Nouri Najjar, 'The WTO Consistency of Carbon Footprint Taxes' (2015) 46(3) Georgetown Journal of International Law 765–801; Frank Biermann and Rainer Brohm, 'Border Adjustments on Energy Taxes: A Possible Tool for European Policymakers in Implementing the Kyoto Protocol' (2005) 74(2) Vierteljahreshefte zur Wirtschaftsforschung, pp. 249-258; Javier de Cendra, 'Can Emissions Trading Schemes be Coupled with Border Tax Adjustments? An Analysis vis-à-vis WTO Law' (2006) 15(2) RECIEL pp. 131-145; Aaron Cosbey et al., 'A Guide for the Concerned: Guidance on the elaboration and implementation of border carbon adjustment' (2012) Policy report Entwined, available at https://www.iisd.org/sites/default/files/publications/bca_guidance.pdf; Felicity Deane, Emissions Trading and WTO Law. A Global Analysis (Edward Elgar Publishing, 2015), in particular chapter 7; Paul Demaret and Raoul Stewardson, 'Border Tax Adjustments Under GATT and EC Law and General Implications for Environmental Taxes' (1994) 28(4) Journal of World Trade 5-66; Olivier De Schutter, Trade in the Service of Sustainable Development. Linking Trade to Labour Rights and Environmental Standards (Hart Publishing, 2015), in particular chapter 3; Susanne Droege, 'Do border measures have a role in climate policy?' (2011) 11 Climate Policy 1185-1190; Kateryna Holzer, Carbon-Related Border Adjustment and WTO Law (Edward Elgar Publishing, 2014); Gary Clyde Hufbauer, Steve Charnovitz and Jisun Kim, Global Warming and the World Trading System (Peterson Institute for International Economics 2009); Henrik Horn and Petros Mavroidis, 'Climate Change and the WTO: legal issues concerning border tax adjustments' (2010) 53 Japanese Yearbook of international law, pp. 19-40; Roland Ismer et al., 'Inclusion of Consumption into Emissions Trading Systems: Legal Design and Practical Administration' (2016) DIW Berlin Discussion Paper No. 1579; Roland Ismer, Klimaschutz als Rechtsproblem (2014) Mohr Siebeck; Roland Ismer and Karsten Neuhoff, 'Border tax adjustment: a feasible way to support stringent emission trading' (2007) 24(2) Eur J Law Econ 137-164; Ben Lockwood and John Whalley, 'Carbon-motivated Border Tax Adjustments: Old Wine in Green Bottles?' (2010) World Economy 33:6; 810; Charles E. McLure, 'The GATT-Legality of Border Adjustments for Carbon Taxes and the Cost of Emissions Permits: A Riddle, Wrapped in a Mystery, Inside an Enigma' (2011) 11 Florida Tax Review 221-294; Michael A. Mehling et al., 'Designing Border Carbon Adjustments for Enhanced Climate Action' (2019) American Society of International Law 433-481; Joost Pauwelyn, 'Carbon Leakage Measures and Border Tax Adjustments Under WTO Law' in Geert Van Calster and Denise Prévost (eds), Research Handbook on Environment, Health and the WTO (Edward Elgar Publishing, 2013), 448-506; Alice Pirlot, Environmental Border Tax Adjustments and International Trade Law (Edward Elgar Publishing, 2017) 92-94; Geert Van Calster, International and EU Trade Law. The Environmental Challenge (Cameron May, 2000) 414-485; Richard A. Westin, Environmental Tax Initiatives and Multilateral Trade Agreements: Dangerous Collisions (Kluwer Law International, 1997); Ulrike Will, Climate Border Adjustments and WTO Law – Extending the EU Emissions Trading System to Imported Goods and Services (Brill/Nijhoff Publishing, 2019).

[4] Generally speaking, they have been very few cases of "environmental" border tax adjustments. One of the rare examples often mentioned is the Superfund case concerning polluting chemicals. See the Report of the GATT Panel adopted on 17 June 1987, United States – Taxes on Petroleum and Certain Imported Substances, L/6175; 34S/136.

[5] See the different design options that have been analysed in past scholarship (supra n. 3).

[6] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, OJ L 275, 25 October 2003, p. 32 [hereinafter EU ETS Directive].

[7] European Commission, 'The European Green Deal', supra n. 1, p. 4.

[8] Roland Ismer and Manuel Haussner, 'Inclusion of Consumption into the EU ETS: The Legal Basis under European Union Law', 25 Review of European, Comparative & International Environmental Law (2016), 69-80.

[9] See, however, European Commission, Communication from the Commission to the European Parliament, the European Council and the Council, Towards a more efficient and democratic decision making in EU tax policy, 15 January 2019, COM(2019) 8 final.

[10] DIW calculations based on
International Energy Agency (2017) Energy Technology Perspectives 2017, UNFCCC (2012) National greenhouse gas inventory data for the period 1990–2010 https:// unfccc.int/process/transparency-and-

reporting/greenhouse-gas-data/ghg-data-unfccc/European, Environmental Agency, (2016) Greenhouse gases viewer. http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer.

[11] Given the incorporation of the EU ETS directive into the EEA Agreement, this also applies to all products produced in the EEA EFTA States (Iceland, Liechtenstein, and Norway).

[12] Alternatively, the inclusion of imports could also come in the form of a direct payment of an amount equivalent to the cost of acquiring these allowances.

[13] Article 10b(1)(b) of the EU ETS Directive as inserted by Article 1 No. 12 of the Directive 2009/29/EC of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community. The reference to the inclusion of imports was deleted by Article 1 (15) of the Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814.

[14] I.e., by reference to historic production volumes multiplied by a benchmark of the average carbon intensity of the 10% best installations in the EU.

[15] Commission Decision of 27 April 2011 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council, OJ L 130, 17 May 2011, pp. 1-45.

[16] For the linear reduction factor of 1.74 per cent regarding allowances, see Article 9 of the EU ETS Directive. The provision has been amended by Article 1(12) of Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814, which increases the factor from 2021 onwards to 2.2 per cent.

[17] Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814.

[18] In the automobile industry, for example, some components cross the border three to five times, see https://www.ft.com/content/c397f174-9205-11e6-a72e-b428cb934b78.

[19] See e.g. Roland Ismer and Karsten Neuhoff, 'Border tax adjustment: a feasible way to support stringent emission trading' (2007) 24 Eur J Law Econ 137-164; Stéphanie Monjon and Philippe Quirion, 'A border adjustment for the EU ETS: Reconciling WTO rules and capacity to tackle carbon leakage', 11 Climate Policy (2011), 1212-1225 (with further references).

[20] Karsten Neuhoff et al., 'Inclusion of Consumption of carbon intensive materials in emissions trading – An option for carbon pricing post-2020', Climate Strategies Report, 2016, available at https://climatestrategies.org/publication/inclusion-of-consumption-of-carbon-intensive-materials-in-emissions-trading-an-option-for-carbon-pricing-post-2020/ (last accessed 19 November 2019).

[21] A very small carbon signal might still arrive in the value chain, if the marginal steel producer has a carbon efficiency below or above the benchmark level, and therefore can sell some of the freely received allowances or needs to buy allowances in addition to the free allocation to cover emissions. These additional benefits or costs would reduce or increase the material price. The scale of this effect will however be small, because inefficiencies relative to best available technologies are small. Worrel and Carreon (2017) find that EU average energy intensity of steel making is only 5% above average energy use in the countries with global lowest energy use - Japan and Korea (Energy demand for materials in an international context June 2017, Philosophical Transactions of The Royal Society A Mathematical Physical and Engineering Sciences). This is confirmed by "The Steel Report", Climate Startegies (2014) Carbon Control and Competitiveness Post 2020: The Steel Report.

[22] See Ismer and Haussner, supra n. 8.

[23] The general lack of direct effect goes back to the seminal decision by the ECJ of 12 December 1972 - Joined cases 21 to 24-72 – International Fruit Company NV and others v Produktschap voor Groenten en Fruit, ECLI:EU:C:1972:115; both the so-called exception (ECJ of 7 May 1991 – C-69/89 – Nakajima All Precision Co. v Council, ECLI:EU:C:1991:186) and the 'Fediol exception' (ECJ of 22 June 1989 – Case 70/87 – Féderation de l'industrie de l'huilerie de la CEE (Fediol) v Commission, ECLI:EU:C:1989:254, paras. 19–22) do not apply here.

[24] World trade law is of course the outcome of negotiations and could be modified, see Mehling et al., 'Designing Border Carbon Adjustments for Enhancing Climate Action', (2019) 113(3) American Society of International Law, pp. 433-481 (479 ff.). Agreeing on such changes, however, would take time so that the current analysis is based on the world trade law as it stands.

[25] See recent disputes and consultations on the following WTO webpage: https://www.wto.org/english/tratop_e/dispu_e/dispu_status_e.htm

[26] Statement by Ministers, Davos, Switzerland, 24 January 2020, available at https://trade.ec.europa.eu/doclib/docs/2020/january/tradoc_158596.pdf.
[27] Past scholarship has analysed the risks of incompatibility under WTO law at great lengths (see supra n. 3).
[28] On these principles, see the relevant chapters in, among others, P. C. Mavroidis, The regulation of international trade (2016, Vol. 1, The MIT Press); J. Pauwelyn, A. T. Guzman, J.A. Hillman, International Trade Law (2016, 3rd edition, Wolters Kluwer); M.J. Trebilcock, R. Howse, A. Elisason, The Regulation of International Trade (2013, 4th ed, Routledge); M.J. Trebilcock & J. Trachtman, Advanced Introduction to International Trade Law (2020 Edward Elgar Publishing).
[29] Lothar Ehring, 'De Facto Discrimination in World Trade Law National and Most-Favoured-Nation Treatment—or Equal Treatment?' (2002) 36 Journal of World Trade, Issue 5, pp. 921–977; R. H. Regan, "Regulatory Purpose and 'Like Products' in Article III:4 of the GATT (With Additional Remarks on Article II:2)" (2002) 36(3) J. World Trade 36, pp. 443-478, in particular pp. 455-456; E. Vranes, Trade and the Environment: Fundamental Issues in International Law, WTO Law, and Legal Theory (2009 OUP), Chapter I of Part III.
[30] Lothar Ehring, 'National Treatment under the GATT 1994: Jurisprudential Developments on de facto discrimination', in Anselm Kaperman Sanders (ed.), The Principle of National Treatment in International Economic Law: Trade, Investment and Intellectual Property (Edward Elgar, 2014), 34 (36).
[31] Pirlot, supra n. 3, pp. 124-137 as well as chapter 6 (p. 224-281).
[32] See footnote 1 to Article 1.1(a)(1)(ii) of the ASCM.
[33] See the literature mentioned supra n. 3.
[34] See e.g. Elena de Lemos Pinto Aydos, 'Paying the Carbon Price: The Subsidisation of Heavy Polluters under Emissions Trading Schemes' (Edward Egar, 2017), pp. 141 ff. with further references; Felicity Deane, Emissions Trading and WTO Law. A Global Analysis (Edward Elgar Publishing, 2015), chapter 6; Kateryna Holzer, "Emissions trading and WTO law", in Stefan E Weishaar (ed.), Research Handbook on Emissions Trading (2016 Edward Elgar, pp. 326-352; Hufbauer, Charnovitz, Kim, supra n. 3, pp. 62-64.
[35] See, among others, the cases Canada – Measures affecting the export of civilian aircraft, WT/DS70/AB/R and Australia – Subsidies Provided to Producers and Exporters of Automotive Leather, WT/DS126/R.
[36] Joanne Scott, Extraterritoriality and Territorial Extension in EU Law, The American Journal of Comparative Law, Volume 62, Issue 1, Winter 2014, Pages 87–126.
[37] S. Davidson Ladly, "Border carbon adjustments, WTO-law and the principle of common but differentiated responsibilities" (2012) 12 Int Environ Agreements, pp. 63–84; Pananya Larbprasertporn, "The interaction between WTO Law and the Principle of Common but Differentiated Responsibilities in the Case of Climate-Related Border Tax Adjustments" (2014), 6(1) Goettingen Journal of International Law 145, at pp. 149-150.
[38] For the parallel discussion in the context of a carbon tax, see Samuel Kortum and David Weisbach (2017), The Design of Border Adjustments for Carbon Prices, National Tax Journal, 70:2, pp. 421-446, at 435 ff..
[39] Ibid.
[40] Pirlot, supra n. 3, pp. 238-240.
[41] Frédéric Branger, Jean-Pierre Ponssard, Oliver Sartor and Misato Sato (2015) EU ETS, Free Allocations, and Activity Level Thresholds: The Devil Lies in the Details, Journal of the Association of Environmental and Resource Economists, Vol. 2, No. 3, pp. 401-437.
[42] IPCC (2014), Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Fifth Assessment Report, p. 386; Glen B. Peters and Edgar G. Hertwich (2008), 'CO2 embodied in international trade with implications for global climate policy', Environmental Science & Technology 42, 1401. For more details see Susanne Droege et al. (2009), Tackling Leakage in a World of Unequal Carbon Prices, Climate Strategies, available at http://climatestrategies.org/wp-content/uploads/2009/10/cs-leakage-final-230909.pdf, pp. 16.
[43] Helene Naegele und Aleksandar Zaklan (2019): Does the EU ETS cause carbon leakage in European manufacturing? Journal of Environmental Economics and Management, Elsevier, vol. 93(C), pp. 125-147.
[44] See article 10b of the EU ETS Directive (consolidated version).
[45] European Commission, "The European Green Deal", supra n. 1, p. 4.
[46] For more detail see Dröge et al. (2019), 'How EU Trade Policy can Enhance Climate Action: Options to Boost Low-Carbon Investment and Address Carbon Leakage', available at: https://www.ceps.eu/wp-content/uploads/2019/09/EU-trade-policy-can-enhance-climate-action.pdf
[47] More precisely, in Model 1A, but not in Model 1B.
[48] Such incentives, however, appear no longer essential, after the paradigm shift in international climate policy: The process up to COP 15 in Copenhagen was characterized by the belief in the rapid implementation of a global carbon price. The Paris Agreement pursues the territoriality more limited approach of nationally defined contributions. It is expected that countries implement domestic policy, like carbon pricing, to support actors, e.g.

producers and consumers, in their territory in contributing towards the achievement of climate objectives. See e.g. Robert Falkner (2016), The Paris Agreement and the new logic of international climate politics, International Affairs, Vol. 92:5, 1107.

[49] Or, more precisely, Model 1A, see above at 2.1.

[50] Neuhoff et al.(2019) "Building Blocks for a Climate-Neutral European Industrial Sector", Climate Strategies Report; Wyns et al. (2019) "Industrial Transformation 2050: Towards an Industrial Strategy for a Climate-Neutral Europe, IES Report

[51] Timo Gerres, Manuel Haussner, Karsten Neuhoff and Alice Pirlot (2019) Can Government Ban Materials with Large Carbon Footprint? Legal and Administrative Assessment of Product Carbon Requirements, DIW Discussion Paper 1834.