Carbon border adjustments: salvation for the EU's climate trilemma?

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Contents

Abstract

The European Union (EU) faces a climate trilemma: in its current set-up, EU climate policies cannot ensure non-disrupted trade relations externally, domestic acceptance of climate mitigation costs and have high degrees of greenhouse-gas (GHG) emission abatement. Border Carbon Adjustments (BCAs) could propose a solution to this trilemma. BCAs are a policy tool that the European Commission (EC) could potentially use to incentivize third countries to reduce GHG emissions. The BCA would consist in adding levy on top of import tariffs on good, based on product emission intensity benchmarks that reflect the necessary GHG emission pricing to reach the IPCC's 2°C pathway. This paper shows that this is the most effective method for incentivizing companies exporting to the EU to invest in low-carbon technologies. The success of its implementation depends on the EU's capacity to expand the BCA level to third countries so as to create a level-playing field for companies and citizens exposure to climate mitigation costs (climate coalition). The BCA's effectiveness however hinges on its design and the political context surrounding its implementation. The paper concludes by acknowledging that the BCA's highest effectiveness may lay in the simple threat of implementing it. If the EU were to implement a BCA, we recommend a progressive phase-in to avoid legal challenges and retaliatory measures by trade partners under WTO law.

1. Introduction

Amazonian wildfires, the US Democrat's Green New Deal, Greta Thunberg and the Friday school marches for climate: 2019 has produced a streak of memorable events orbiting the hot topic of climate change. Few were as disruptive for European policies as the yellow vest protests in France. The protests started in October 2018 as a reaction to a domestic consumption tax added on energy fuels. The French government retracted on the tax and the movement resulted in a large political crisis with pan-European ripple effects. The lack of acceptability of climate policies is now used by refractory governments throughout Europe to justify the reticence to effective climate policies.

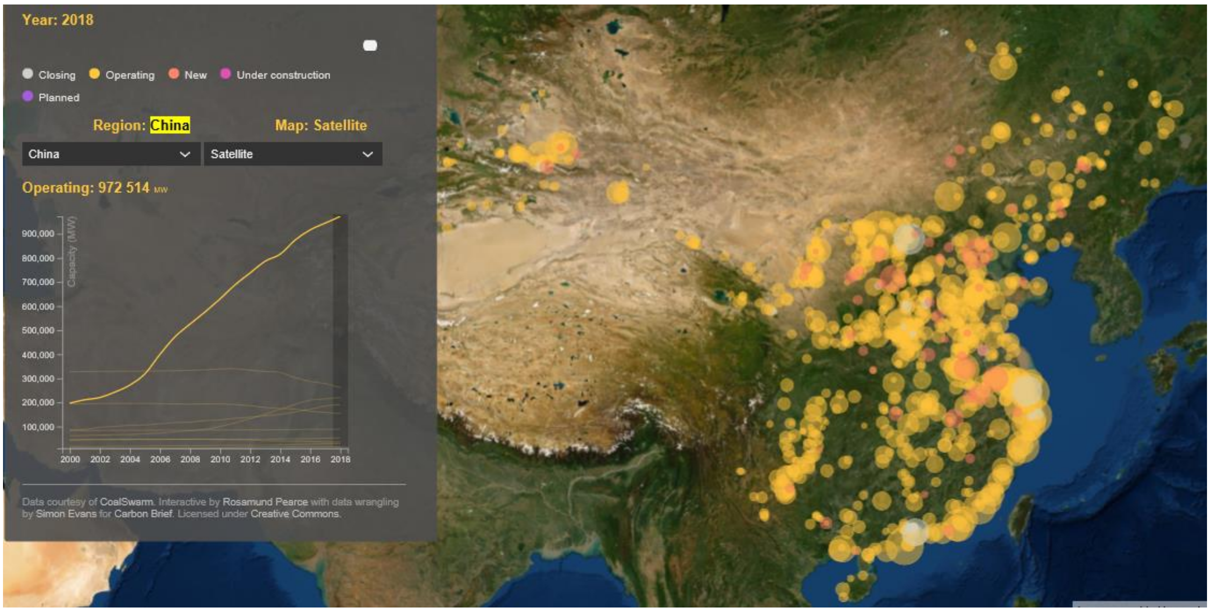
These tendencies are in sharp contrast with the physical reality of global warming. As of today, man-made climate change has led to a 1.0°C increase of global surface temperatures above pre-industrial levels[1]. Current nationally stated mitigation ambitions submitted under the Paris Agreement (PA) would overshoot both the 1.5°C and the 2°C targets. In contrast to its perceived leading role, the EU is on not track both in ambition[2] and delivery: According to Climate Action Tracker[3], the EU's Nationally Determined Contribution (NDC) to the PA are not consistent with holding warming below 2°C, "let alone with the Paris Agreement's stronger 1.5°C limit".

Even if the EU were on track, its emission savings would have a low incidence on global GHG emission reduction – the EU produces merely 10% of the world's total emissions. For good measure, the global gap between the pledges and the PA targets would range between 15 to 19GtCO_2 to reach the 2°C - that is 4.28 to 5.4 times the EU's total emissions[4]. On top of that, its emissions are and will not be able to absorb the worldwide GHG emission increase by 3.301GtCO_2 between 2017 and 2040[5], let alone put the world's total emission trajectory on a 2°C-compatible course. For example, coal capacity in China alone has quintupled to 972

[1] IPCC (2018)
[2] As acknowledged by Ursula Von Der Leyen, European Commission President, in her mission letter to Frans Timmermans, Executive Vice-President for the European Green Deal.
[3] Climate Action Tracker (2019)
[4] The EU's 2017 emissions was 3.5Gt CO2 in 2017
[5] IEA New Policies Scenario, which reflects the current policy commitments

Gigawatt (GW) from 2000 to now (see graph below). As a comparison, the EU has installed 265GW of wind and solar capacity in the same period[6]. Given that emissions are rising elsewhere, and the share of EU emissions in overall global emissions is declining[7], the cost of cutting carbon is even higher for the EU.

Graph 1: Chinese coal capacity



Source: https://www.carbonbrief.org/mapped-worlds-coal-power-plants

While the EU cannot take this fight alone, it is unclear how the EU can justify further efforts and costs towards its constituencies while the rest of the world is lagging. This embodies the free-rider problem in global climate action coined by William Nordhaus. The less leverage EU's climate effort has in the overall CO_2 reduction balance, the more costly – both financially and in terms of political capital – EU climate action becomes. The overarching question is therefore: How can the EU punch above its weight and incentivize other countries for increased emission reductions while not being in control of other jurisdiction's climate ambitions?

[6] European Commission: Statistical pocketbook 2019
[7] IEA World Energy Outlook (2018)

Border carbon adjustments (BCA) are discussed in literature as a resolution to Nordhaus' dilemma. BCAs can be defined as any type of (additional) import levy at the EU border imposed on goods imported into to the EU from third countries. We can identify three *raisons d'être* of BCAs: (1) reduce carbon leakage, (2) address domestic concerns about the loss of competitiveness and (3) leverage other countries' participation in climate agreements. They are primarily discussed in the context of carbon leakage. The proposal gained in prominence in EU politics – Ursula Von Der Leyen, then President-elect of the European Commission, stated that she will introduce a carbon border tax to avoid carbon leakage "(…) to ensure our companies can compete on a level-playing field"[8]. As this paper will argue, there is however a strong misperception in the dimension, scale and scope of carbon leakage. The proposed design of BCAs is therefore flawed. However, BCAs *can* be a suitable instrument to incentivize third countries to adjust their ambitions, leading to emission savings on a global level. A side effect of shifting the burden of climate action to third countries is that it might increase acceptability in EU countries for climate change policies. Many Europeans support climate action[9] but there is large gap between climate action and paying the cost.

This approach however comes with substantial caveats with respect to design, political feasibility and economical impact. We explore this approach within the framework of climate action trilemma – the EU must choose between acceptability, effectiveness and disruptiveness of its climate action.

Aim of this article is to provide background and optionality for political decision-makers. Several options are distilled and assessed according to political feasibility, complexity and

[8] President-elect of the European Commission Ursula Von der Leyen, address to the European Parliament Reference. Full quote: *It means change. All of us and every sector will have to contribute, from aviation to maritime transport to the way each and everyone of us travels and lives. Emissions must have a price that changes our behaviour. To complement this work, and to ensure our companies can compete on a level-playing field, I will introduce a Carbon Border Tax to avoid carbon leakage.*

[9] According to the European Commission, "92% of respondents – and more than eight in ten in each Member State – agree that greenhouse gas emissions should be reduced to a minimum while offsetting the remaining emissions, in order to make the EU economy climate-neutral by 2050". European Commission: Special Eurobarometer, p.4.

effectivity. These dimensions will transcend the question of a workable design of the BCA. The novelty of this article is that bridges the gap between two opposed poles of BCAs: the need for ambitious climate action versus real-life workability of the intended BCA design. Another eclectic approach is to target companies instead of states via a carbon import tariff (BCA). This delegates the responsibility directly to companies, instead of taking the detour via government incentives. This approach however creates a whole new range of challenges.

We identify three conditions for how to make BCAs work:

- Policy should provide incentives for foreign firms to adopt less carbon-intensive technologies;
- The policy must adhere enough to WTO rules so that governments and firms that it would withstand a trade dispute case;
- Policy must be supported by domestic and foreign firms.

Chapter 2 will clarify underpinning assumptions. Chapter 3 will explore the optimal design of BCAs under climate constraints. Chapter 4 will stress-test the proposed design with economic, political and legal conditions. The result will form an in-depth and data-driven assessment of a policy measure that addresses the heart of the climate change trilemma. Therefore, we will look at the following detailed questions:

- How effective are BCA s to cut GHG emissions?
- How disruptive are BCAs for international (trade) relations and can the EU spur the creation of climate clubs?
- How acceptable climate action measures are for population/civil society? This begs the question how these repercussions are cushioned and at which governance level. Civil society and public opinion play a great role in that respect.

2. Problem statement

For the purpose of this paper it is important to follow-through the original logic of BCAs. This section will look at three different dimensions of the inception problem: (1) the climate action trilemma, (2) what the 2°C pathway means and (3) the limits of the carbon leakage approach.

2.1. The climate action trilemma

William Nordhaus provides the theoretical backdrop for global climate action[10]. In his work he describes the naturally strong incentive to for states to free-ride on the climate mitigation efforts of others. A key assumption is that GHG pricing on a global scale is politically elusive. He then distillates the concept of climate clubs. They are defined by an agreement by participating countries to undertake harmonized emissions reductions – neutralizing any potential distortion of competitiveness between them. In this level-playing field, cooperation is rewarded if the club incorporates more members. The bigger the club, the less incentive there is for countries to free-ride as they face the threat of being excluded from the club or penalized by non-compliance. Nordhaus identifies four main benefits of so-called climate clubs[11]:

1. There is a public-good type resource that can be shared – in this case a stabilized climate;
2. The cooperative arrangements, including the dues, is beneficial for each of the members;
3. Non-members can be excluded or penalized at relatively low cost to members and
4. Membership is stable in the sense that no one wants to leave.

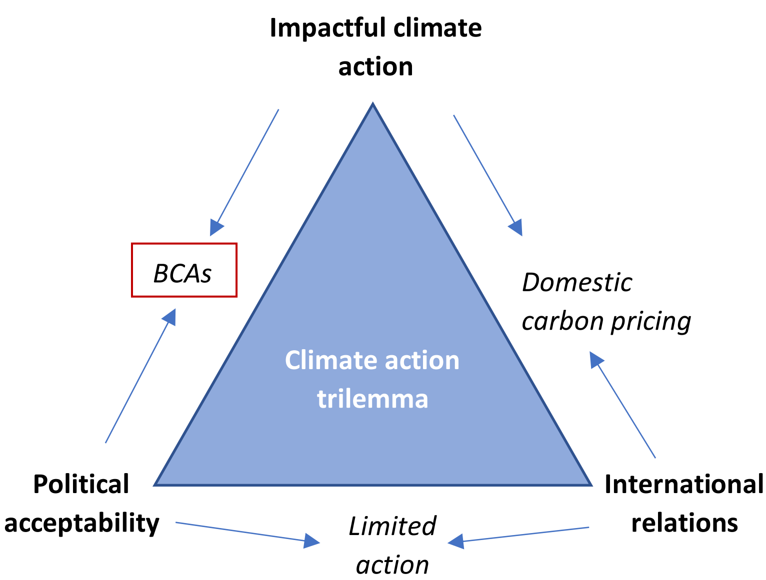
We can isolate three dimensions from Nordhaus' climate club theorem: (1) finding a way to abate GHG emissions (the *raison d'être* of climate clubs), (2) the cost of non-compliance (penalties for non-members) and (3) the cost of the climate club. This dimension is addressed by Nordhaus as cost for the country as opposed to welfare benefits. These are positive in his model but stretched out in time. Hence, a key dilemma is that generations that pay the price for climate action now might not see the full welfare benefit of acting. In order to reduce the costs of unilateral climate action, the EU has a strong incentive to enlarge its climate club, i.e. project its climate ambitions by raising the cost for non-participants.

Without sanctions against non-participants in international agreements there are no stable coalitions other than those with minimal abatement. Hence, the PA can hardly be considered

[10] Nordhaus (2015)
[11] Nordhaus (2015), p. 1340

as climate club – non participation is not sanctioned, exiting the agreement is relatively easy (e.g. the US' withdrawal) and the commitments do not add up to sufficient climate action to stay on the 2°C pathway. The PA suffers from the absence of an effective enforcement arm and its reliance on its Parties' good will to implement the commitments. By contrast, we can consider the EU as a climate club. It sets out a regime with trade penalties on non-participants and induce a large, stable coalition with high levels of abatement. The EU crafts a remarkable set of climate action rules, enforced by a robust legal framework and underpinned by a sophisticated discourse that transcends multiple/supranational, national and regional[12] governance levels. Yet, imposing these set of rules to other countries might disrupt trade relations and aggravate the cost of action by further cutting into the EU's welfare.

Does the EU have the clout to exert sufficient pressure on other countries to expand its climate club? If so, it would have to act within the trilemma underpinned by the three dimensions above: (1) Impactful climate policy (2) minimal impact on international welfare (3) ensure political acceptability of climate policies at home.



12 See the array of EU regional climate and environment funding.

The climate trilemma postulates that climate action always come with a trade-off.

(1) The EU cannot prioritize impactful climate action and maintaining good international relations (status quo), as this would expose its businesses to climate action costs and reduce acceptability.

(2) It could avoid disrupting international relations and ensure political acceptability of its actions, but only by reducing the scope and impact of climate action, resulting into insufficient GHG emission reductions.

(3) Finally, the EU could boost climate action and ensure political acceptability by shifting costs to third countries, but not without disrupting international relations by forcibly imposing to share the cost of climate action.

There is a clear incentive for the EU to spread the costs of climate action: Böhringer et al. (2012) reveal that the overall costs of achieving an approximately 10% emission reduction by the coalition countries are relatively modest (up to 0.6% GDP loss)[13]. With uniform emissions pricing only, acting countries carry a substantially higher burden, as opposed to non-acting countries. By contrast, BCAs split the burden sharing almost equally between acting and non-acting countries (in terms of their GDP losses)[14].

2.2. Fixing the GHG emission bill: embedded carbon and emission responsibility

BCAs require to take a different view on emissions. For now, inventories only account for emissions that occur within the borders of a jurisdiction. There are significant limits to Europe's climate change mitigation action if one uses different metrics. In 2017, EU's annual emissions amounted to 3.5Gt CO_2. EU producers and consumers bear the cost of carbon, but solely for the domestic part of the value chain.

BCAs would shift the responsibility and cost for emissions. The international paradigm for GHG emission attribution is "the polluter pays". But this is not necessarily reflected in the way that GHG emissions are accounted for in the reality of global value chains. This opens the Pandora's box of responsibility for GHG emissions. So far international climate negotiations

[13] Böhringer et al. (2012), *The role of border carbon adjustment in unilateral climate policy*, p. 102
[14] Böhringer et al. (2012), *The role of border carbon adjustment in unilateral climate policy*, p. 99

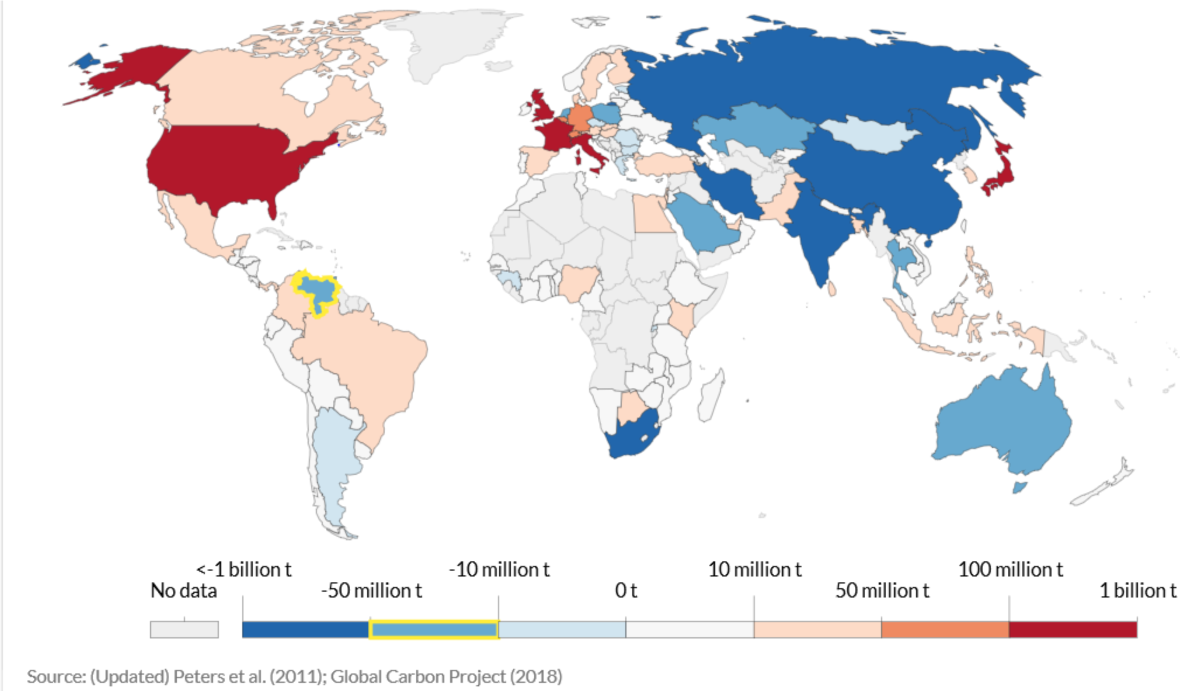
have focused on striking a balance between historic and current emissions. There is another responsibility nexus between producers and consumers. Who is responsible: the countries that directly emit CO2, or the countries that purchase goods associated with those CO2 emissions?

Accounting for imported emissions renders a more complete picture of the actual emissions associated with EU demand (covered both by domestic production and import of external goods)[15]. A good metric to reflect this phenomenon is to track consumption emissions. Those account for imported CO_2 from trade. By this metric, the EU is as a region a larger climate culprit. According to carbon brief, the carbon embedded in imported goods and services amounts to more than 30% of domestic emissions in Europe. In one extreme case, Switzerland's emissions are 209% higher (more than three times as large) once CO_2 imports are taken into account. While Switzerland is a comparatively small economy, a few EU member states are among the main GHG importers – UK, Italy, France, Germany and Belgium are among the top 8 net carbon importing nations. Under the full lifecycle accounting method[16] EU emissions have grown by 11% over the period 1995 to 2009. According to carbon brief, "even though domestic emissions have fallen 27% in the UK between 1990 and 2014", once CO_2 imports from trade are considered, this is equal to a mere 11% reduction.

Yet, this picture must be put into context. According to carbon brief, China and India have both seen dramatic increases in emissions since 1990 (…); their emissions are still mostly due to domestic consumption"[17]. Notably, CO_2 exports from China have decreased by around 25% from their peak in 2007, and "(…) some of this is due to growing imports of goods to China and India associated with an expanding middle class, which helps balance out CO_2 exports as internal production is absorbed by domestic consumption".

[15] Carbon Brief (2019)
[16] See Becqué (2018), p. 3
[17] Carbon brief: *China's production emissions have increased by 430%, while their consumption emissions have increased by a slightly lower 400%. Similarly, India's production emissions have increased by 349% and their consumption emissions by 319%.*

Graph 2: CO2 emissions embedded in trade, country balances



Data explanation: Carbon dioxide (CO_2) emissions embedded in trade, measured as the net import-export balance in tonnes of CO_2 peryear. Positive values (red) represent net importers of CO_2 (i.e. "100 million" would mean a country was a net importer of 100 million tonnes of CO_2 in a given year). Negative values (blue) represent net exporters of CO_2.

Moreover, in a globalized market with complex integrated supply chains, multiple polluters add emissions to a product as it moves along the supply (and value) chain. BCAs would be able to capture that dimension by reflecting the partial emissions addition by every economy along a product's value chain. This would increase the BCA's system perceived fairness. This approach has the benefit of being straightforward and reflecting a degree of control over emissions within borders, but also penalizes countries for emissions associated with goods that they do not consume domestically. All parts of the value chain have a different exposure to carbon pricing (or, in most cases, not at all), leading to unbalances in competitiveness – leading to carbon leakage.

2.3. The limits of the carbon leakage approach

From a global GHG emissions reduction perspective, the more carbon a country imports, the less its climate actions within its own jurisdiction make sense. Some of the hard-earned reductions in Europe have been offset by carbon imports from countries with a more intensive energy mix. The definition[18] of carbon leakage states that stricter domestic carbon taxes may reduce EU emissions but may shift them elsewhere as consumers switch suppliers. In large swaths of the literature carbon leakage is used as main rationale for BCA. There are however several reasons why this approach has a limit.

The first limit is conceptual. In its current EU ETS set-up, measures against carbon leakage are set up to address domestic concerns about the loss of competitiveness due to carbon pricing. Number of authors – and the European Commission – argue that BCAs should complement the EU ETS as to reinforce any carbon leakage. As the argument goes, BCAs would be used as a mean to keep industrial (energy-intensive) capacity in the EU and avoid that this capacity is shifted to non-abating economies.

The BCA would then be a counter-carbon leakage measure where production shifts back into abating country. That would degrade BCAs to a mere competitiveness tool. If adjusted to the ETS, such a BCA would price the import of goods into the EU based on a European price GHG price signal. Whether this send a clear price signal to external producers and incentivizes them to adjust the production methods is questionable. The EU ETS has been volatile (see graph 3) – giving low visibility for external producers, which limits the willingness to invest into more carbon-efficient production methods. Carbon pricing is only one cost component among many. Whether it can be absorbed by affected sectors depends strongly on other capital and operational expenditure factors, i.e. if international coke prices drop significantly, steel producers might be able to absorb carbon pricing more easily. It therefore only has a relative importance in the overall cost structure.

18 *Felder et al. (2007)*

Graph 3: Price evolution of EU ETS allowances, 2009 to 2019

Source: Sandbag, available at: https://sandbag.org.uk/carbon-price-viewer/

Moreover, it would not send a price signal to European producers to further improve their own emissions. Quite the opposite: It has been empirically proven that the ETS has for long struggled to project any meaningful carbon price. According to Condon, "EU Member States have instead tackled possible competitiveness loss of EU industries by granting free allowances to energy-intensive industries"[19].Therefore, there is missing evidence about the scale associated with carbon leakage. Not only was that effect limited, but also was the ETS specifically tweaked to avoid carbon leakages via multiple exemptions and adjustments mechanisms[20]. The effect of increased carbon intensity of sectoral carbon imports of an abating jurisdiction from a non-abating exporter are in the lower percentage (3%)[21] and within the statistical error margin. This is in line with other data. There is not much evidence that reductions over the past decade have been offset by outsourcing of manufacturing in most countries. A conclusion from that is that carbon leakage is less extended than expected.

Another argument against carbon leakage (see chapter 3) is the main emissions stock – both in absolute terms and in terms of growth rates - has not stemmed from industrial processes, but from the energy sector as shown in graph 8. Finally, by nature literature (this paper included)

19 Condon et al. (2013)
20 See de Bruyn, Sander (2016)
21 Aichel (2011), p. 24

is speculative and confined to modeled impact assessment. Most of it has to do with the fact that to date no BCA exists[22].

Carbon leakage has been the chief argument for protecting domestic industries by handing them out free allowances. Due to the likely double failure to project a meaningful carbon price – both externally and internally – the climate mitigation impact of an ETS-complementary BCA would be limited. BCAs should be used as a tool to reflect the true cost of externalities to spur technology change. Therefore, the chief reason for BTA must be reflecting the true cost of carbon, and not the impact of carbon pricing on competitiveness. If this is the case, another criterion must serve as benchmark. That has strong implications for the design of BCAs.

3. Chasing Greenhouse Gases: defining the benchmark for BCA levels

Literature has carved out 4 different taxes possible[23]: firm-specific border tax, border tax based on average foreign emissions or average domestic emissions, border tax based on best available domestic technology or worst available domestic technology. Instead of discussing each of these options, we will look at the empirical evidence for the GHG emissions stocks and then adapt the design of the BCA to capture these stocks.

This paper argues that well-designed and targeted BCAs can augment the GHG saving effects in third countries beyond carbon leakage. From the above analyses we can derive a few questions for the next chapter: what is a meaningful GHG price signal, how can the EU project the price signal and what is a critical threshold for the size of the climate club to reach full effectiveness of the BCA scheme?

22 Over the last decade it had been proposed by European and US legislators.
23 See Ismer and Neuhoff (2007)

3.1.Benchmarking

First, which is the most accurate metric to reflect a countries' emissions? To answer that, we must deconstruct the carbon emission flows and determine where the main carbon stocks are located.

We will include all GHG emissions. Policies and public discussions tend to focus on CO_2 emissions, but the global emissions gas cocktail is much more diverse. It includes carbon dioxide (CO_2), methane (CH4), nitrous oxide and fluorinated gases (F-gases). CO_2 represents the bulk of global emissions, stemming from fossil fuel, industrial processes and forestry and other land uses[24]. While focus on CO_2 is relevant, the climate effect of methane for example is 28 times more powerful than CO_2 on a 100- and 80 times more powerful over a 20-year scale. Hence, the relative effect (despite the smaller volumes) of other gases must be reflected in the calculations of BCAs.

Literature is abundant with proposals for the scope of BCAs. Wiers (2008) proposes country-wide metrics rather than carbon content, such as overall GHG emissions per capita or per unit of GD. By contrast, Böhringer identifies three different options[25]: (1) Uniform embedded carbon tariffs are applied to all unregulated countries, based on the average carbon content of the abating coalition, (2) Uniform embedded carbon tariffs are applied to all non-abating countries, based on the average carbon content of the non-coalition (importing) countries and (3) Tariffs are applied specific for each exporting country/region in the model, based on their carbon content. For the reasons outlined below, these proposals have their limits.

There are several ways of looking at emission origins[26].

24 For a full overview please visit EPA website, available at https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data
25 Böhringer et al. (2012), p. 6
26 Wiebe (2016), p. 6

Territorial vs. demand-based emissions: Which geographies would yield the biggest effect?

Territorial emissions are emissions associated with fuel purchases from any type of consumers within a jurisdiction. These emissions are allocated to the country where the fuel is purchased. By contrast, consumption-based emissions are allocated to the final domestic demand. This reflects GHG emitted along global production chains to the countries where the final product is consumed.

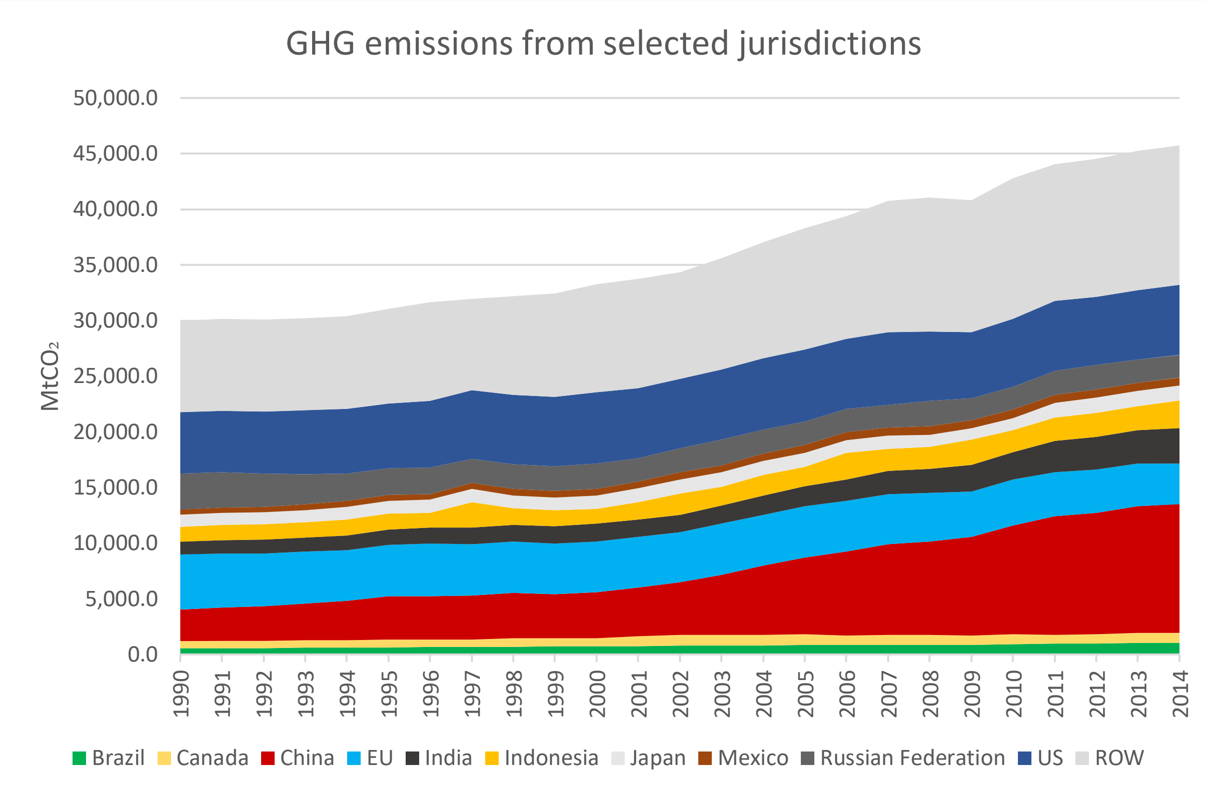
Since the goal is to focus on absolute emission reduction, addressing emissions per capita is not conducive at this stage. If we consider Böhringer's option (2) based on the average carbon content of the non-coalition countries, that would be counter-effective because the average carbon content of non-coalition countries lies significantly (close to 5 times) above the EU average (CO_2 equivalent/million $GDP, 2014). In effect this would lower the incentive for non-coalition countries to decrease their emissions and simply adjust to the average emission standard.

Territorial emissions

There is a significant variance when taking into account different metrics of territorial emissions. Since trade relations are established primarily between the EU and third countries, we will focus on national jurisdictions. The EU indeed concludes trade agreements with other blocks such as Mercosur, however these would not act as a legal personality in the case of a trade dispute since these blocks are not custom unions like the EU. Moreover, no other economic block has either the internal exclusive trade policy competence nor the climate legislative powers that the EU has. Therefore, we look at the relevant national jurisdictions.

For the BCA to be as effective as possible, we are looking at the most important emitters on a global scale. A basket of 10 jurisdictions (China, US, EU, India, Indonesia, Russia, Brazil, Japan, Canada and Mexico) covers 72% of the world's emissions. Targeting those is therefore effective. This basket is also representative: their emission growth has been equal to the emission growth rate of the rest of the world (both 65%). These are the jurisdictions the EU should try to coerce into its climate club if it aims to produce an impactful climate measure.

Graph 4: GHG emissions from selected countries

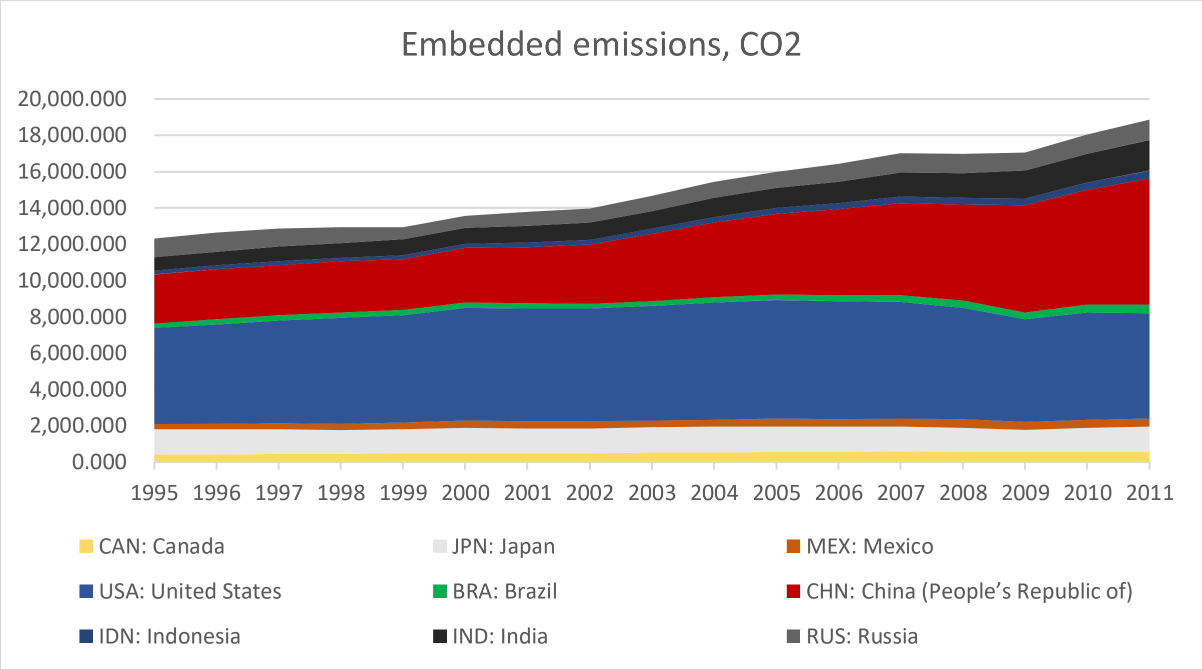


Source: climatewatchdata.org. Note: ROW = rest of the world.

Demand-based emissions

Böhringer's third option (tariffs are applied specific for each exporting country/region in the model, based on their carbon content) is the equivalent to consumption-based emissions. The following graph gives an overview over which jurisdictions export the most CO_2. On a global scale, CO_2 emissions embedded in international trade make up a significant stack of overall global emissions.

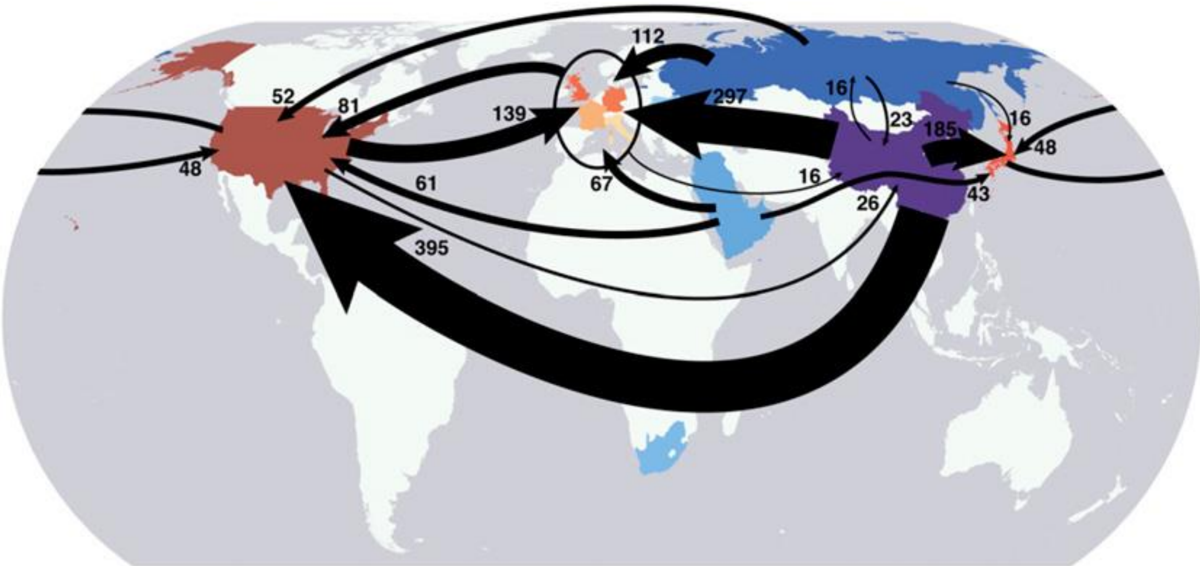
Graph 5: embedded CO2 emissions from selected jurisdictions



Source: OECD.Stat.: [*https://stats.oecd.org/Index.aspx?DataSetCode=IO_GHG_2015*](https://stats.oecd.org/Index.aspx?DataSetCode=IO_GHG_2015)

China and US represent the bulk of embodied emissions exports. This is also reflected in graph 6 below: both countries are responsible, with the EU, for the majority of carbon emission flows via international trade.

Graph 6: global flows of embedded CO2 emissions



Source: carbonbrief.org

The first advantage of the demand-based approach is that it avoids the politically delicate task of selecting some sectors, risking retaliation from impacted non-abating countries. The demand-based approach has another benefit. There is a covariance of the consumption-based and production-based accounting method: 8 out of the top 10 emitters in production terms are also the largest CO_2 exporters. While only exported emissions are in the grasp of BCAs, the leverage of influencing the GHG footprint from those entities could have repercussions on their domestic energy mix. The BCA could therefore act as a multiplier, with possible effects on domestic carbon intensity of the economy. Therefore, it would make sense to target the trade relationships with these countries.

3.2. Which trade relations can yield the biggest leveraging effect?

The EU is a global trade behemoth. With over 20% of global gross domestic product (GDP), the EU is the world's largest economical entity[27]. In 2018, the share of EU in World Trade was 15.2%, in second position after the US (17%). Trade is accounting for EUR 2 791 billion of exports and EUR 2 578 billion of imports in goods and services[28]. In 2018, the 9 countries we selected in our basket of top emitters accounted for 53% of all global imports into the EU. From a transaction cost standpoint, this is exceptional – only 9 countries account for more than half of exports to the EU. If one adds the next 8 exporters to the EU (European non-EU28 countries[29], Algeria, Libya, South Africa, South Korea, Taiwan, Saudi Arabia, Australia), this group accounts for 87.1% of exports to the EU. Were the success of BCA to depend only on the size of the climate club, such a narrow circle of countries could be tremendously effective. The next step is to measure the trade intensity of the EU with these countries. Only a significant trade relation can create the leverage the EU needs to nudge change in those countries.

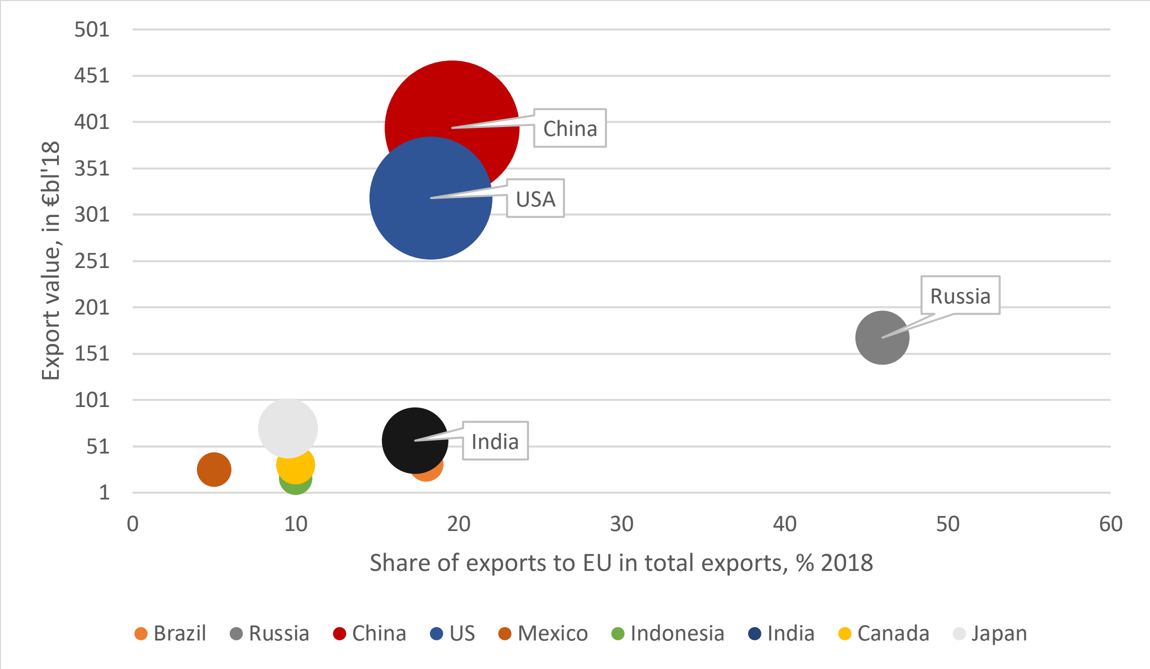
Important selection criteria here are:

- Trade intensity (volumes);
- Non-abating country reliance on EU (% share of overall trade volumes);
- Volumes of embedded GHG emissions

The next step is to determine how dependent those countries are on the EU importing their products. The selection of top emitters is relatively dependent on trade with the EU as they have an average exposure of 15% of their trade value to the EU.

27 European Parliament (2019)
28 See above.
29 On which the EU can potentially exert influence as a regional heavyweight

Graph 7: trade intensity of selected jurisdictions with the EU



Source: climatewatchdata.org, European Commission Trade webpage available at: https://ec.europa.eu/trade/policy/countries-and-regions/countries/china/ ; own calculations. Note: the size of the bubble shows the volume of embedded emissions in the overall trade of the respective country.

This paper assumes that the higher the trade intensity with the EU is, the higher the propensity of the specific country to defend its market share in trade with the EU. From that, we assume a higher willingness of highly exposed countries to comply with or accept paying a BCA premium for their exports. Looking at the above graph, the optimum case for the EU would be countries in the top right corner: high dependence on the EU on trade, and high volumes of embedded GHG emissions. We can see that US and China are the most impactful candidates. Russia is in a position of high dependence on the EU and has a substantial amount of embedded emissions. The lower left corner sports a range of smaller non-abating countries; however, Brazil and India stand out as they are more dependent on the EU.

A potential challenge to this approach lays in the degree of substitutability of the EU as a central trading partner. Depending on which goods are exported to the EU, markets could react to the BCA by doing the following:

(1) decreasing production capacity of the product or sector (high dependency on the EU as export market, low capability to cope with the BCA price),

(2) adjustment of emission intensity of the sector (high dependency on the EU as export market, high capability to cope with the BCA price),

(3) domestic absorption or export to another non-abating country of the production capacity (low dependency on the EU as export market, low capability to cope with the BCA price),

(4) reduction of export to the EU (low dependency on the EU as export market, high capability to cope with the BCA price),

This matrix demonstrates that it is key for the design of the BCA to target a BCA price level that hits point (2). A lower effect would make it difficult to argue in favor of potential political and trade disruption cost. Other factors must be considered as well. By default, the EU has the biggest leverage for goods where there is (a) low capacity of the non-abating jurisdiction to absorb substantial trade volumes, (b) low demand in other non-abating jurisdictions and (c) sustained demand in EU willing to accept the increased import price. This depends on the type of goods, how complex and whether domestic demand high and fast enough to keep with production volumes. The modelling of these sensitivities goes beyond the scope of this paper.

3.3. Carbon intensity of sector vs product-based approach

Further deconstructing the origin of the emissions allows us to sharpen even more the BCA design. Other metrics however can provide greater insight. Two options exist: should BCAs be based on a product-by-product basis or only wholesale across all products from a given country?

Böhringer et al. distinguish between 3 possibilities[30]: (1) the tariff is levied on direct (fuel) emissions, only, (2) the tariff is levied on direct (fuel) emissions plus indirect emissions from electricity and (3) the tariff is levied on the total embedded carbon. Direct emissions arising during the industrial manufacturing process from combusting fossil fuels. According to the IPCC, in particular producing cement, chemicals, and non-ferrous metals leads to the inevitable release of significant 'process emissions' regardless of energy supply[31]. Indirect emissions include emissions relating to the purchase of electricity generated from fossil fuel use. Finally,

30 Böhringer (2012), p. 5

31 See IPCC (2014), p. 745

the tariff levied on total embedded carbon would additionally include transport emissions to freight the good to the final customer.

Total embedded carbon would reflect the total emissions of a product. Moreover, it is indiscriminate: irrespective of where a good is produced, the climate footprint of the good is taken as a measure for its import cost to the EU. Yet, reflecting this is challenging. The below Sankey diagram shows the complexity of tracking the emission stream throughout the whole manufacturing process of a good.

Graph 8: schematic energy inputs into good production process

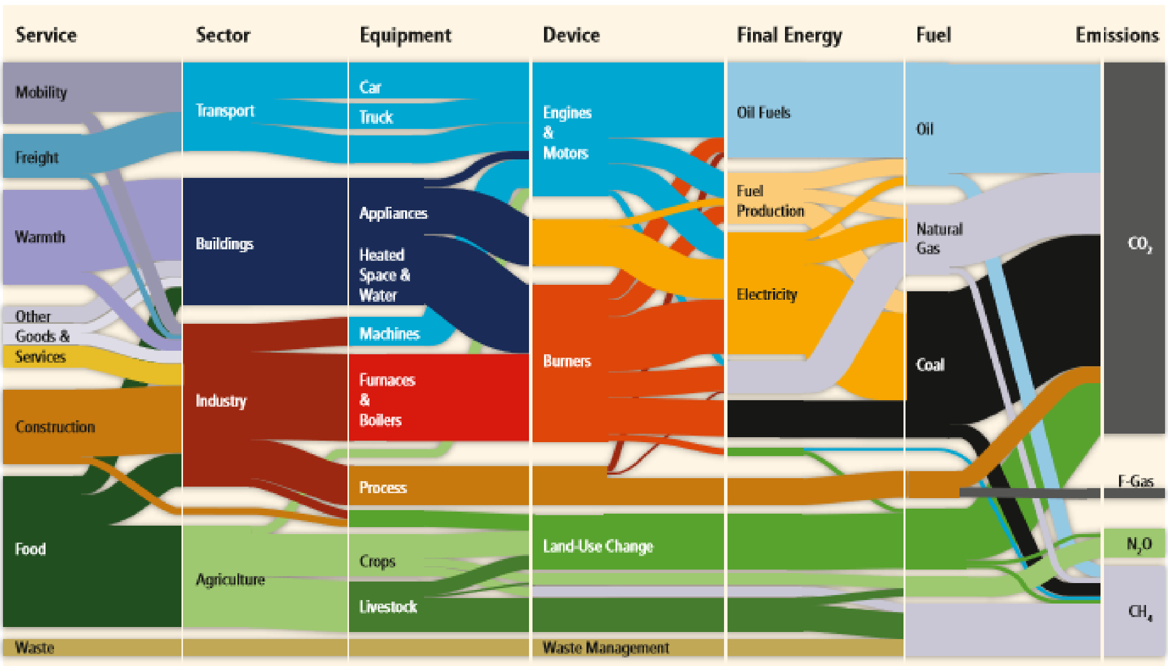
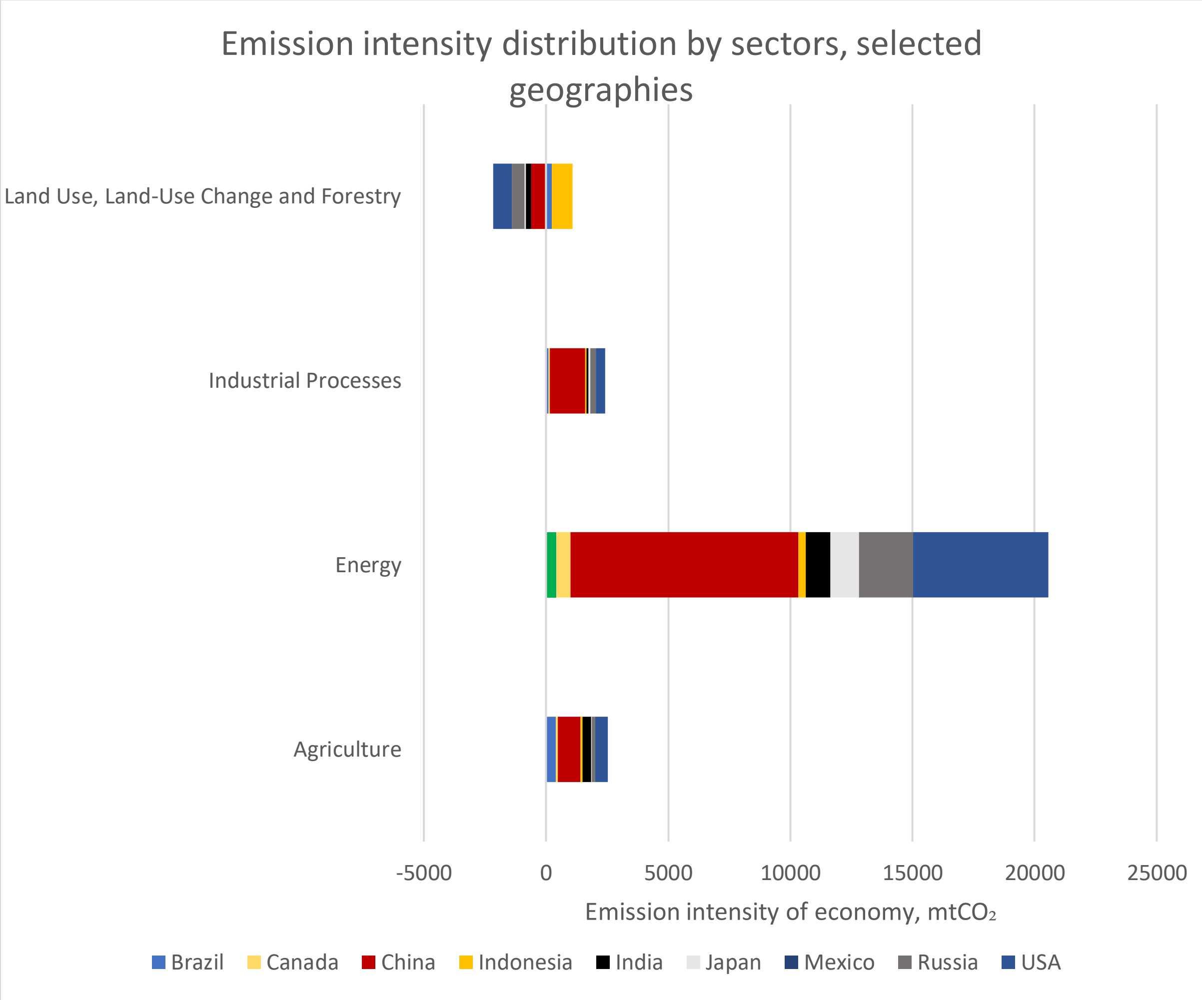


Figure 10.1 | A Sankey diagram showing the system boundaries of the industry sector and demonstrating how global anthropogenic emissions in 2010 arose from the chain of technologies and systems required to deliver final services triggered by human demand. The width of each line is proportional to GHG emissions released, and the sum of these widths along any vertical slice through the diagram is the same, representing all emissions in 2010 (Bajželj et al., 2013).

Source: IPCC

The fairest solution would be to look at product-specific embedded emissions. This begs the question: on a product level, how much is (1) direct fuel emission intensity, (2) electricity emission intensity and (3) transport emissions? Every good will have a different blend of these energy inputs depending on its peculiar characteristics, and the emission intensity distribution in the countries it is processed. Decomposing the emissions in the sectors allows us to have a more detailed look at how emissions are constituted in a specific economic entity. The below chart evidences that energy is the sector conveying the most absolute carbon emissions.

Graph 9: Emission intensity distribution by sectors, selected geographies

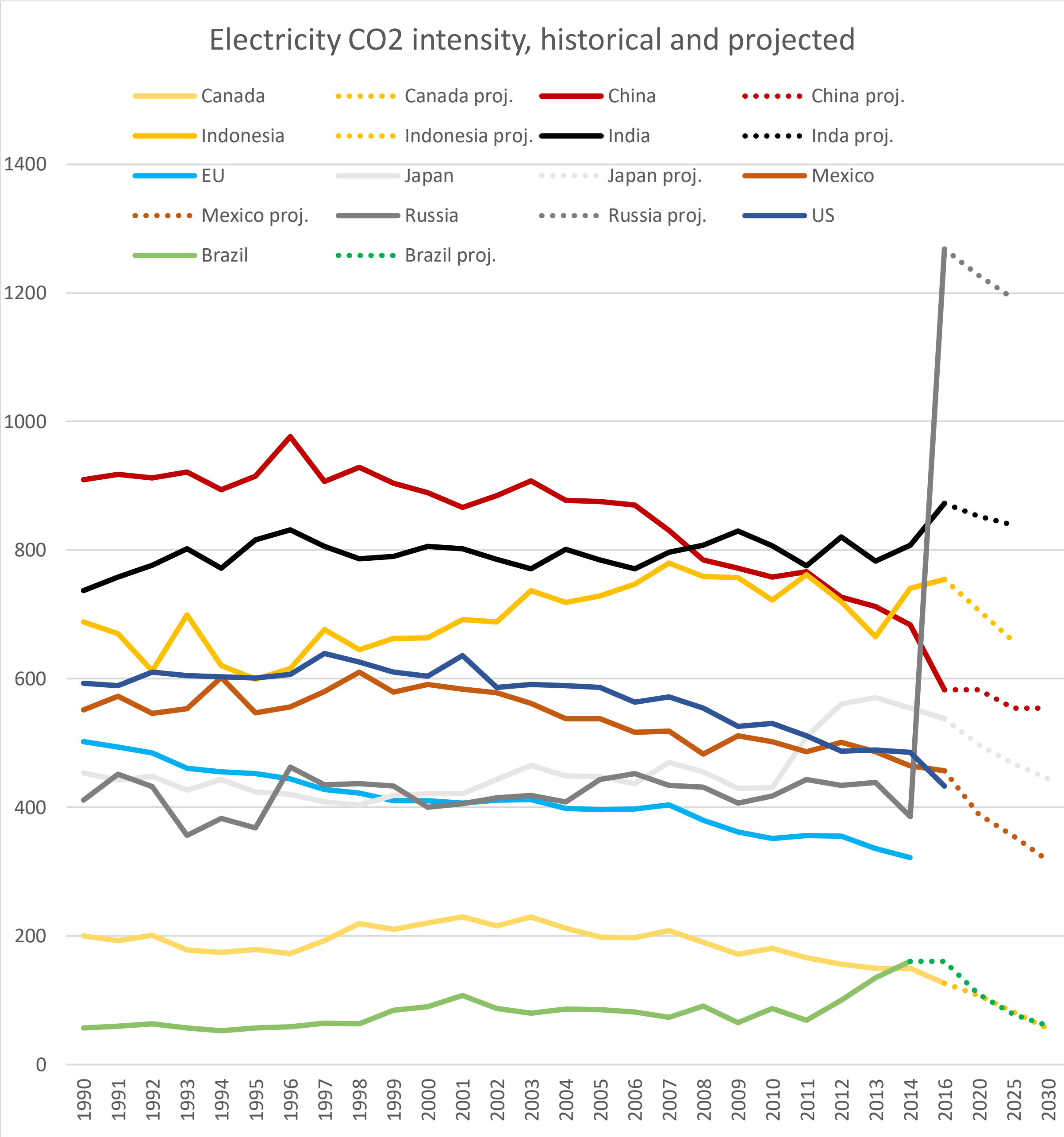


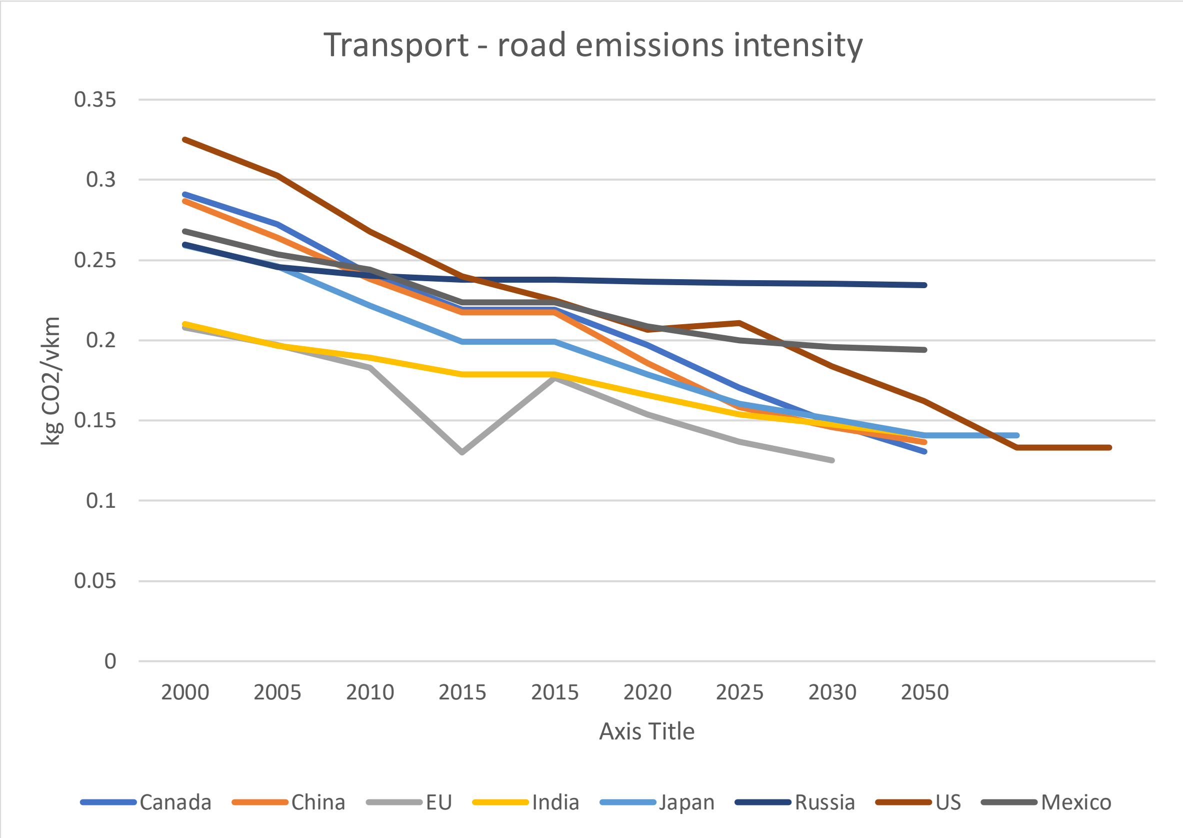
Source: climateaction.org. Note: Data on agriculture for Brazil (2012), India (2000) and China (2005) is not up to date.

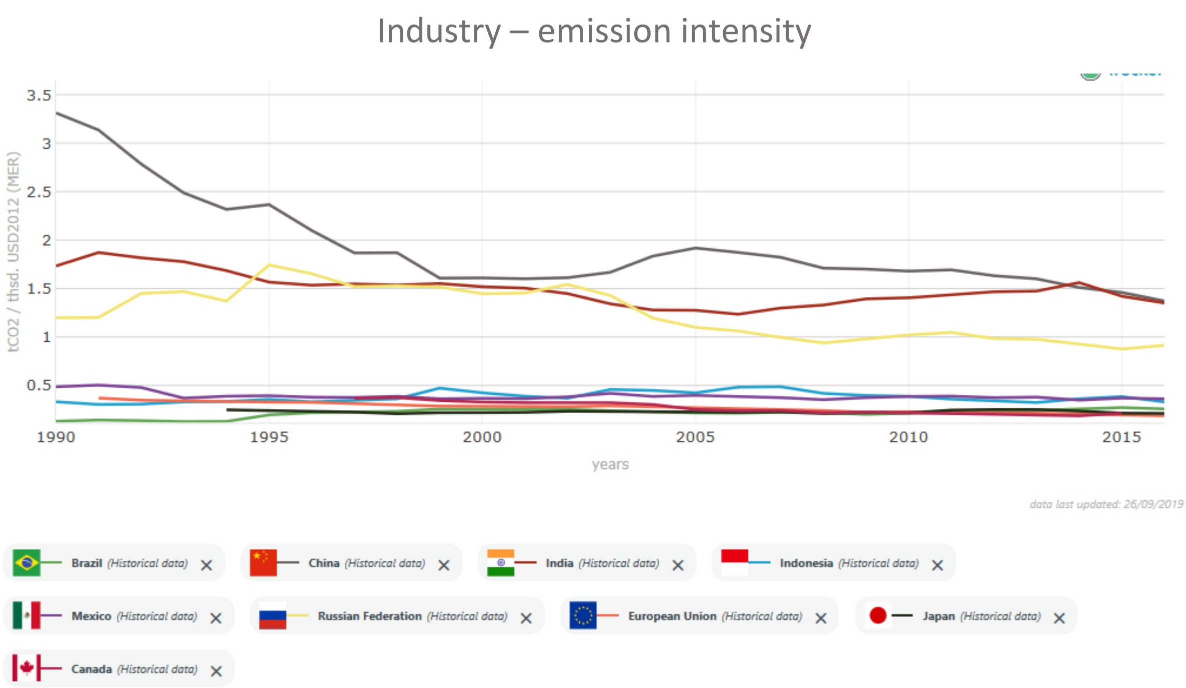
Energy includes the transport, electricity and heat generation as well as buildings. Of those, we can exclude heating for buildings as these are immobile stocks. What is relevant is the power generation mix, emissions from transport sector, emissions from industrial processes and agriculture.

The production and processing of goods is inherently carbon-intensive due to the reliance on the energy inputs represented above. Efficient economic allocation reflecting the externality of GHG emissions would allocate production to countries with (1) low-carbon production processes, (2) low electricity carbon intensity and (3) low-carbon means of transport.

Graphs 10 to 12: Emission intensity distribution by GHG emission sectors, selected geographies







Source for all above graphs: climate action tracker

We can extract three learnings from the decomposed analysis of non-abating countries' emission intensities. First, carbon intensity differs significantly from one country and one sector to another. Emission intensities converge in the transport sector (as each economy has equally low absolute transport electrification rates) but differ substantially in the electricity and industry sector. Second, since transport emissions converge, there is little incentive to impose a BCA on transport emissions[32]. Third and most importantly, this leads us to the conclusion that the GHG content of goods from these countries will be most heavily impacted by the electricity mix and the fossil fuels used in the manufacturing process.

If we now factor in the right cost of GHG emissions into the emission distribution in the value chain of a product, we get an idea on what would be a fair and effective BCA.

3.4. Benchmarking the right GHG standard?

Which GHG emission price level reflects the true cost of emissions? The obvious way is to peg the price of GHG emission to the 2°C emission pathway, if not the 1.5°C pathway. Carbon pricing schemes cover only a fifth of global emissions, and only 1% of emissions subject to carbon schemes face a price as high as $40 per ton of carbon dioxide. The range deemed necessary to limit warming to no more than 1.5C is 40-80$ according to the World Bank-backed committee chaired by Joseph Stiglitz[33]. For good measure, that is a delta of €20 to €47 compared to the current EU ETS allowances. Thus, the EU itself is far off this benchmark, and ETS does not even cover all sectors, on top of a multitude of loopholes.

Monjon et al. (2011) propose that, instead of a world average BAT, which would be difficult to determine, the "BAT standard could be based on the recently defined EU product-specific benchmarks"[34]. These benchmarks were established by the European Commission in order to

[32] Including transport emissions might prove difficult to implement due to coverage for those regions already existing. See method on biofuels from the commission. However, as chapter 4 will show, this method might be very difficult to defend in front an WTO Appellate Body as it discriminates a product on the basis of the country of origin. Moreover, schemes for the reduction of emissions from shipping and aviation already exist.

[33] High-Level Commission on Carbon Prices (2017), Report of the High-Level Commission on Carbon Prices. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO

[34] Monjon and Quirion (2011)

determine the appropriate amount of free allowances in the EU ETS. They are based on a value reflecting the average GHGs emissions performance of the 10% best-performing installations in the European Union. However, this might turn out not to be effective. First, EU installations would serve as a standard whereas it would be incredibly cumbersome to define a standard for each production process. Second, it would be far from guaranteed that the EU has the most advanced processes and cleanest energy mix. That is why we exclude also Böhringer et al.'s proposal to base the BCA on the average carbon content of the abating coalition.

Böhringer et al. emphasize the importance to set an incentive for tech improvement[35]. To do so, we need to understand how responsive companies are to incentives. These incentives should spur investments into new low-carbon technologies and gauge demand for renewable energy in the electricity mix.

Different economic agents from different sectors show different investment behaviors. In a study, Demailly and Quirion[36] find that a USD 15/tCO_2 tax a particular set of countries would result in a 20% leakage rate in the cement industry. Notwithstanding, the picture would be different in another sector: exposed to the same carbon price, the copper industry was unresponsive owing to the fact that adjustments in the copper industry are constrained by infrastructure requirements and institutional factors.

Therefore, the level of GHG pricing should be high enough to set a real incentive. If carbon prices are used as an indicator, they should be used taking into account individual decisions of economic agents. It is known that companies factor in scenarios assuming a carbon price of 50$/t$CO_2$ or more in the valuation of their assets. What drives a company to invest into alternative processes/energy sources and what is their threshold? This is difficult to determine as it varies from one company to another.

However, when factoring third country's emission intensity, the BCA level could also consider the investment threshold of the specific company exporting the good. Macroeconomics must

35 Böhringer (2012)

36 See Demailly et al. (2008), p. 337

be supplemented by behavioral studies microeconomics of companies, reflecting investment patterns and propensity to switch to low-carbon technologies. There are two ways to look at this problem. The first is that renewable technologies require high capital investments, adoption rates are low, transaction costs are high, and entry costs to the market to create sizeable hurdles. In some industries – deemed hard-to-abate sectors – the threshold of changing methods of production is high. The other viewpoint is that renewables (especially wind and solar) experience unprecedented cost reduction rates. Solar is projected to further reduce costs by 15 to 35% by 2024[37]. Moreover, a wide range of financial instruments and business cases exist to accommodate investment opportunities for companies:

- Adapting to cleaner processes for manufacturing
- Contracting renewable capacity
- Voluntarily contracting carbon allowance
- On-site power generation
- Transport: contracting cleaner forms of transport, but limited in international trade

According to Böhringer, region-specific tariffs on all products based on direct plus electricity emissions are the most cost-efficient emissions[38]. Our analysis confirms that option. Moreover, efficiency of the BCA scheme is improving if imposing carbon tariffs on all products, not just energy-intensive and trade-exposed. This is reflected in other studies as well. Monjon and Quirion evaluate the efficiency of various border adjustment designs in limiting carbon leakage and concluded that a full border adjustment, including both exports and imports, was the most economically efficient and reduced total global emissions[39]. Equally, Holland[40] argues that emissions-intensity standards are a better method for regulating carbon and can yield higher welfare[41].

The above conclusions come with necessary trade-offs. Tariff rate differentiation can either raise or reduce legal costs but increases border bureaucracy. When embedded carbon coverage

[37] IEA (2019)
[38] Böhringer et al. (2012), p. 23
[39] See Monjon and Quirion (2011)
[40] Defined as trading to another block
[41] Holland (2009)

is high, legal risk of generating bureaucracy on the border will be high, on the other hand, higher tariffs would be politically more effective as coercion tactics to join the coalition and as means toto satisfy domestic industries. More complex and detailed systems tend to create more efficient outcomes. This leads to the conclusion that BCAs should cover as much as possible of the embedded carbon content and covering more goods is important in efficiency terms.

4. Making BCAs work in the real world

The above findings need to be tested with the existing legal frameworks and the dynamics of international trade relations.

4.1. WTO compliance

The features of the BCA design (coverage, level of adjustment, etc.) are a function of WTO compatibility, feasibility, and political acceptability[42]. This goes beyond compliance. Political feasibility and low international trade disruption should be at the centerpiece of any BCA design. Moreover, in practical terms, analyses of BCAs must anticipate the ramifications of any potential WTO retaliation measures that might come up. Flannery recommends that WTO develops design approaches to reconcile international trade[43], yet this paper argues that this might be a cumbersome process – the BCA will have to adjust to WTO law. This begs the questions: In a world of politically motivated trade disruptions/trade war, is implementing BCA timely or just adding oil to the fire? Does WTO law allow BCAs to be implemented? And which institution is best-placed to address these concerns?

4.1.1. Legal basis

The EU enjoys exclusive competence on the block’s trade policy. According to the TFEU, this includes right to changes in tariff rates[44]. The Treaties also confer (a less extensive) competence

42 Böhringer (2012), p. 16
43 See Flannery (2016)
44 Art. 207 par. 1 TFEU

to the EU in terms of climate negotiation[45]. Therefore, we assume that the EU would have the competence to design a mechanism akin to a BCA. That competence was allocated to the European Commission for a type of BCA: the ETS (Directive 2009/29/EC) empowers the Commission[46] to include in the ETS importers of products which are produced by the sectors or subsectors at risk of carbon leakage. The Commission never used this clause. At the same time, any measure must conform to the principles of the United Nations Framework Convention on Climate Change (UNFCCC). BCAs also need to be in conformity with the international obligations of the Community, including the obligations under the WTO agreement.

4.1.2. GATT provisions and possible exceptions

By default, two GATT provisions would be violated: most-favored national principle (art. I GATT) and the national treatment principle. Article III:4 GATT prohibits a less favorable treatment of imported goods with regard to laws, regulations and requirements affecting their sale, purchase, transportation, distribution, or use. In addition, article III:2 GATT precludes any internal charges or taxes to like domestic products. According to Kaufman et al., the BCA must not discriminate based on the origin of a product but based on the level of the emissions control programme applied to it[47]. Thus, article III:2 GATT would apply. Is BCA an internal charge? In other words, are domestic economic agents exposed to the same charges as are external ones? This creates a dilemma. As explained above, the ETS is not sufficiently high to project a carbon cost to what would be necessary to achieve the 2°C threshold. On the other hand, not harmonizing the BCA with the ETS would put the EU at high risk of being challenged by retaliatory tariffs under WTO law. If the BCA is to deviate from the ETS, then the EU would have to seek exceptions to article III:2 GATT. Art. XX GATT features two clauses that may justify exceptions in the case of any form carbon tariffs.

45 Art. 191 par. 4 TFEU
46 Art. 10 (1) (b) of Emission Trading Directive
47 WTO DSB, US Shrimp (1997)

Protection of human, animal or plant life, or health

Article XX(b) makes exceptions for measures that are necessary to protect human, animal or plant life, or health. Wiers concludes that the exception must be found to contribute to its stated goal of reducing the impacts of climate change[48]. The legal grounds applied to BCA in this case are at best faltering. Wiers refers to AB US-Shrimp decision where the AB had acknowledged the loss of biodiversity as a justifiable ground, ruling that "relating to" implies a rational connection between a measure and the conservation of exhaustible natural resources". It is questionable whether the intent of the provision would be to target the depletion of *quality* rather than the depletion of mere *quantity* of natural resources. In addition, it is difficult to argue in favor of climate as an exhaustible resource – not only because of its changing nature, but also because of the multifactorial reasons for climate change induced weather effect, where the magnitude of climate change impact and thereby the proof of causality is difficult to establish[49]. Moreover, there would be other, less restrictive measures to counter the loss of biodiversity. Besides, most loss of biodiversity would take place outside of the EU, so the court would challenge the grounds on which EU would protect diversity in other jurisdictions. One other problem is that loss of biodiversity might not be clearly attributable to climate change – or at least difficult to prove a direct line of causality and an immediately perceptible change in a reasonably foreseeable time period. Health could provide a safer legal ground but could end up running into similar issue when proving causalities.

Preservation of exhaustible resources

Article XX(g) allows exceptions for trade measures that are related to the conservation of exhaustible natural resources and are made effective in conjunction with restrictions on domestic production or consumption. Can climate be defined as such an exhaustible resource? It appears as a complex question, however jurisprudence has been forward-leaning. Previous

48 Wiers (2008)

49 It is difficult to pin single events on higher concentrations of CO_2 in the atmosphere but climate scientists are clear that more extreme weather events are linked to human-induced emissions.

panels have ruled clean air as an exhaustible natural resource[50]. And climate change affects other natural resources. As Kaufman[51] notes, the environmental or health policy choices made by governments have never been questioned by the Appellate Body or a Panel. According to Kaufman et al. it is therefore more likely that a justification for carbon-related measures would be sought under Article XX(g) GATT[52].

4.1.3. Necessity and proportionality tests

Article XX GATT[53] justifies a violation of the GATT based on legitimate non-trade policy goals, provided that such interests are adequately balanced against the objective of free trade.

Necessity test

In Korea–Various Measures on Beef[54], the Appellate Body (AB) looked at three necessity criteria: (1) "relative importance of the common interests or values that the law […] is intended to protect," (2) the "contribution of the measure to the realization of the end pursued" and (3) the impact of the measure on trade. According to the AB "[t]he more vital or important those common interests or values are, the easier it would be to accept as "necessary" a measure designed as an enforcement instrument" [55]. While criteria 1 would be easy to satisfy (the relationship between the measure at stake and the legitimate environmental policy could be explained straightforwardly), criteria 2 (contribution of the measure to the realization of the end pursued) and 3 (impact on trade) would be challenging. The EU would have to demonstrate that the BCA would have a sizeable reduction effect on (a) not only its own GHG emission but also (b) on the targeted countries'/economic block's emissions. In addition, the EU would have to choose a BCA design that puts as little stress as possible on trade relations.

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50 In US-Gasoline the panel found that clean air could be "depleted" by pollutants. This was a sufficient condition to rule that the the regulation of pollutant emitting gasoline combustion was justifiable under this exception. This finding, according to Wiers[50], could be extended to "air not 'depleted' by excessive greenhouse gas concentration caused by human-induced CO2 emissions may also qualify as an exhaustible natural *resource."*

51 Kaufman, p. 521

52 See above

53 See above

54 WTO DSB (2011)

55 See Kaufman

Proportionality test

If the first test fails, the second step of the test applies: the public policy interest of protecting human health and the environment needs to be balanced against the interest of liberalized trade. According to article XX (i) GATT it needs to be determined whether the BTA measure on imports is indispensable to reach a Member State's policy goals – meaning less restrictive measures would have to be readily available. Given the array of possible carbon related measures, this criterion may be rather difficult to fulfil in practice. An important step towards ensuring that the BCA passes the proportionality would be (1) the alignment of the BCA with other international carbon mitigation tools and (2) the equivalence with of the BCA with the domestic carbon pricing. Indeed, the second standard from the article XX GATT Chapeau is that the measure must not be a "disguised restriction on international trade". Thereby the BCA would satisfy Article III:2 GATT which prohibits the discrimination between domestic and foreign products with regard to internal taxes or other internal charges. Again, that would oblige the EU to impose an obligation to participate in an ETS for both importers and domestic producers would more likely be compatible with Article III:2 GATT. It would also force the EU to increase the scope of the ETS or find alternative taxes if it were to include non-ETS sectors like agriculture or transport.

At the same time, the environmental objectives pursued by the EU would have to be "important and legitimate in character"[56] and be carried out in "good faith. Wiers (2008) expects that this good-faith standard would require that the implementing country demonstrate its serious efforts to "seek international agreement on climate change before enacting a carbon tax.". Could a good-faith standard be used the other way around? Given that the individual and aggregated contributions don't add up to the Paris Agreement's stated goal at staying below 2°C, would it be justifiable to impose a measure on the states that are not compliant. An issue here is that the Paris Agreement does not explicitly single out individual member state's contribution. Therefore, targeting individual states would be enormously difficult and difficult to justify under WTO law. Secondly, this dilemma could be resolved by having a uniform way of measuring and a clear methodology as outlined in chapter 2. But again: a key requirement would be to be consistent with the ETS in order to avoid any charges of discrimination.

[56] See WTO DSB, US Shrimp

4.1.4. Legal engineering

Another clause could provide a way out. Article III:2 and 4 GATT– and particularly on national treatment – explicitly state that the non-discrimination relates to *like* domestic products. Thus, products can be similar by appearance in their final stage but dissimilar in their production processes and methods. In other words: can two similar products be considered unlike because of their different – i.e. more carbon-intensive – production methods, even if there are physically alike. In that case, WTO law has developed a process and production methods (PPM) test. No case so far that has been looking into the question whether different PPMs – incorporated and not-incorporated in the final product – are sufficient to make products 'unlike'. Production processes, i.e. whether the product was produced using renewable energy, might be accepted as something that may be taken into account when determining likeness. Such a case might quickly run into a challenge though. While the WTO distinguishes between de facto and de jure discrimination, both are illegal unless justified. One of the key challenges would be to define what is sufficient documentation of the production methods. Beyond which lies the problem of carbon content metrics problem (see chapter 4).

Getting the BCA through the WTO dispute settlement system would be challenging. According to Trachtman, the lowest risk of successful WTO legal challenge would be presented by a BCA in relation to a national product-based tax that does not vary by reference to carbon intensity of production but is set at a fixed rate for specified categories of products. Under WTO law negotiations between partners have been put forward as prerequisite for trade-restrictive measures to be justifiable Typically, a member would contest another member's domestic measures as a violation of WTO law. by bringing a challenge to the Dispute Settlement Body (DSB). It is highly likely that the DSB will be invoked. To mitigate the risk of an uncertain outcome of WTO legal challenges, the EU could adjust the BCA design.

4.2. Navigating disrupted international relations

The design would have to do a delicate balancing act between being inherently flexible to reflect change and at the same time project sufficient pressure on countries and companies to invest into low-carbon technologies. Getting the necessary buy-in from companies and citizens is a pre-requisite for the BCA to work.

First, the EU should seek to get the necessary buy-in from external companies. The BCA would benefit from being phased in smoothly, at a linear rate for companies to adapt. Economic agents value visibility, as it decreases risk. Lower risk reduces the multiplication of disruptive effects on trade. Exporters from non-abating countries will tend to internalize the EU BCA costs and pass them on to European consumers. Therefore, the EU has a clear incentive to not expose non-abating countries to a sudden BCA phase-in. This entails the risk of sharp price rises from external goods, in particular goods on which the EU is highly dependent – fuels, for example. It is crucial to give economic agents and customers time to adjust so as to direct investment into low-carbon technologies and appliances. This is a key feature of the acceptability dimension of BCAs.

Second, the EU should show flexibility when it calculates the footprint of products. The EU is dependent on some rate of cooperation from non-abating countries' governments. They key issue here is data availability. Large uncertainties due to data inaccuracies would be the Achilles' heel of any BCA. Surveying millions of imported products will be an administrative nightmare. According to Flannery, procedures are likely to be administratively complex, inaccurate, and based on political rather than objective criteria."[57]. It is difficult to gather relevant data across borders. For the recommended product-specific metrics, it would add significant compliance costs to firms in non-abating regions. What is particularly challenging with the product-based BCA is to demonstrate the actual carbon footprint of import basket. It is unlikely that third countries would fully cooperate with the EU for certifying the accuracy of data, and the EU does not have any competence in investigating in foreign countries[58]. Therefore, it makes sense to introduce a voluntary data sharing system where companies would communicate their embedded emissions according to the EU's methodology. The input would then be checked, depending on resources, on a continuous or random check basis by a dedicated European Commission unit. Given that Eurostat has a limited collection of GHG emission data, especially on such high level of granularity, further databases would have to be developed. The incentive for foreign companies could look like this: the EU could set a default rate for a basket

[57] Flannery (2016), p. 7-8

[58] Moore rightly points out that "a system based on invasive and aggressive investigations by domestic authorities seeking out detailed information about foreigh firms intimate commercial and technological decision is eerily reminiscent of controversial antidumping investigations", Moore (2010), p. 20

of products (most likely on a sectoral level). Unless an exporter can demonstrate that its embedded emissions are below that threshold, it would have to pay the full BCA rate. If it can demonstrate that the emission intensity is below that threshold – or even the EU average -, sharing (truthful) information would be rewarded. The same reduction of payable BCA rate could be awarded if an exporter can demonstrate that it invested into a low-carbon technology that effectively lowers its GHG emission footprint. This shifts the responsibility, but also the action from non-abating countries to companies.

Third, the EU could introduce exemptions from or reductions of BCA rates for exporters from developing countries. This would be in line with the principles of the United Nations Framework Convention on Climate Change (UNFCCC), in particular the principle of common but differentiated responsibilities and respective capabilities, taking into account the particular situation of least-developed countries (LDCs). Scholars have[59] voiced concerns about "green protectionism, that is likely to undermine efforts to get emerging economies to make binding reduction commitments in emissions. In similar fashion, Flannery voices concern of "backlash from developing nations that could jeopardize already fraught international cooperation on both trade and climate change"[60]. Yet, the EU should not be too benevolent. On a global level, trade between developing countries is unfolding. In addition, as outlined above in chapter 2, the existing binding commitments are insufficient. In effect, the selection of economies considered as developing needs to be carefully crafted. On the one hand, some states have more means that others to adapt their production methods and their energy supply structure. This needs to be reflected. In that respect declining levelized cost of electricity (LCoE) of renewables could be factored into the BCA rate, adjusted for the specific level in the non-abating country. The evolution of the competitiveness of low-carbon technologies should also be reflected. Condon at al. suggest considering that non-abating countries already might employ employing a "wide range of carbon-reduction policies including energy-efficiency standards and afforestation programs"[61]. Not only would that make the whole exercise more complex, but also it would again count into territorial emissions, which do not necessarily reflect a company's individual

59 Evenett et al. (2009)
60 Flannery, p.1
61 Condon (2013), p. 14

investment choices. The intention is to avoid a blurring of the enforcement as happened with ETS.

4.3. Coalition building: the BCA endgame

The EU should not see BCA as the final stage of its climate efforts. BCA is a tool to coerce non-abating trade partners into a coalition. Detractors will argue that most countries globally have now implemented some form of GHG emission reduction program. The main issue is that most programs and policies are scattered and unharmonized. A BCA would ensure a joint and harmonized view on the scope of speed of GHG emission reduction.

The first principle to act upon should be to identify the right way to coerce countries to join the coalition. This requires *Fingerspitzengefühl* - a careful balance between targeting non-abating countries with the biggest emissions – pursue scale – and avoiding the risk of lengthy WTO disputes or even trade retaliation. From a pure coalition building perspective, it would make sense to involve US first, as they are the largest CO_2 importers worldwide (in terms of volume).

Second principle, the threat of implementing a BCA might be a sufficient condition to coerce non-abating countries. BCAs could be a negotiation tool in the quite limited toolset the EU disposes of. If the US stay outside of the PA, and the low aggregated commitments to GHG emission reductions persist, BCAs could be a matter of last resort to spur climate action on a global level.

Third principle, the EU should insist on the benefits of joining the climate club, and, if appropriate, sweeten the deal for countries that intend to join. This could consist it further reductions of import tariffs on selected products to compensate for the BCA. The EU's advantage is that it rests on a substantial amount of well-established trade relations with

5. Conclusion

The climate action trilemma provides a structured framework to address global GHG emissions. National or even European policies have proven to be ill-equipped to nudge both consumer behavior and investment in clean technologies. BCAs offer a solution to address the GHG emission reduction dilemma at its core.

The BCA design should be guided by climate science and the empirically proven global distribution of GHG emissions across geographies and trade flows. We suggest for the EU to depart from the polluter pays paradigm, thereby taking responsibility for a larger share of global emissions. Legally, there is no obligation for the EU to pay for the imported emissions. However, the EU could – via its trade relations – leverage these emissions via the BCA. A key concern voiced often in literature is its low impact on carbon emissions. This is difficult to measure empirically.

Our analysis has shown that substantial volumes of GHG emissions are embedded in trade and can potentially be captured by a well-targeted BCA. The preferred option consists in embedded carbon averages in imported products from non-coalition regions weighed against the 2℃ GHG emission reduction pathway benchmark. Given the dependency of some exporters on the EU – in particular emission heavyweights China, US and Russia, but also countries with steadily rising GHG emission rates like India – the potential adjustments of their production processes, electricity mixes and transport policies could have ripple effects beyond just trade with the EU. Not only would exports to Europe benefit from an improved emission intensity, but also all other exports would have the same energy input and emission intensity. The above analysis finds that BCA can be a suitable instrument for tackling GHG emissions and the free-rider problem, however with some caveats.

First, BCAs spare national and European policy-makers the painful introduction of carbon taxes that put fiscal pressure on consumers. Yet, this does not make any of the BCA design simple. A balanced approach will be necessary when ironing out the details of BCAs. Unless the EU lowers tariffs on impacted products, BCAs are likely to increase the price of products from non-abating countries. The repercussions of that should be part of the initial impact assessment. Compensating measures where appropriate will be necessary to shield consumers and enterprises from rising costs. This can be resolved in a clever way. The impacts could be partly mitigated by compensating exporters into the EU with reduced tariffs. Another part of the revenues could be earmarked for climate mitigating measures at European or national level.

Retributive tax or levy systems increase the acceptability of carbon taxes. In that respect it is important to integrate the fact that the EU does not have experience with managing large financial flows subjected to international market dynamics.

Second, BCA would challenge the current paradigm of states being accountable for GHG emissions. In a time of complex value chains, with a product integrating a range of diverse energy inputs throughout its production lifecycle, this view is antiquated. BCAs would also hit companies that operate only nationally within a non-abating country but export to the EU. For that matter, not being exposed brings a competitive advantage. The EU has the means to incentivize those companies – global and national – to invest into low-carbon technology. This approach has an element of bypassing countries' authority over its own trade relations. But this is compensated by the fact that countries can protect their exporting industries via WTO dispute settlement and retaliatory tariffs. So far, WTO law represents the biggest threat to a functioning and effective BCA.

Third, the BCA will be worthless if it inhibits trade on a large scale or it gets the EU entangled in a multitude of trade disputes or even retaliatory measures. One could argue that the current international environment – with the US government waving the threat of increasing tariffs at its closest trade partners – is the opportune moment to nudge measures from EU side. But this scorched-earth perspective is faulty. The aim is to incentivize as many of the EU's trade partners to join the coalition, not to open another front in the trade war. Achieving a coalition with at least one of the world's GHG emission behemoths US and China or with a blend of countries highly dependent on EU trade (Russia, Brazil, increasingly India), the EU could reach a coalition tipping-point where the sheer scale of the coalition could spur more non-abating countries to join.

As an opening, academic research gets better at modelling the expected outcomes and impacts of different BCA scenarios. In the absence of any existing example, the excellence of the modelling is crucial to anticipate real-life potential fallouts of any BCA design. In that respect, we would encourage the detailed analysis of company and consumer sensitivities and price responsiveness to BCA-induced changes in goods exported to the EU.

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