

Louvain School of Management

**The Carbon Border Adjustment Mechanism:
Overview of the EU proposal**

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Executive summary

The European Green Deal, announced in 2019, contains several policies which are supposed to lead to a reduction of carbon emission of 55% for 2040. One aim of this plan is to modernize the ETS (European Trading System) which rules the carbon pricing in the EU. This reform goes through the end of the free allowances and the creation of a Carbon Border Adjustment Mechanism (CBAM). This measure imposes a carbon tariff for certain goods entering the EU. If the policy tool is still negotiated – a test phase should begin in 2023 –, it has already been widely discussed in the litterature. This thesis details the EU proposal of CBAM and its potential impact on the EU economy and on third countries. It presents the potential issues that the measure could raise, an example being a conflict with WTO rules. Finally, different policy recommendations are addressed.

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0. Introduction

The consequences of climate change are more and more apparent (IPCC, 2014). A few days ago, July 2022 was recognized as the hottest July in the last sixty years in France. These hot and dry conditions were the cause of unprecedented forest fire (Météo France, 2022). To tackle this growing issue, the European Union (EU) has launched in December 2021 the European Green Deal. This roadmap establishes different actions and policies to reach a reduction of 55% of carbon emission for 2030 compared to 1990 (Commission, 2019). Among these measures, there is the reform of the EU Emissions Trading system (ETS), which organizes carbon quota for firms located within EU. To replace the free ETS which were granted to sectors pressured by international competition, the Commission proposed to create a Carbon Border Adjustment Mechanism (CBAM). It would require from products entering EU allowances related to their carbon content. Therefore, it would create a level playing field between the EU firms contributing to the ETS system and third nation firms paying their allowances thanks to CBAM.

At the time I write these lines, the measure follows its legislative process, and its final features are not defined yet. As the first jurisdiction in the world to want to implement Border Carbon Mechanisms at a supranational level, there are uncertainties around the actual impact on carbon emissions and economics variable (Marcu & al. 2022). However, a diverse literature already exists on this subject. The goals of this thesis are twofold. First, it aims at presenting complete information about CBAM in order to understand what is at stake during the present negotiation and what could be expected for the future in this area in terms of economic consequences or potential international trade conflicts. Second, I draw a critical conclusion on the measure and what features should be changed to maximize its effectiveness.

To do so, it is important to understand what we are talking about. This is why in the first section, I present the general features of the EU CBAM proposal, starting with the context and the rationale of the measure, then the detailed proposal, followed by a study of the different sectors of CBAM and concluding by an overview of other Border Carbon Adjustment (BCA) projects. In the second section, I present the impact that the CBAM would have first on the EU, then on its major trade partners. The third section studies how the CBAM would interact with international regulation, i.e. WTO rules and the UNFCCC principle. The fourth section presents different criticisms addressed to CBAM with a focus on carbon leakage, the main reason of CBAM. Finally, section 5 concludes.

1. General presentation of CBAM

In this first section, I will present the EU proposal of CBAM. First, it is important to understand what will be the role of the CBAM and its interaction with the EU ETS system. Then, I will detail what would be the main features of CBAM as described in the Commission's paper. To seize the extent of the impact that CBAM could have on EU and trade partners, I will present key characteristics of the targeted sectors in the third sub-section. Finally, to complete the understanding of the policy, I will detail projects of similar policy areas by other countries, mainly the US.

1.1 Context around the EU CBAM

Since its appointment, the Commission of Von der Leyen has shown growing ambition in the fight against climate change, biodiversity loss and pollution. In December 2019, the President of the Commission presented the European Green Deal, the plan to transform the EU into a modern, resource-efficient and competitive economy, which encompasses environmental, social and economic objectives. For European leaders, the transition through a more resilient economy could be an opportunity to strengthen the position of the EU at the international level (Sebastian & Kelly, 2008). One key target of this plan is the carbon neutrality of Europe, which should be achieved by 2050. To get there, the Commission has developed a number of legislative proposals as part of the Fit for 55 package which aims at cutting emissions by at least 55% by 2030 (EU Council, 2022), including the reform of the Emission Trading system (ETS) and a new proposal for the Carbon Border Adjustment Mechanism (CBAM).

The ETS is the first international emissions trading system (ERCST, 2022). Introduced in 2005, it is based on a 'caps and trade' system. It sets a cap on the amount of greenhouse gas emissions that can be released from industrial installations in certain sectors (EU Commission, 2015). The level of cap represents the level of allowances released, one allowance representing the equivalent of the emission of one tonne of CO₂ (EU Commission, 2015). For certain participants, allowances are free to discourage them from relocation outside the EU and avoid the ETS (Pellerin-Carlin et al., 2022). However, "free allocation under the EU ETS weakens the price signal that the system provides for the installations receiving it compared to full auctioning and thus affects the incentives for investment into further abatement of emissions" (European Commission, 2021). Therefore, the Commission proposed in 2007 the CBAM as an alternative solution to the carbon leakage issue, which could lead to the end of the free allowances (European Commission, 2021). However, this first proposal and the two others which followed in 2009 and 2016 were refused because of WTO compliance concerns or because the ETS system was preferred.

In 2021, the EU ETS entered its fourth phase which implies a decrease of the annual emission cap and stricter requirements for free allowances (Kardish, 2021). This has pushed the carbon price up and at the same time increased the risk of carbon leakage. Carbon leakage encompasses the behaviour of firms that for reasons of costs related to climate policies, want to transfer production to other countries with laxer emission constraints (Böhringer & al. 2017). This is due to the fact that the firms staying in the EU and that are subject to the additional cost of carbon pricing would have a competitive disadvantage compared to foreign products who don't have to pay this cost for their emissions produced. Such carbon leakage can shift emissions outside of Europe and therefore seriously undermine EU and global climate efforts (Pirlot, 2021). The Carbon Border Adjustment Mechanism addresses this issue by putting a price on the carbon of imported goods. It works in symbiosis with the ETS system, applying the domestic carbon pricing schemes to imported goods (Arnold & al., 2021). In addition to preventing carbon leakage, three other objectives were cited by the Commission (2021): i) protecting EU industries; ii) incentivising non-EU trade partners to adopt measures comparable to the EU's; and iv) yielding revenue which will contribute to other policies in favour of the green transition.

The Commission published its proposal of CBAM on the 14th of July 2021. The goal was to gradually implement the CBAM from 2023 until the end of 2025 (Assous & al. 2021). During this phase, the importers will have to report their embedded carbon emissions, but no fee will be charged (EU proposal, Chap. X, 2021). In 2026, a transition period of 10 years will be launched to switch from ETS free allowances to importer carbon tax. For the moment, five high risk carbon leakage sectors are targeted by the measure: Iron and steel, cement, fertilizer, aluminium and electricity production (EU Commission, 2021). These sectors are called EITE for Energy-Intensive Trade-Exposed. Following the Commission's proposal, the discussion started with the two legislators the Council and the European Parliament. On the 15th of March 2022, the Council validated the general approach on the CBAM, which was quite close to the Commission's original proposal. The Council's main suggestion was a greater centralisation of some elements of the CBAM governance.

In May 2022, the Committee on Environment, Public Health and Food Safety of the European Parliament published their report on the CBAM (European Parliament, 2022). In this report, they proposed several changes to broaden the ambitions of this policy. For instance, they claimed for the inclusion of aluminium, hydrogen, polymers and organic chemicals in the mechanism. Moreover, MEPs wanted that the CBAM would be managed at the central EU

level by a competent body (European Parliament, 2022). The text was then discussed during the June plenary session of the European Parliament as part of the Fit for 55. Three measures were rejected: the Emissions Trading System reform, the CBAM and the Social Climate Fund legislation. The European Parliament adopted its report in the plenary vote on 22 June. The co-legislators have held the first trialogue meeting on 11 June 2022. According to the head negotiator of CBAM, the main point of contention between Parliament and Council is the timeline of the phase-out of EU ETS (Euractiv, 2022). Other trilogues are planned in the coming months.

To conclude this sub-section, I will present the different reactions to the CBAM proposal from private stakeholders. The targeted sectors welcomed the measure since it adds a protection for them from third countries competition. In January 2021, the main representatives of the targeted sectors published a joint statement to provide their recommendations (Joint Statement, 2021). Their main one was to organize a smooth transition between the actual ETS framework and the new regulation/proposal. NGOs also welcomed the measure. Greenpeace highlighted that the revenues brought by the measure should be used for the green transition rather than adding to the EU budget.

1.2 The Commission's proposal

In this section, I will present the EU CBAM proposal. First, I will detail its scope in terms of sectors, countries and emissions. Second, I will explain the functioning of the mechanism. The CBAM proposal targets sectors with high emission intensity and trade exchange (also known as EITE) (Kardish & al. 2021). Therefore, the six industries targeted by the measure are:

- Cement
- Aluminium
- Fertiliser
- Electric energy production
- Iron and Steel

The selection by the sectors was based on criteria, namely (1) the relevance of sectors in terms of emissions; (2) the sector's exposure to significant risk of carbon leakage, as defined pursuant to Directive 2003/87/EC; (3) the need to balance broad coverage in terms of GHG emissions while limiting complexity and administrative effort.

To give an indication, these sectors together with those of oil refinery, paper and chemicals represented 94% of EU industrial emissions (European Parliament, 2021). The sectoral scope of the CBAM could be extended in a second phase by adding other products of the ‘carbon leakage list’ of EU ETS. This list identifies the sectors eligible for the free allowances of EU ETS and covers about 95% of the emissions (Assous & al. 2021).

In terms of country coverage, the CBAM should apply to non-EU members, except those who participate to the ETS systems (Iceland, Norway and Liechtenstein) or that have a cap-and-trade system (Switzerland) (UNCTAD, 2021). The least developed countries could also benefit from a lighter treatment (European Parliament, 2021). The interactions between the EU border adjustment and other internal carbon taxes should also be defined.

The emission covered in the first phase of the CBAM implementation are the direct emissions¹ (or scope 1), which are the emissions from sources owned or controlled by the reporting entity (GHG protocol). Indirect emissions (scope 2), i.e. emissions originating from other entities (from the energy production for example) could be added in a second phase. This could improve the ecological impact of CBAM since energy prices offers great variation across countries which reflects on industrial sectors (Cosbey et al., 2012).

In practice, companies that want to import goods originated from third countries to the EU will have to purchase certificates. In other words, companies importing non-EU goods must “surrender carbon allowances equal to the carbon footprint of the imported products” (Magacho & al., 2022). Then, firms will have to provide the correct number of certificates corresponding to their emissions on an annual basis. The price of the certificates will be based on the weekly auction price of the EU ETS allowances expressed in €/tCO₂ (European Commission, 2021). To estimate the carbon fee applied to a product, a method is detailed in the EU proposal taking into account the actual direct embedded emission (European Commission, 2021). If there is not enough data to compute the emissions, a default value should apply based on the average emission intensity of the 10 percent worst performing EU installations for that type of good (European Commission, 2021). In the EU proposal, each country has to designate a competent CBAM authority to manage administrative aspects (Assous & al. 2021). However, the creation of a European central authority to manage and coordinate the CBAM certificates has been part of the amendments proposed by the European

¹ The ETS system also taxes the direct emissions.

Parliament (European Parliament, 2022). As mentioned before, the Council has also proposed a hybrid management model which would be partially centralised (the EU Council, 2022).

Starting from 2026, the selling of CBAM certificates will generate revenues which should be managed by the EU. The co-legislators have divergent views on how to use the money received from CBAM certificates. In the proposal of the Commission, it is clear that it should be integrated in the EU budget (European Commission, 2021). Indeed, in the broad recovery plan NextGenerationEU, the EU institutions are committed to find new sources of revenues, which included CBAM. Within the EU budget, the CBAM incomes could have several functions: while some argues that it should be used to develop the EU climate policy, others think that it could contribute to the reduction of EU deficit (Krukowska, 2020). Moreover, literature shows that such allocation of the CBAM revenue would place the burden of the climate policy on developing countries (Böringer & al. 2018). Indeed, EU would charge fees to the imported products from these nations. This explains that some researchers argue that those earnings from the carbon tax should help third countries in their green transition (Böringer & al. 2012; Fisher & Fox, 2012). Moreover, such transfer would align the CBAM with WTO rules and the UNFCCC principle (see section 3 for a discussion about WTO compliance and the relation between CBAM and developing countries).

As we see, the CBAM is the outcome of 15 years of aborted proposals and negotiations. It seems that this will be the good one, despite the ongoing uncertainty about the final terms of the measure. Therefore, it is important to study the different targeted sectors to anticipate the potential impact CBAM could have in the future. This will be done in the next section.

1.3 Presentation of the sectors targeted

As mentioned in the previous part, the CBAM proposal focuses on six different sectors. The potential impact of this measure depends on the importance of the sector in the imports of the EU. In this section, I will present the different sectors, starting with cement, then electricity, fertilisers, aluminium and finishing with iron and steel.

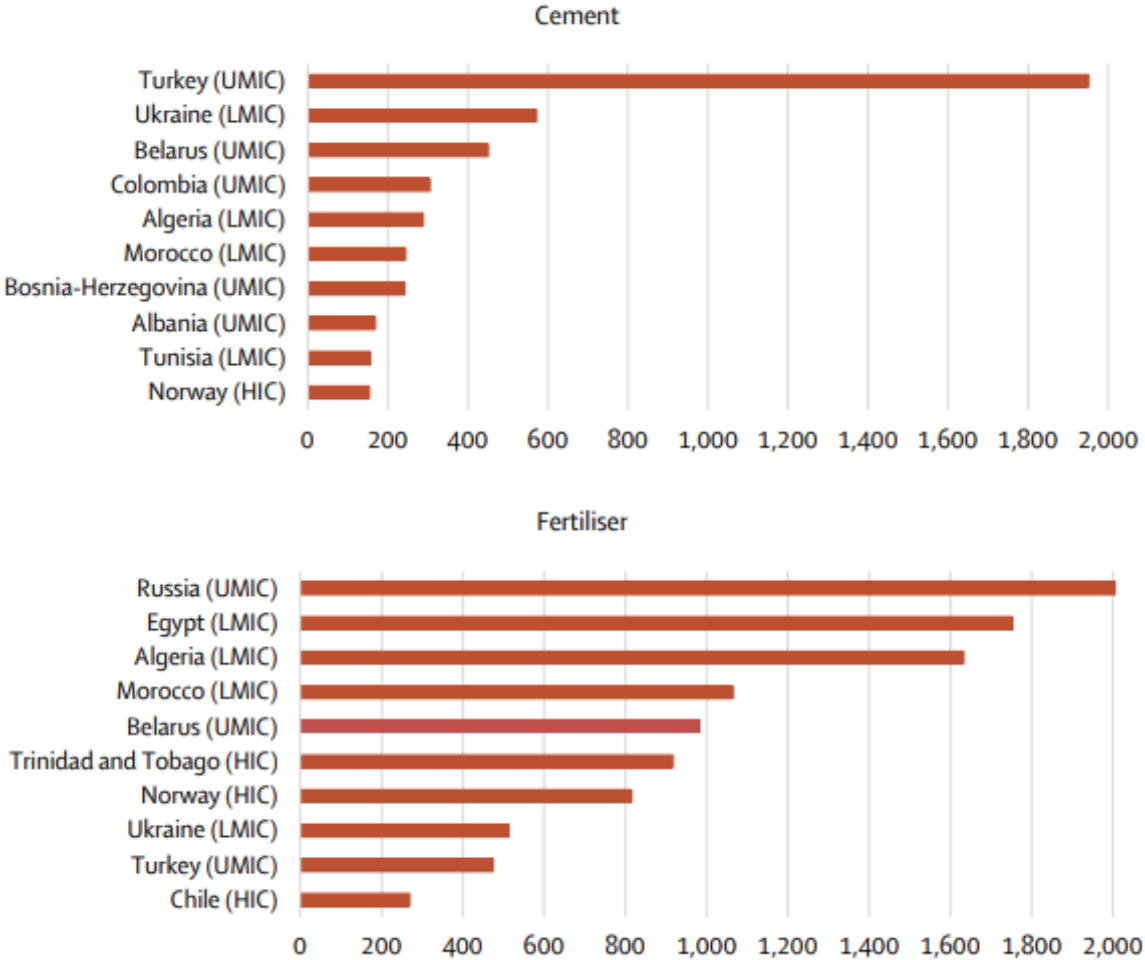
Cement industry

In 2019, the imports of cement constitute 2,6% of the domestic consumption while exports represent 7%. As we see on the graph (Fig. 1), the five main countries of origin of cement were Turkey (34%), Colombia (8%), Ukraine² (7%), Belarus (7%) and Bosnia-Herzegovina

² This thesis was written while Ukraine's war with Russia was still ongoing. This might change the current trade situation of the country.

(4%) (Eurostat, 2019). Despite the positive trade balance, there is a trend of increasing imports and decreasing exports lately. This could be a mark of leakage. The manufacturing of cement is classified as risk of leakage under the EU ETS (European Commission, 2019). There is a requirement for a certification for cements entering the EU market, which should ease the determination of CO2 emissions of each product (Marcu et al., 2021). The limited transportability of cement makes worldwide trade less competitive which explains why the majority of imports comes from neighbouring countries. The main source of carbon emissions comes from the calcination process that turns limestone into quicklime (Marcu et al. 2021). The use of alternatives to fossil fuels could be a first step through the decarbonisation of the sectors.

Fig 1: CBAM-relevant imports to the EU (in thousands of tonnes, 2019)



Source: Eurostat, retrieved from Brandi, 2021

Fertilisers

EU imports 29.5% of its domestic consumption of fertilisers and exports 21.3% of its production (Marcu et al. 2020). As we see on the graph, the most important providers of fertilisers are Russia³, Egypt and Algeria (Brandi, 2020). The EU fertiliser firms do not export that much in general, but specific installations are specialised in trade with third countries. The production of two fertilisers is encompassed in the ETS program because of their high GHG rejection (Marcu & al. 2020). Fertiliser production requires heat and pressure, which is mainly caused due to natural gas imported from Russia (Marcu et al. 2020). Therefore, an important share of the carbon emissions are direct emissions and will be encompassed by the CBAM.

Aluminium

EU imports 36.6% of its domestic consumption of aluminium and exports 23.7% of its production (Marcu et al. 2020). In 2018, the main source of imports are Norway, Russia, China, United Arab Emirates and Switzerland (Marcu et al. 2020). The price of aluminium is fixed at the global level which limits the possibility for firms to pass through carbon cost (Marcu & al. 2020). The production of aluminium is highly energy intensive, which makes the sector exposed to the fluctuations of the electricity market. Therefore, the inclusion of indirect emissions would allow a better inclusion of this industry's carbon emissions into CBAM (ERCST, 2022).

Steel and Iron

Concerning iron and steel, the EU imports 19.7% of its domestic consumption and exports 15.6% of its production in 2019 (Marcu & al. 2020). Main sources of imports are Russia (15%), Turkey (11%), Ukraine (10%), China (10%) and South Korea (8%). EU production is less carbon intensive than that of its trade partners. As other CBAM targeted sectors, the steel industry is carbon-intensive and has a high trade exposure (Marcu & al. 2020).

Electricity: A local market

There is no single electricity market in the EU, but rather a number of regional markets (Marcu & al. 2021). Interconnections between these submarkets are scarce which implies that only the border one will be confronted to non-EU high carbon intensive electricity. Sandbag (2020) estimates that the use of the connections with non-EU countries to import electricity is

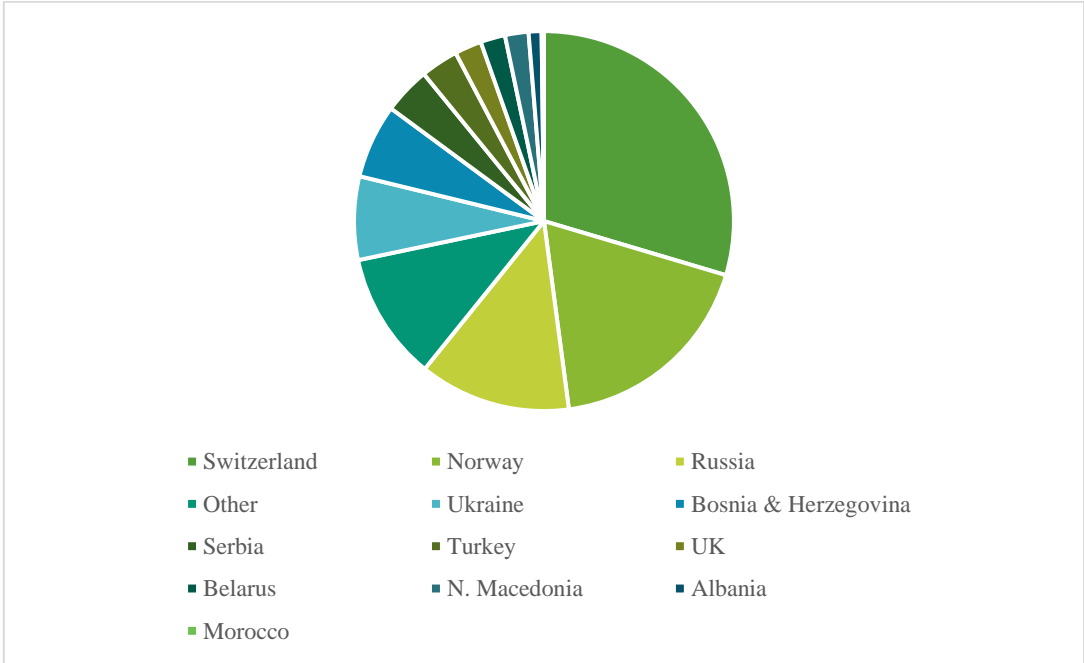
³ This thesis was written while Ukraine's war with Russia was still ongoing. This might change the current trade situation of the country.

on average of 13%. The sector is foreseen to be growing in the future, as there is a push for electrification (Bloomberg, 2018).

Generally the electricity market is not considered as a source of carbon leakage because of the balanced trade. However, the border regions could be a place of leak as imports from outside the ETS countries is growing (Marcu & al. 2020). This trend could be confirmed in the future as new interconnections are planed with these countries and projects of new production sources (Marcu & al. 2020).

The carbon emissions of the electricity sector have decreased by 54% between 1990 and 2020 (European Environment Agency, 2021). The carbon emission of the EU is on average of 287gCO₂/kWh with important disparities.

Fig 2: Main source of imports of electricity (2018)



Source: Marcu & al (2020)

In conclusion, the sectors covered by the CBAM have different challenges which may require adequate features. Some European sectors are export oriented and should welcome any measure preventing carbon leakage (Marcu & al. 2020). It also illustrates that across sectors CBAM will mostly impact the EU neighbourhood countries such as Russia, Ukraine and Turkey in addition to China. Moreover, several countries may be concerned by the measure as they export one or several targeted products. Before presenting different impact assessment articles in the next section, I will close this one by talking about other Border Carbon Adjustment (BCA) projects from third countries.

1.4 Other CBAM projects

At the moment, the CBAM is the most completed Border Carbon Adjustment project, but other BCA proposals exist in third countries. Shortly after the EU proposal, two members of the US senate launched a proposal of border carbon adjustment on polluting imports (New-York Times, 2021). The so-called Coons-Peters Bill has the same aim as its European cousin of avoiding relocation of firms by creating an economic and environmental level playing field (Leonelli, 2022). However, the two regulations differ on certain points. The scope of the US proposal is broader because it targets ‘covered fuels’ and ‘covered goods’, encompassing goods composed of 50% or more of aluminium, cement, steel and iron sectors (Leonelli, 2022). Another difference is the absence of domestic carbon price in the US, which could complicate its framing. Furthermore, the US carbon border adjustment is also seen as a geopolitical tool to put pressure on China (Sobczyk, 2022). The US proposal is still at the beginning of the legislative process and a lot of work remains to be done to achieve a concrete proposal which could gather enough votes from senators. Furthermore, Canada has announced its interest in a border carbon adjustment in 2020 but hasn’t published any concrete proposals yet (Department of Finance Canada, 2021). UK, which left the EU ETS for its own ETS in January 2021, has also considered to implement such a border carbon adjustment (BCA) (Environmental Audit Committee, 2022). The country is highly exposed to CBAM since it exports iron, steel and aluminium to the EU (Cornago & Lowe, 2021). Moreover, the situation of Northern Ireland could complicate the negotiations about the compatibility of UK ETS with CBAM. Therefore, cooperation between UK, Ireland and the EU will be key in the future months.

2. The CBAM’s economic impact

To assess if CBAM could be an appropriate measure for carbon leakage, it is important to study its impact on the economy. The impact of BCAs does not reach a consensus among authors. While some found a negative effect of carbon tariffs on domestic competitiveness accompanied by a reduction of emissions, others found no significant changes (Monjon & Quirion, 2011; Fisher and Fox, 2009). Beyond this debate, the EU CBAM will lead to a redistribution of competitiveness among countries and regions (Zhong & Pei, 2022). In this section I will present the changes that a CBAM measure would incur, first on the EU, second on third countries in general with a focus on China in the third section.

2.1 Effect of CBAM on the EU economy

In this section, I will present several studies which estimates the impact of CBAM on the EU. It is worth noting that the different assumptions laid by articles may be a source of divergence between the results presented below. Moreover, the paper of the Commission could suffer from a bias in favour of the proposal. However, its comprehensive analysis is useful to seize the impact of CBAM. I will first present the potential reduction of carbon leakage and carbon emissions in general. Then, the change on the European production and competitiveness will be approached. Finally, other economical variables will complete this overview.

Carbon leakage & carbon emissions

Before estimating the impact on the European economy, it is worth studying if the CBAM is an efficient measure to limit carbon leakage. Several studies showed the efficiency of carbon border mechanisms. Branger & Quirion presented in 2014 a meta-analysis of the publications around CBAM's impact estimated by Computable General Equilibrium model (CGE). They found that while the leakage ratio was around 5% to 25% without CBAM, it was between 5% and 15% with it (Branger & Quirion, 2014). Moreover, in 2021, a United Nations Conference on Trade and Development paper found that CBAM could halve carbon leakage. Another simulation from Perdana & Vielle (2022) shows a reduction of leakage of one third by 2040. Bellora & Fontagné (2022) complete this analysis by showing that CBAM is more efficient than the current free ETS system. Extending the analysis to more recent studies, Zhong & Pei (2022) found similar results. However, compared to third country partners, the EU energy intensive industry is subject to a number of domestic policies promoting decarbonisation of these sectors, and those emitting less during the production processes. Another encouraging element is the reduction of global emissions that Zhong & Pei identifies in their study (2022). According to them, this occurs through three channels. First, the CBAM incurs a rise of pricing within the EU leading to a decrease in consumption of foreign 'dirtier products'. Second, firms shift back their production to the EU to avoid cross-border costs caused by CBAM. Third, firms outside the EU would increase decarbonisation efforts. The Commission's impact assessment (2021) confirmed this trend. They identified that a reduction of one tonne emissions in the EU results in a decrease of 0.29-tonne in non-EU emissions (Magacho & al. 2021).

Competitiveness & production

One aim of the CBAM is to level the playing field for EU and non-EU firms in the Emission Intensive Trade Exposed Industries (EITEs). Consequently, it is expected that the relative

competitiveness of EU firms raises thanks to the CBAM which targets imported products (Kuusi & al. 2020). This is confirmed by the model-based analysis of several researchers (Branger & Quirion, 2014; Kuusi & al. 2020). Evans & al. (2020) identified that BCA impacts mainly competitiveness in the short run, making EU and third countries' firms closer in competition. Following this idea, a fear raised by Zhong & Pei (2022) is that without export rebates, the short run advantages of CBAM may weaken in the long run due to "cost adjustment mechanisms". Moreover, the industries which rely on imported intermediate products targeted by the measure will see the cost of their inputs raising which will impact their competitiveness on the final products (Kuusi & al. 2020). To conclude, the impact on competitiveness will depend on the elasticity of substitution and the structure of the product's value chain (Magacho & al. 2022).

A consequence of the improvement of competitiveness should be a rise of the European production. At the country level, the Gross Domestic Product (GDP) should barely be impacted by the CBAM (Kuusi & al. 2020, Pyrka & al. 2020). For instance, Magacho & al. (2022) have identified a decrease of 0.2% by 2030. This is explained by the fact that two opposite forces apply to GDP: on one side, the reallocation of resources caused by the measure involves an efficiency loss. On the other side, regional capital and labour levels remains constant which limits the effect on GDP (Kuusi & al. 2020). Furthermore, Kaitila (2022) found that CBAM would benefit the sectors which manufactured products targeted by the measure (i.e. EITE). The figures of the European Commission (2021) confirm the trends with higher outputs in all the targeted sectors.

Other variables

Another consequence of CBAM is the disruption of the trade flows. Kuusi & al. (2020) found that both exports and imports would be negatively affected by the measure. This is confirmed by the impact assessment of the Commission (2021) which predicts an average decrease of 10% for the targeted sectors. From the EU imports side, there is a raise of costs which is measured from 3-4% points for China, Russia and Brazil to 15 percentage points for India in the iron and steel sectors (Xiaobei & al. 2022).

The European Commission's impact assessment report also estimates the administrative cost that the CBAM could represent. Indeed, to have an efficient measure, authorities will have to control the information that firms give. It will require more IT technology and an efficient organisation of a centralized CBAM authority. The overall value is estimated around EUR 14

million by the Commission (2021b). This needs to be put in perspective with the expected gains of CBAM, which are around EUR 14 billion per year in 2030 (EU Commission, 2021b).

On a different topic, Cornago & Lowe (2021) highlighted that the small businesses might be bothered by the measure. Particularly, the administrative costs linked to the compliance with the regulation should be more important for new companies (Cornago & Lowe, 2021). The declaration of carbon emissions also requires resources and competences that small businesses might not have.

Summarizing the discussion, the CBAM should have a restrained impact on EU economic variables while limiting carbon leakage. An important challenge would be the management of the administrative work attached to the measure. However, as for many studies around CBAM, the effect depends on the carbon price and the sectors considered. Other parameters could influence the results, in particular trade exposure, composition of embodied emissions and trade elasticities (Zhong & Pei, 2022). The risk of political tensions leading to trade retaliation might also have a negative influence on these results.

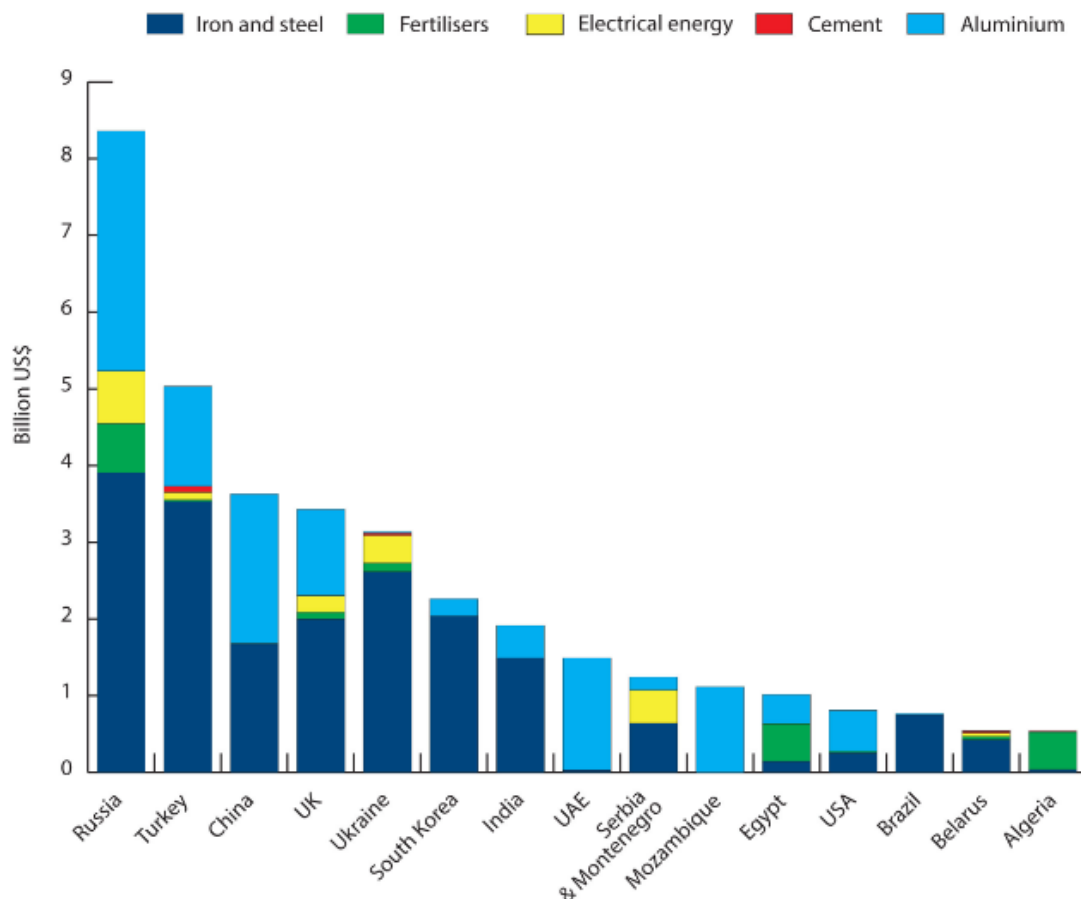
2.2 Effect of CBAM on third countries trade

In this section, I will present different studies which attempt to estimate the impact of the CBAM on third countries' economies. As a first remark, it is important to note that since the definitive features of the carbon mechanism are not yet agreed by the European Co-legislators, it implies that studies may rely on different assumptions. Moreover, I only focused on the estimation based on a CBAM of scope 1, i.e. taking into account direct emissions, because it fits with the EU Commission proposal. A first indicator of the countries which could be particularly affected by the CBAM is the EU imports. I already presented the main countries per sector in the preceding section, but this overview allows for a clear understanding of the overall impact of CBAM on EU trade partners. As we see on the graph, Russia is the most vulnerable country due to its iron and steel and aluminium sectors. Turkey and China follow, mainly because of their important aluminium and iron and steel sectors. In the following section, I will present studies of impact of the CBAM for the main countries impacted in the order of the importance of the EU import, starting with Russia.

RUSSIA⁴

As we see on the graph, Russia exports mainly Aluminium, Iron and Steel to the EU. Estimating the impact of the CBAM on Russia, the World Bank (2021) uses a CGE approach to encompass wider macroeconomic effects in their analysis. If Russia does not change its policy, different models predict a decrease in exports since European companies repatriate their production in Europe (Worldbank, 2021; Bashmakov & al. 2021). This loss is estimated at 2.8% of the real exports to the EU. An estimate of Simola (2021) concluded that the CBAM would cost EUR 2,142 million. The sectors targeted by the CBAM suffers the most, especially the chemical sector (-60% in 10 years). At the macroeconomic level, the CBAM should not have significant impact (Worldbank, 2021). However, the inclusion of scope 2 emissions would further damage the Russian economy.

Fig 3: EU imports of products covered by proposed CBAM regulation from 15 most exposed countries (2019)



Source: Cornago & Lowe (2021) based on 6-digit harmonized system import data available from UN Comtrade.

⁴ The war between Ukraine and Russia and the several sanctions ta by the EU in this context might modify the trade relations and consequently the impact of CBAM on the EU and Russia.

UKRAINE⁵

The cost of CBAM for Ukraine is estimated by several studies around EUR 850 million (Simola, 2021; Assous & al. 2021; Dröge, 2021). Chepeliev (2021) provided a more detailed assessment of the impact of CBAM on Ukraine. As a major trading partner of the EU (EU represents 41% of the total Ukraine's exports), the country could be severely impacted by the measure. Moreover, Ukraine's ferrous metal exports represent 20% of the national production. This sector is also the principal source of embodied emissions into Ukraine's exports (Chepeliev, 2021). Relying on a computable general equilibrium model, Chepeliev shows that the reduction in output in the CBAM involved sectors is compensated by the raise of activities outside its scope (Chepeliev, 2021). To achieve such conclusion, the author assumes a carbon price of 26\$US/tCO₂ which is the average ETS carbon price of 2019. From a macro perspective, the estimation of the aggregate income change due to CBAM leads to a minor impact.

TURKEY

The attempts to estimate the cost of CBAM offers a range of estimates in function of the starting hypotheses. Simola (2021) evaluates the loss around EUR 690 million, while Assous & al. (2021) achieve an estimation of 800 million. According to Yeldan & al. (2020), the CBAM could cost between 1.1 and 1.8 billion euro annually to Turkish exporters. If we detailed among sectors, the cement industry (170 million €), iron and steel and chemical industry are the most affected sectors. These costs could increase if Turkey does not implement a policy to reduce the carbon emissions (Yeldan & al. 2020). However, the European measure could also constitute an opportunity for the Turkish economy if the country adopts a strategy compatible with CBAM (Yeldan & al., 2020). From a macro perspective, the GDP of Turkey will be negatively affected by the CBAM if the policy remains unchanged. Furthermore, the report of Eicke & al. (2021) highlights that Turkey supports a high relative risk in the face of CBAM.

OTHER STUDIES

Magacho & al. (2022) analyse the impact of the CBAM on EU trade partners with a focus on multidimensional exposure. According to their model, the impact is proportional to the exports of the country to the EU. In terms of export, the most affected countries are Russia, China, Turkey and Ukraine. If we compare this to the total exports of a country, Mozambique

⁵ Ukraine might receive a special treatment regarding the war it's facing with Russia.

appears as the main ‘victim’ of the CBAM, because of its important exports of aluminium. To a smaller extent, Bosnia Herzegovina, Ukraine and Serbia would be affected by the CBAM as more than 5% of their exports are CBAM products (Magacho & al. 2022). In a second phase, authors estimate the potential carbon revenue of the CBAM by country and by sector considering a carbon price of 60\$US/tCO₂. Most of the potential revenue of the carbon mechanism comes from Russia, China and Ukraine. Finally, they identified the countries which were the most exposed to the CBAM in terms of changing demand. Indeed, the CBAM will affect the prices of the goods included in its scope, which could have a ripple effect on the economy of the country. The states most vulnerable to this risk would be the Balkans, Mozambique, Zimbabwe and Cameroon (Malgacho & al. 2022). Other studies focusing on Least developed countries (LDCs) highlights the significant welfare losses that could cause CBAM (Brandi, 2021; Perdana & Vielle, 2022). This is confirmed by the paper of Eicke & al. (2021) which focuses on the threat the CBAM could constitute for “Global South” countries and extend it to other developed countries. In addition to the trade exposure, the study considers the vulnerability of southern countries, i.e. the inability to adapt to the measure (Eicke et al. 2021). It evaluates countries in function of their relative risk, which encompasses export structures of the countries, their emissions intensity, emissions reduction targets and institutional capacities to monitor and report product-based emissions. It shows that the relative risk caused by CBAM is unevenly distributed across the world. The most affected countries are located in Africa, which could be explained by the importance of the EU imports within these economies. Balkans and Ukraine also support a high relative risk.

To conclude, it remains difficult to clearly determine the impact that the CBAM will have on foreign economies. On the one hand, several figures seem alarming in terms of drop in the export. Some countries are particularly dependent to EU exports and could be badly affected by CBAM. This explains the reluctance of certain countries regarding this measure and the invocation of the UNFCCC principle (see sub-section 3.2). On the other hand, the effect on total export of trading partners and on their income is limited (Simola, 2021; Kuusi & al. 2020). Moreover, there is a risk of trade retaliation and a deterioration of the international climate cooperation (Banks and Fitzgerald, 2020; Mehling & al. 2019). The global outcome for these countries will depend on their ability to adapt with CBAM requirements and to organize a carbon reduction policy.

2.3 CBAM and China

As an important trade partner of the EU and a major international actor, China deserves a special case study. Before presenting impact assessment studies, it is important to draw the economic and political context surrounding CBAM.

The country is a major contributor to the EU imports as it constituted 22.4% of the EU total imports in 2021 (Eurostat, 2022). Reversely, in 2020, China (10%) was the third largest partner of the EU exports behind the US (18%) and UK (14%). Concerning the targeted sectors of the EU CBAM, China is the world's largest producer of steel, cement, and aluminium (Worldsteel, 2022; Statista, 2022). In this regard, it constitutes the first country of origin for the imported steel in the EU. China is also the 4th provider of aluminium (WITS, 2019). However, from a Chinese perspective, the products covered by CBAM only represent 1.8% of their exports in value to EU (Assous & al. 2021). At the same time, China is the world's largest carbon emitter and its emissions constituted 26% of the total imported emissions of EU in 2014 (Friedlingstein et al., 2022; Simola, 2022). Taking into account the rising negative effects of air pollution and the opportunities of the green transition, China announced in 2021 several measures to decrease its carbon emissions, with a target of carbon neutrality achieved before 2060 (Kardish et al. 2021). Among them, there are the decrease of investment in carbon-intensive industries and the fostering of transition through cleaner technologies. The latest matches with the EU CBAM proposal since it focuses on petrochemicals and iron and steel, sectors also targeted by the European measure (Kardish et al. 2021). From a trade perspective, China wants to adjust its imports and export tariffs to avoid overproduction and fostering the transition (Kardish et al. 2021). This will lead to a scrapping of imports for certain metals products and the end of export rebates for other. Finally, since 2021, China has a national ETS system which could be increasingly important in the future. It covers the power sector and embodies 40% of China's carbon emissions in its first phase (Kardish et al., 2021; Nakano & Kennedy, 2021). In addition, eight regional ETS pilots are experienced. Other sectors targeted by the EU CBAM will likely be included in the mechanism since they are already part of regional ETS systems.

As a principal trade partner, China sees the CBAM as a concerning trade barrier (Kardish & al. 2021). The measure is interpreted as a unilateral policy and certain Asian countries claim for more cooperation (Kardish & al. 2021). Industries concerned by the EU CBAM have not organized their compliance to the system because the features of the mechanism are not defined yet and that they hope that their compliance to the Chinese ETS would free them from

CBAM additional fees (Kardish & al. 2021). Moreover, the CBAM could raise the price of the Chinese ETS (Luo, 2022). Indeed, its price is lower than the EU one, varying between USD3.28 and USD12.62 while the EU one varied between EUR17.45 and EUR32.7 in 2020 (Assous & al. 2022). This could lead to a double payment for Chinese imported goods: after paying the domestic carbon tax, it will have to buy CBAM certificates due to the difference in carbon price (Luo, 2022).

To foster cooperation on this issue, the European Union and China launched in 2020 discussions which aim at coordinating the policies of both entities on climate change and helping China in the building of their ETS system (EU-China ETS website, 2020). This initiative could increase political benefits for the government and improve the CBAM effectiveness (Huang & al., 2022). Moreover, it could also decrease the administrative costs of CBAM for Chinese firms, mainly the calculation of embodied carbon.

At first glance, the CBAM could have a significant impact on China since the carbon intensity is very different in both entities (Kardish et al. 2021). For instance, the CO₂ released by the production of primary steel is 2.2 tons in China and 1.9 in Europe. Similar differences also exist in the aluminium industry. This is partially due to the use of coal for the production of Chinese electricity (Kardish et al. 2021). Bao & al. (2013) found that the total emission of China would be reduced after the launch of a BCA in the EU. However, the impact will depend on the final features of the CBAM.

Several studies tried to estimate the impact with models but few of them focus on the sectors announced by the CBAM. Huang et al. (2022) studied the impact of the EU CBAM proposal on China through the scope of game theory. Actors were the government and exports firms, and they could choose to act or not. The first hopes that firms will adapt to the new regulations; the second weights the costs and opportunities of low carbon production. Authors show the conditions for the CBAM to create positive reactions of the actors. On one side, the government should perfect the carbon market and push for a decrease of export dependence (Huang et al., 2022). On the other side, firms would realize the opportunities of the carbon market and the potential avoidance of the carbon tax to speed up their transition. Finally, Chinese regions will unlikely be uniformly impacted by CBAM (Zhong & Pei, 2022). Coastal regions are found to be directly impacted by the measure in terms of output, which is related to their higher trade exposure. However, landlocked regions suffer indirectly as the demand shock spread through “inter-regional industrial linkage” (Zhong & Pei, 2022). This illustrates the fact that CBAM has global effects and that policy makers should not ignore less trade-

exposed regions in their policy. Furthermore, the impact on the production channel of China could be important. Qi & al. (2022) shows that the cost efficiency of the Chinese steel and cement industry decreases because of CBAM (respectively -0.14% and 0.68%).

Other studies which do not focus on China still provide insights of the situation of the country. Simola (2021) concluded that CBAM would cost about EUR 120 million to China. Assous & al. (2021) found a slightly more important amount of EUR 170 million, integrating additional products in the scope of BCA. One reason of the negative impact of CBAM is that it will affect the cost efficiency in different industries (Qi & Al, 2022). Depending on the carbon price, this effect could be more or less important: above a threshold, it is significantly smaller.

To conclude, as a major trade partner, China will be negatively impacted by the CBAM. Because of its polluting industry and its important trade relations with the EU, the losses of the Asian country seem important. The cost efficiency of the Chinese industry should decrease because of CBAM. However, the terms and conditions of the compatibility of the Chinese carbon pricing system could modify this outcome.

3. The EU CBAM and International regulations

As we have just seen, the CBAM could cause economic damage to the trading partners of the EU. Supporting their reluctance on this topic, is the fact that as a rule on foreign imports, the CBAM encroaches on international regulations. Two of them are mainly affected. In the first sub-section, I'll present the discussion around the compliance of CBAM with the international trade rules of the WTO. Then, the potential conflict of CBAM with the UNFCCC principle will be detailed.

3.1 The CBAM and the WTO rules

The World Trade Organisation deals with the rules governing international trade. Since the first proposal of BCA, the compliance with international trade rules has been the concern of several researchers⁶. As we will see in the next sub-section, developing countries are particularly sensible to this matter and claimed that the CBAM is unfair from “numerous perspectives” (Lim & al. 2021). Moreover, the United Nations Conference on Trade and Development estimates that the measure violates the GATT rules (UNCTAD, 2021). Before developing the contentious article, it worth noting that the EU, since the birth of this policy project, has always claimed that the CBAM would be compatible with the international trade

⁶ see for instance Holzer (2014), Quick (2020) and Bellora & Fontagné (2022).

rules. In practice, the Commission has adopted a strategy of parallel adaptation which consist, on one hand, of trying to establish regulations compatible with WTO rules; on the other hand, of trying to modify the actual international regulations (Han, 2021). However, this could be insufficient to convince all WTO members of the legal compatibility of CBAM.

What are the WTO rules which could be in conflict with the CBAM proposal? Lim & al. (2021) estimate that six articles could be challenged by the carbon border measure. I will focus on the GATT's non-discrimination which is embodied in Article I and III of the GATT. All details of potential incompatibilities between CBAM and the WTO are available in annex.

Article I is a fundamental article of international trade law (Centre du commerce international, 1999). It bans discriminatory treatment between members under the principle of Most-Favoured Nation: an advantage given to one country must be extended to all trading partners who are WTO members (WTO website). The CBAM will price the different goods according to their carbon emission. Since all nations do not have the same technology of production, they would differ in their emissions which could constitute a discrimination (Lim et al. 2021). Furthermore, the nations with a lower climate ambition will have a different treatment than those with greater ambitions (Leal-Arcas & al. 2022). Finally, the fact that the EU could determine the trade barrier it imposes in function of their carbon content can be considered as a discrimination under Article I (Bacchus, 2021).

Linked to Article I, Article III states the National Treatment rule: the internal treatment should be applied equally to foreign countries (GATT, 1986). Accordingly, "imported products be given no less favourable treatment than that given to like domestic products" (GATT, 1986). The CBAM will not apply the same carbon tax to all products, creating a barrier for imported goods (Leal-Arcas & al. 2022). More precisely, the granting of free allowances for European products while imported similar products require a CBAM certificate is a breach of the National treatment rule (Bacchus, 2021).

In addition, Article XX provides exceptions to the non-discrimination principles which could apply to CBAM (Kardish & al. 2021). Measures "necessary to protect human, animal or plant life or health" and "relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption" can be enforced by the states (GATT, 1986). There is, however, one condition for such a measure to be GATT compliant: it should also be applicable domestically (Article XX general exceptions, 1982).

Some researchers argue that features of the CBAM which could contribute to its effectiveness enter in conflict with WTO rules (Cosbey & al. 2019; Bierbrauer & al. 2021). For instance, the calculation of embodied emissions should be as accurate as possible to encourage firms to improve their production process. However, measuring carbon emissions in third countries is a difficult task and the use of default values could be required. Such measure would conflict with art. III and the exception of art. XX should be applied (Böhringer, 2022). The Commission, however, claims that the CBAM will be applied in a non-discriminatory manner and apply in the same way to imported and domestic products; this is why the CBAM is designed in a way whereby ETS allowances are phased out gradually as CBAM is phased in. By ensuring importers pay the same carbon price as domestic producers under the EU ETS, CBAM will ensure equal treatment for products made in the EU and imports from elsewhere and avoid carbon leakage. Moreover, given that CBAM is an environmental measure, the Article XX exception applies to it. Given the purely climate-related objective of CBAM, the EU should be able to use the exemption of article XX of GATS.

To conclude, the compliance with the WTO rules will depend on the final design features of the proposal currently under discussion by the co-legislators (Arnold & al. 2021). It could be seen as a protectionist measure of domestic producers (Bacchus, 2021). For instance, the inclusion of export rebates would likely make this measure incompatible with the WTO rules, since export rebates would constitute a prohibited subsidy under the Agreement on Subsidies and Countervailing Measures (Cosbey et al. 2019). Knowing this issue, the Parliament and the Council are supposed to provide a report on the WTO compatibility in 2025, before the effective application of the measure (European Parliamentary Research Service, 2022). Beyond the uncertainties surrounding CBAM, the risk of international trade conflict is important and could lead to trade retaliation (Appunn, 2021).

3.2 CBAM and the UNFCCC principle

In addition to the conflict with international trade rules, the CBAM could also contravene to a principle of international green policy, the United Nation Framework Convention on Climate Change (UNFCCC) principle. This precept recognises that Least Developed Countries (LDCs) have a differentiated responsibility and capability in the fight against climate change⁷. LDCs are defined by the UN as low-income countries confronting severe structural impediments to sustainable development (UN, 2022). According to the UNFCCC principle, not all countries have the same ability to fight climate change. Applied to CBAM, least

⁷ Also known as common but differentiated responsibility.

developed countries, supported by several academics, claimed that they should be exempted from the mechanism (Brandi, 2021; Leal-Arcas et al. 2022,). Indeed, the CBAM will protect European companies by putting a price on the imported goods, shifting the “burden of climate policy from developed regions to trading partners, particularly developing regions” (Zhong & Pei, 2022). In response to this criticism, the Commission’s proposal refused any exemption that would be counterproductive by fostering the investment in carbon intensive industries and create “carbon havens” (EU Commission, 2021; Branger & Quirion, 2013). Rather, it proposes targeted measures to support the transition of LDC’s and respect the UNFCCC principle. Moreover, the European Parliament’s position adopted on the 22nd of June 2022 is taking into account these claims stating that “The EU must provide financial support at least equivalent in financial value to the revenues generated by the sale of CBAM certificates, to support least developed countries’ efforts to decarbonise their manufacturing industry” (European Parliament, 2022). This issue could seem minor for the EU since the LDCs constitute 0.1% of imports to the EU in Iron and Steel, Fertiliser and Cement (EU Commission, 2021). However, from the LDCs these trade exchanges may be crucial for their economies. It remains to be seen if this measure will be sufficient to moderate the complains of the least developed countries.

4. Criticism about the CBAM

Now that we have a comprehensive view of what is CBAM, its potential impact on the EU and trading partners and the potential issue surrounding its application, I will present the arguments that opponents to CBAM raise. The main discussion, discussed in sub-section 1, is around the importance of carbon leakage. Other arguments are then developed in the second sub-section.

4.1 The debate around carbon leakage

As a reminder, carbon leakage is defined as situations where businesses transfer their production to other countries to avoid costs related to climate policies (European Commission, 2022b). Among authors, the existence and magnitude of carbon leakage is not unanimously supported. To understand why carbon leakage raises such a debate, it is important to study how carbon leakage occurs. There are four sources of carbon leakage (Droege & al. 2009). The first one is competitiveness leakage, which is the fact that foreign goods have a competitive advantage because of the domestic carbon price. This leads to increased production and carbon emissions outside the EU. The second is the energy market channel. It arises when countries with less stringent climate policy benefits from fossil fuel price decrease to increase their consumption and thus their carbon emission (Simola, 2020).

Then, there is the income channel and the technology spill overs channel. A first source of divergence across researchers' conclusions on carbon leakage is the source they consider. Different studies try to estimate the level of carbon leakage within the EU, achieving opposite results.

Another source of differences across carbon leakage studies is the methods used. Part of the literature uses ex-ante models based on simulations, while other authors have tried to quantify the carbon leakage ex-post based on trade flows (European Commission, 2021). Both methods lead to opposite conclusions. While the ex-post studies of the Kyoto protocol found evidence of leakage (Magacho & al. 2022), more recent papers do not find evidence of carbon leakage. For instance, a report of the World Bank concluded in 2019 stated that there was little evidence of relocation of firms due to carbon pricing. Another study from Ellis & al. (2019) reached the same conclusion that CBAM has a limited effect on competitiveness after reviewing ex-post literature.

Conversely, the ex-ante method often finds signs of carbon leakage. For instance, the meta-analysis of Branger & Quirion (2014) shows that the share of saved domestic emission that are offset by increased emission in other parts of the world would be of 14% on average. According to the Commission, the difference between the two models relies on the fact that ex-ante studies do not usually take into account protection measures against carbon leakage. Such policy like free allowances limit the phenomenon, like the ex-post studies illustrate (European Commission, 2021). Another explanation of this difference could be the low price of carbon between 2006 and 2018 which doesn't pressure firms and limits their need to relocate (Eline Blot & Kettunen, 2021).

Moreover, carbon leakage can operate through two channels: direct leakage and indirect leakage, i.e. international energy prices channel (Zachamn & Mc Williams, 2020). These different forms require differentiated solutions. The inclusion of indirect emissions has already been discussed.

Few articles attempted to estimate the carbon leakage in the emission-intensive and trade-exposed sectors (EITE). In the cement, aluminium and steel and iron industry, leakage is estimated between 20% and 70% (Demailly & Quirion, 2005; Ponsard & Walker, 2008).

Furthermore, the impact of CBAM in the fight against carbon leakage is also challenged by some authors. For example, Lesmann & al. (2009) found that leakage decreases slightly when imposing a border adjustment tax. Another study which criticizes the effectiveness of it is

detailed by Elliott & al. (2010). Conversely, evidence of the efficiency of CBAM against carbon leakage exists. Böhringer & al. (2012) analysed 12 different CGE models and showed that leakage is reduced by the implementation of CBAM. On this issue, Sato (2022) also underlines the fact that the CBAM would apply without taking into account the climate policy of ambition of the third country, since it is based on the placing price on emissions. Moreover, a higher environmental target does not systematically translate into higher costs. The higher cost that would be supported by the EU firms does not further lead to a higher consumer price and a decrease of demand for EU products (Sato, 2022). Consequently, carbon leakage is not an automatic issue.

To conclude, the extent of the issue of carbon leakage remains controversial. The numerous parameters that enter the estimation of this event complicates the drawing of a straightforward conclusion.

4.2 Other criticism/risk for the CBAM

On top of the uncertainty linked to the carbon leakage issue, other disadvantages come with the CBAM measure, i.e. international reluctance, carbon pricing variations and miscomputing of the carbon emissions.

First, there is a risk of political resistance around CBAM could turn into conflict and deter international cooperation on climate issues (Zhong & Pei, 2022; Banks & Fitzgerald, 2020). Indeed, the measure could be seen as protectionist, especially by developing economies. Hagen & Schneider (2021) studied the issue of retaliation and identified a ‘threshold effect’. In this sense, Lim & al. (2022) provide empirical evidence of potential retaliation effects. Moreover, the threat of trade sanctions doesn’t affect the threat of retaliation for small coalitions. Conversely, as I briefly introduced in the first section, several authors argue that cooperation would lead to a more efficient CBAM than conflict. Indeed, several studies concluded that, under certain conditions, CBAM could foster cooperation. For instance, Lesman & al. (2009) found that imposing tariff on imports rise the participation to coalition. This is what Nordhaus (2015) will develop later: Pushing coordination could lead to a stable climate club with a high level of abatement. Being the most mature BCA, the EU CBAM could constitute an important element in the building of a climate club (Bierbauer & al. 2021). Accordingly, the combination of carbon pricing with trade sanctions could have a great impact on global emissions (Böhringer & al. 2022). However, these trade sanctions would conflict with the WTO rules and create tensions between countries. Moreover, the effect on

international inequality could be negative, as Böhringer & al. (2018) found: a carbon tariff applied by the OECD would make OECD/non-OECD inequalities rising.

Second, the variation of carbon pricing could affect the effectiveness of the measure as well as the cost supported by emerging countries (Simola, 2021). Indeed, the price of carbon emission could rise due to CBAM and more generally due to the rising climate ambition of the EU (Bellora & Fontagné, 2022). As an illustration, the price of carbon varied from less than \$US1/tCO₂ and \$US127/tCO₂ in 2019 (Ramstein & al. 2019). With such a range of prices, it sounds difficult to organize a global climate policy. Marcu & al. (2021) underline the methodological challenge that the heterogeneity of carbon costs may set up. Moreover, the difference between the carbon price of third countries could weaken the mechanism and its coordination with foreign similar policy. Finally, the administrative costs of CBAM could be considered as important for firms as well as for the institution managing the mechanism (European Commission, 2021).

Another key element of Carbon Border Adjustment is the estimation of the embedded emissions. Indeed, these estimations need to be accurate and up to date so that they encourage foreign firms to reduce their emissions (Magacho & al. 2022). However, it could be difficult to gather enough data to have a fair idea of the real carbon content of goods, especially for indirect emissions (Böringer & al. 2022). More than an issue of effectiveness, the challenges linked to embedded emission could lead to a conflict with the national treatment principle of WTO rules. In some sectors targeted, the complex downstream value chain could allow firms to avoid the CBAM. Indeed, they could buy downstream products from third countries which are not encompassed in the taxonomy (Marcu & al. 2021).

Finally, there is a risk that resource shuffling would limit the effect of CBAM (Marcu & al. 2021). This expression “refers to the allocation or attribution of less emissions-intensive materials production towards markets with higher carbon costs, while the overall carbon intensity of production in the home market remains constant” (EU Commission, 2021). In other words, non-EU producers will shift their low carbon intensive goods to the EU and their more polluting production to less strict countries (Kardish & al. 2021). To resume an example of Marcu & al. (2021), China could send the 10% of aluminium production from hydroelectric power to the EU while aluminium produced with coal-fired electricity will be directed to other markets. A paper of Stede & al. estimated in 2021 that it could be until 80% for certain sectors. This would result in higher carbon leakage and undermine CBAM effect.

5. Conclusion – Policy recommendations

The concept of Carbon Border Adjustment had been widely discussed in the literature. In 2021, the policy proposition of the EU Commission, the CBAM, has fostered the publication of studies on this topic. Among those papers, no consensus arises on the merits and effectiveness of the measure. In this thesis, I tried to provide a comprehensive overview of the mechanism, its economic impact and the different issues that the proposition raises.

The CBAM should replace the system of free ETS and prevent carbon leakage. The measure will first be tested between 2023 and 2025. From 2026 onwards, the transition between ETS and CBAM will be gradually applied. However, all these features remain subject to modification since trilogue negotiations are still in place to validate a final version of the measure.

Researchers have multiple opinions on the measure. On one side, the measure will have a negative impact on several trading partners of the EU. Developed countries have/profit from a high degree of exchange, hence the damage could be more severe for least developed countries which are more dependent on their EU exports. In this sense, the CBAM goes against the principle of common but differentiated responsibilities. The uncertainty surrounding the reception of CBAM by the WTO and the possibility of trade retaliation is highlighted by academics (Fouré & al. 2016, Banks and Fitzgerald, 2020). Finally, the discussion around carbon leakage raise question about the appropriateness of such policy.

On the other side, as the free ETS allocations seem to reach their limits, there is a need for a policy change to protect EU firms and foster the reduction of carbon emissions. Therefore, CBAM is presented by some authors as an effective measure to fight carbon leakage and improve competitiveness. Moreover, it could foster climate action in other countries.

To reconcile the pros and cons of CBAM around a common measure, different recommendations could be addressed. First, the inclusion of indirect emissions would increase the impact of CBAM by encompassing a greater share of carbon emissions (Marcu & al. 2022). Considering the complexity of calculation of indirect emissions, the CBAM's coverage of these emissions should be included in a second phase. Next, improving the dialogue with third countries could help to find a common ground and avoid UNFCCC litigation (Institute for European Environmental Policy, 2021). The distribution of a share of CBAM revenue to least developed countries, or at least a support to help them to improve their carbon footprint, could also contribute to limit the reluctance against the measure (Brandi, 2021). The EU

should also pay attention that free ETS allowances and CBAM do not overlap, which would constitute a double protection difficult to justify at WTO (Kardish & al. 2021). Finally, an efficient CBAM should include a carbon price which incentivizes firms to adapt and improve their carbon footprint. Considering these different remarks could lead to a CBAM with a greater impact on the environment and which is better accepted by third countries.

However, one element has escaped to the reflection of this thesis: a study of the firm's behaviour. Indeed, it's difficult but crucial to observe how firms would react to CBAM, would they comply to the measure and how should they do so. Helped by the upcoming steps of the CBAM implementation, it should be easier to seize the microeconomic impact of CBAM.

Annex

GATT/WTO Article	Key Issues	Possible Incompatibility	Note
GATT Article I: General Most-Favoured-Nation (MFN) Treatment	Article I is the most fundamental GATT principle banning discriminatory treatment between members. Thus, there should not be any discrimination in tariffs, fines, import/export regulations, procedures, and more, for all members.	The EU will assess the border adjustment tax in different ways considering CO ₂ content, environmental regulations, and technology of exporters on a particular item. Therefore, this is clearly incompatible with the MFN treatment principle.	There is no way to resolve the incompatibility issue with Article I as of now (Englisch and Falcao, 2021).
GATT Article II: Schedules of Concessions; Clause (a) Border Adjustment Tax (BAT)	"A penalty, commensurate to an inland tax, on all or partial goods which contribute to manufacturing or production of imports or domestic goods" is included in Article II Clause (a). Whether the CBAM does apply to the BAT or not is a critical issue.	Although the EU maintains the CBAM is not a BAT, non-EU countries with higher tariff burdens tend to view it as a BAT.	If the CBAM tariffs exceed the EU's binding tariffs, the situation could get worse.
GATT Article III: National Treatment on Internal Taxation and Regulation	In principle, an inland tax or other penalties that are normally not imposed on domestic goods must not be imposed on foreign goods (the GATT's second principle).	The carbon adjustment tax is imposed only based on carbon content. This can violate the national treatment principle.	There is a limitation on the EU when assessing the carbon content of all imports. Also, other technical issues can arise.
GATT Article XX: General Exceptions	The CBAM-related aspects in Article XX are clauses (b) and (g) as well as the chapeau clause. Clause (b): A measure on health and life protection of humans and animals/plants. Clause (g): A measure on preservation of limited natural resources. Chapeau: The environmental preventive measures must not be used as a "willful" or "unfair discriminatory tool" between countries in similar conditions.	Clauses (b) and (g) can be compatible. However, the CBAM must be applied in the same manner as a domestic carbon tax. There must not be any willful or unfair discriminatory tool, as declared in the chapeau. It depends on the regulations mentioned in the chapeau clause.	If the CBAM is permitted as a general exception, other countries' imposition of carbon taxes must also be allowed. That is, there is the possibility that protectionism will prevail.
GATT Article XI: General Elimination of Quantitative Restrictions (QR)	This is one of the GATT's top three principles. The article bans quantity restrictions and import licensing; only tariffs, taxes, and penalties are allowed.	Based on this article, the way the CBAM enforces foreign producer participation in the EU ETS can be interpreted as a form of QR. Thus, this is incompatible with the WTO agreement.	In this case, the costs of the CBAM can be increased due to the QR.

GATT/WTO Article	Key Issues	Possible Incompatibility	Note
GATT Article XXI: Security Exceptions	When members seek to protect critical national security interests, they can take exceptionally necessary measures under this article (specifically, during wartime or other internationally urgent circumstances).	Whether the Intergovernmental Panel on Climate Change (IPCC) announcement can be construed as being for security purposes or not will be a critical point.	Similar measures adopted by their countries will also have to be approved as a national security exception.
WTO Agreement Clause 3 of Article IX and Clause 4 of Article XVI	If it is difficult for a member country to implement a WTO agreement due to an “exceptional circumstance” the country can ask for a waiver of duties, but all member countries must agree to grant the waiver.	If the CBAM is considered a critical situation, it can be deemed an “exceptional circumstance”, and thus, the EU can request a waiver.	Since the WTO requires unanimity, the likelihood of receiving a waiver is remote.

Source: Lim & al. (2021) based on the Articles of the GATT

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