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FINANCIAL IMPACTS OF THE CARBON BORDER ADJUSTMENT MECHANISM ON SELECTED TRADE PARTNERS: CROSS-NATIONAL AND CROSS-SECTORAL ANALYSIS

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ABSTRACT

The Carbon Border Adjustment Mechanism (CBAM) is an import fee levied by a region, i.e., the European Union (EU), that taxes carbon on goods produced in countries that do not tax carbon. This EU climate neutrality support mechanism, which should be implemented by 2050, has caused some concerns. For example, it could reduce the export of the EU's trading partners, especially those countries largely dependent on exporting energy-intensive goods and materials to the EU. Least developed countries, due to their high risk of vulnerability and high exposure, could face particularly pronounced adverse effects from the CBAM's introduction. Therefore, this article aims to analyze how the introduction of the CBAM will affect the EU's external trade partners, with particular attention to its potential consequences for selected economies. Most of the literature related to the introduction of the CBAM focuses on the consequences for EU countries. However, this mechanism, which aims to decrease CO2 emissions and encourage a low-carbon transition, could disproportionately affect some countries outside the EU. That is why the article uses data on the exposure of selected non-EU countries to the CBAM, utilizing data on the export of the CBAM-affected products to the EU and CO2 emission intensity. The analysis encompasses five regions and 59 countries, using data from the year 2019. The rationale for using 2019 data is to avoid the effects of global shocks in recent years, such as the coronavirus pandemic and Russia's invasion of Ukraine. The analysis results reveal that the exposure of regions and countries varies based on the strength on their trade relations with the EU, leading to different trade impacts from the CBAM. The lowest exposure is observed in the regions of the Americas and Australia. This article provides valuable insights to policymakers and entrepreneurs in navigating the challenges and opportunities arising from the interlinkage of environmental policies and global trade dynamism. It can help facilitate decision-making related to participation in foreign trade involving products with a higher carbon emissions.

KEY WORDS

CBAM, financial impacts, relative CBAM exposure index, trade relations

CLASSIFICATION

JEL: F18, F38, H23, Q56, Q58

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INTRODUCTION

The EU Emissions Trading System (ETS) certainly affects the costs incurred by the manufacturers in the EU, and consequently, their competitiveness in both EU and international markets. It can be foreseen that EU manufacturers would react to such a system in various ways, depending on product characteristics such as carbon-intensiveness and trade volumes [1]. The EU faces two main challenges related to this situation. One is the potential loss of employment and production to other countries, driven by adherence to CO_2 emission regulations. Additionally, any producer unwilling to comply with CO_2 emission reduction regulations could realocate their business outside the EU, continuing production with the same emission level as before. Ultimately, this would mean that efforts to reduce CO_2 emissions and create a greenhouse within the EU would have limited impact and could not be effectively applied on a global scale.

The threat of carbon leakage is an issue that arises from the disparity between regions or countries that do or do not implement effective carbon regulations. In the context of reducing CO_2 emissions, one of the most important strategic decisions could be the adjustment of the CBAM. The primary purpose and goal of this mechanism is to eliminate differences in carbon costs in traded goods through border adjustment procedures [1]. The CBAM aims to reduce and prevent carbon emissions while placing foreign producers on equal footing with EU producers, who are required to comply with the EU ETS regulations. This would create a level playing field for producers both within and outside the EU. Additionally, the CBAM could encourage non-EU governments to adopt greener policies and motivate their producers to reduce their carbon emissions [2].

A United Nations Conference on Trade and Development study [3] found that the CBAM could alter trade patterns by favoring economies with relatively carbon-efficient production and suppressing exports from developing economies with carbon-intensive industries. Economies with emissions-intensive and trade-exposed products as a large share of their exports would be particularly vulnerable. Moreover, the risks associated with adapting to the CBAM would increase for economies that rely heavily on the EU as their export market, as well as for those lacking the capacity to monitor and report production-related carbon emissions [4]. Economies struggling to adapt to the low-carbon paradigm may face greater risks, due to their exposure and vulnerability to the CBAM.

The CBAM's introduction can have significant economic implications for trade and investment, particularly in developing countries. Building on this, the following paragraph provides insight into the research question addressed by this article and outlines its research aim.

The research question is:

RQ: *Are there significant differences in exposure to the CBAM among selected non-EU countries?*

The aim of this research is to conduct a comparative analysis of the exposure of selected non-EU countries to the CBAM, both in aggregate and by sector.

The article is structured as follows. Section 1 provides a literature review. Section 2 outlines the context of the research. The third part presents the data used and the methodology. Section 4 illustrates the findings and discusses the results. Section 5 concludes the article and proposes directions for future research.

LITERATURE REVIEW

The introduction of the CBAM has triggered a lively debate on its potential impacts, particularly when it comes to developing countries [5] Many authors [6-11] review environmental policy design features such as the CBAM. From an economic perspective, the most pressing concern in studies of the CBAM is its effectiveness in promoting fair competition, curbing carbon leakage, and improving global welfare [5]. Depending on how the impacts develop, the CBAM's effects can be classified as direct and indirect. The direct effects are, in fact, variations in market outcomes caused by (relative) price changes due to CBAM implementation, such as reducing competitiveness loss and carbon leakage triggered by unilateral climate policies [12, 13]. Indirect effects refer to the CBAM acting as a threat that motivates countries to enhance their climate ambitions, either by inducing economies to join the climate club or by promoting more stringent carbon policies.

The notion that the CBAM can influence affected countries to adopt emission controls of their own is also referred to as its strategic value [5]. Böhringer et al. [14] find that the CBAM can effectively mitigate carbon leakage and smooth out the negative impacts on energy-intensive and trade-exposed sectors in countries with unilateral carbon pricing mechanisms. In an extensive literature review by Newman [15], the CBAM is frequently advocated as an effective, WTO-compliant, non-discriminatory tariff, and a precautionary measure. According to the "pollution haven hypothesis" or the "pollution haven effect," as countries become economically wealthier, they tend to introduce stringent environmental regulations that force domestic firms to outsource or relocate polluting industries to regions with less strict environmental rules [16]. Concerns have been raised about the ecological inequality that low-income economies likely face from increased pollution and environmental degradation due to hosting these relocated industries [17].

As noted by [16], the CBAM is one of the practical instruments a country can employ to address carbon leakage and the competitiveness of domestic industries in the local market. The key idea behind the CBAM is to impose a carbon price on imported goods based on carbon content to create a level playing field with domestically produced products. Many economists prefer the CBAM proposal and argue that it is feasible, legal, and has the potential for a significant impact on global emissions. There is a consensus among many economists that the CBAM is legal under WTO laws and guidelines.

Before it came into force, several studies, including those of [3] and [18], indicated that economies relying on exporting goods with high carbon content to the EU27 would be adversely affected. Thus, the impact of the CBAM is a subject of significant interest and debate among policymakers, economists, and global stakeholders [14, 16, 19-21]. Numerous authors believe that the introduction of the CBAM will hurt poorer countries due to their low level of energy transition. Studies like that of [3] suggest an increased diffusion and uptake of environmentally friendly technologies.

A study by [22] finds that the impact of the carbon tax on most trading partners of the EU27 will be limited, but the effect will also vary widely among regions and sectors. In a review of the impact of the intended carbon tax by the EU, [3] finds that EU-CBAM has the potential to alter global trade patterns in favor of countries with less carbon-intensive production processes. This impact suggests that the exports of developing countries to the EU27 will be adversely affected. [15] argues that a carbon border tax is likely to succeed in reducing carbon emissions if regulated and enforced properly.

Previous literature largely analyzes the effects of the CBAM on EU member states, focusing on the potential reduction in imports into the EU and the increase in the price of imported goods. Consequently, there is a lack of studies providing a comparative analysis of the effects of the CBAM on countries outside the EU that have trade relations with the EU.

This article addresses the aforementioned literature gap by providing a comprehensive comparative analysis of the exposure of EU trade partner countries, detailing the country-specific contexts, and linking them to the exposure to the CBAM. The analysis is conducted for each sector covered by the CBAM measure.

BACKGROUND

CONTEXTUAL OVERVIEW

As countries begin to price carbon and implement additional policies to address environmental damage, the issue of "carbon leakage" has emerged. Instead of reducing pollution as intended, domestically produced products are beign replaced with more carbon-intensive imports. This undermines the effectiveness of carbon pricing and makes environmental regulations less effective. To combat this, the European Commission proposed the CBAM on July 14, 2021. This carbon border tax aims to prevent carbon leakage and increase global accountability for environmental degradation by equalizing the price of carbon in the EU with that of imports [15]. The CBAM functions as a tax based on the carbon content of imported goods and the price difference between carbon in the EU and the exporting economy, where a carbon price is often nonexistent [4].

IMPLEMENTATION TIMELINE OF THE CBAM

Figure 1 presents a timeline of the CBAM's introduction. As illustrated, in December 2019, the European Commission adopted a communication on the European Green Deal. This was followed by the "Fit for 55" communication in July 2021, which included a package of legislative proposals aimed at achieving a 55 % reduction in greenhouse gas (GHG) emissions by 2030, as an intermediate goal towards climate neutrality by 2050 [2]. The package also included a proposal for implementing the CBAM [23].

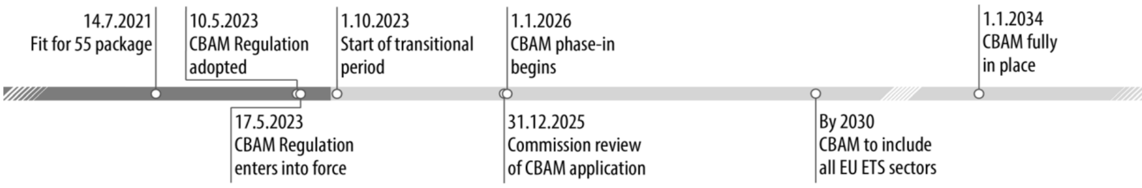

Figure 1. CBAM's introduction timeline

In May 2023, the EU adopted Regulation 2023/956, which establishes the CBAM to impose a price on GHG emissions from imports equivalent to that of products manufactured in the EU. By adopting the CBAM, the EU became the first jurisdiction to extend its domestic carbon price to emissions generated outside its borders [24].

OVERVIEW OF ACTORS IN THE CBAM

The CBAM aims to strengthen climate action by including imported goods in carbon pricing, thereby giving goods with a lower carbon footprint an advantage over those associated with high emissions. The CBAM ensures that the same carbon price is paid for goods within the EU, irrespective of whether they are produced in the EU and thus covered by the EU ETS or abroad. Importers must report the emissions occurring during production (embedded emissions) and surrender CBAM certificates, which are sold at the average price of EU allowances. If producers in third countries pay a carbon price, the surrender obligation is reduced to reflect the price effectively paid, Figure 2.

OVERVIEW OF CBAM SECTORS, REPORTING REQUIREMENTS AND CERTIFICATE PRICING

The sectors covered by the CBAM are cement, electricity, fertilizers, iron and steel, and aluminum, as well as some precursors and downstream products derived from cement, iron and steel, and aluminum. The CBAM's product scope is expected to be extended to cover all EU ETS sectors by 2030. The CBAM also includes indirect emissions from the generation of

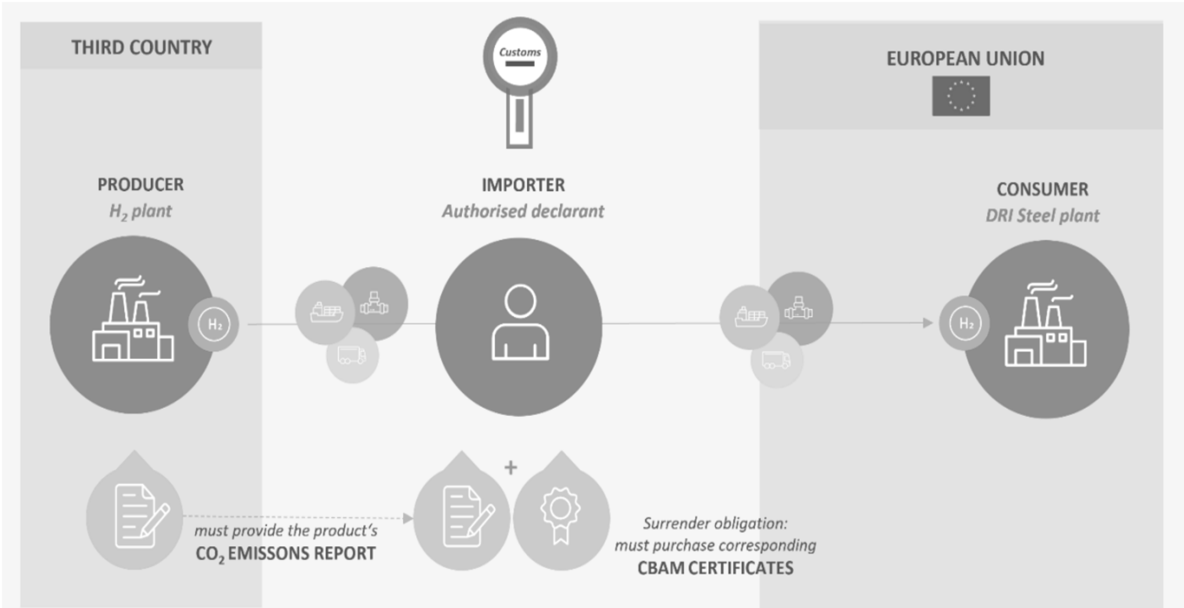

Figure 2. Participants involved in the CBAM and their roles.

electricity used for producing goods, except for goods for which the EU ETS Directive allows the member states to compensate indirect costs [2]. The GHG emissions covered under the CBAM are CO_2 and, where relevant, nitrous oxide (N_2O) and perfluorocarbons (PFCs) [25]. Table 1 provides an overview of the emission requirements related to the sectors subject to CBAM.

Table 1. Overview of emission-related requirements for CBAM sectors.

Issues	**CBAM goods**					
	Cement	**Fertilisers**	**Iron/Steel**	**Aluminum**	**Hydrogen**	**Electricity**
Reporting metrics	(per) Ton of goods					(per) MWh
GHG covered	Only CO_2	CO_2 (plus N_2O for some fertiliser goods)	Only CO_2	CO_2 (plus PFCs for some aluminum goods)	Only CO_2	Only CO_2
Emission coverage during transitional period	Direct and indirect					Only direct
Emission coverage during definitive period	Direct and indirect		Only direct, subject to review			Only direct
Determination of direct embedded emissions	Based on actual emissions, but estimations (includings default values) can be used for up to 100 % of the specific direct embedded emissions for imports until 30 June 2024 (i.e., CBAM reports due until July 31, 2024) and for up to 20 % of the total specific embedded emissions for imports until December 31, 2025.					Based default values, unless several cumulative conditions are met
Determination of indirect embedded emissions	Based on actual electricity consuption and default emission factor for electricity, unless conditions are met (i.e., direct tehnical connection or power purchase agreement). Estimations (including default values) can be used for up to 100 % of the specific indirect embedded emissions for imports until June 30, 2024.					Not applicable

During the transitional period (i.e., from October 1, 2023, to December 31, 2025), only reporting requirements are in place. Starting January 1, 2026, importers will be required to acquire CBAM certificates for the GHG emissions associated with the production of imported goods that are not subject to equivalent carbon pricing in the country of origin [2]. The penalty for non-compliance is a charge ranging from EUR 10 to EUR 50 per ton of unreported emissions.

The price of the CBAM certificates follows the price of emissions allowances in the EU ETS, thereby creating a level playing field between foreign and EU producers. The CBAM will gradually replace the EU ETS free emissions allowances mechanism, utilizing a 9-year phase-out of free allowances under the EU ETS from 2026 to 2034, with a corresponding phase-in of the CBAM. During this period, free emissions allowances will be reduced at an initially slower rate, which will accelerate as the period ends. The reduction rate for free allowances, according to the EU ETS, is as follows: 2,5 % (2026); 5 % (2027); 10 % (2028); 22,5 % (2029); 48,5 % (2030); 61 % (2031); 73,5 % (2032); 86 % (2033); and 100 % (2034) [2].

RESEARCH METHODOLOGY

This study uses descriptive statistics to analyze the exposure of selected non-EU countries to the CBAM, utilizing data on carbon emission intensity and the export of CBAM-affected products to the EU. The authors employ methods of analysis and deduction to interpret the collected data, ensuring a thorough examination of the exposure and challenges.

The analysis includes five regions and 59 countries for which data for the year 2019 were available on the World Bank website, along with two additional countries – Norway and Switzerland) – that are included only in the sector-specific exposure analysis. The rationale for using 2019 data is to avoid the effects of recent global shocks, such as the coronavirus pandemic and invasion of Ukraine, as noted in [26]. This is shown in Table 2.

For the comparative analysis of exposure for each country, both aggregate and by sector, the Relative CBAM Exposure Index developed by the World Bank is used, as stated by [4]. The Relative CBAM Exposure Index is designed to identify countries with high exposure to the CBAM, using carbon emissions intensity and exports of CBAM-affected products to the EU. Assuming a carbon price of USD 100 per metric ton, the index measures the additional cost of CBAM certificates for exporters compared to the average EU producer, adjusted by the proportion of exports to the EU market. It recognizes cost changes in the EU market, where EU producers also bear emissions costs, enabling relatively clean exporters to gain competitiveness despite the requirement to purchase certificates. The aggregate relative index represents the trade-weighted relative exposure across all CBAM-affected products [26].

The methodology for calculating the Relative CBAM Exposure Index can be summarized in the following formula:

$$\text{Relative CBAM Exposure Index} = \frac{X_{cs}^{EU}}{X_{cs}^{World}} * \text{USD 100 per ton} * EI_{cs} \quad (1)$$

where c denotes country, s – sector, X – exports, and EI – emission intensity.

This article examines how the selected countries, which are trade partners of the EU, differ in terms of the exposure to the CBAM, both aggregate and by sector. This analysis will identify the countries currently most exposed to additional costs due to the CBAM's introduction.

Table 3 summarizes all variables used in the research, detailing their basic characteristics such as variable name, scope, measurement method, unit of measurement, and source.

Table 2. A list of the selected economies. The categorization of countries by region is based on the division provided in [27]. It has been adapted so that the Americas are considered as one region (without separate division for North America and South America), and Australia and Oceania are combined into a single region (referred to as "Australia" in the following text).

World regions	Country	World regions	Country
Asia	Azerbaijan	Africa	Cameroon
	Bahrain		Egypt
	Cambodia		Ghana
	China		Mauritius
	Georgia		Morocco
	Hong Kong SAR		Mozambique
	India		Senegal
	Indonesia		South Africa
	Iran		Tunisia
	Israel		Zimbabwe
	Japan	America	Argentina
	Jordan		Brazil
	Kazakhstan		Canada
	Kuwait		Chile
	Malaysia		Colombia
	Oman		Costa Rica
	Pakistan		Mexico
	Philippines		Peru
	Qatar		Trinidad and Tobago
	Saudi Arabia		United States
	Singapore		Venezuela
	South Korea	Australia and Oceania	Australia
	Sri Lanka		New Zealand
	Taiwan	Europe	Albania
	Tajikistan		Belarus
	Thailand		Norway
	Turkey		Russian Federation
	United Arab Emirates		Switzerland
	Vietnam		Ukraine
			United Kingdom

Table 3. Overview of key variables in the study**.** The Relative CBAM Exposure Index is based on the following factors: CO_2 emissions intensity of exports (kg CO_2 eq./USD) above EU average intensity, exports to EU (% of country's total exports), and carbon price at USD 100 per ton CO_2 eq. Source: World Bank.

Variable name	Scope	Measurement method and unit measurement
CBAM-affected Products Exports to the EU	Aggregate	% of total CBAM-affected products exports to world % of GDP
	Iron and steel	% of total iron and steel exports to the world
	Fertilizer	% of total fertilizer exports to the world
	Cement	% of total cement exports
	Aluminum	% of total aluminum exports to the world
Relative CBAM Exposure Index	Aggregate	The exporter's emission intensity multiplied by a carbon price of USD 100 per ton
	Iron and steel	The exporter's emission intensity multiplied by a carbon price of USD 100 per ton
	Fertilizer	The exporter's emission intensity multiplied by a carbon price of USD 100 per ton
	Cement	The exporter's emission intensity multiplied by a carbon price of USD 100 per ton
	Aluminum	The exporter's emission intensity multiplied by a carbon price of USD 100 per ton

RESULTS AND DISCUSSION

CBAM EXPOSURE OF SELECTED ECONOMIES: CROSS-NATIONAL ANALYSIS

From Figure 3, it can be seen that the countries closer to the EU have the highest aggregate relative CBAM Exposure Index, indicating higher foreign trade volumes with the EU. These primarily include certain countries in Europe and Asia. Additionally, some countries exhibit a negative value for the exposure index, suggesting that their CO_2 emission intensity is lower than the EU average. Most of these countries are from the Americas (specifically, the South American region).

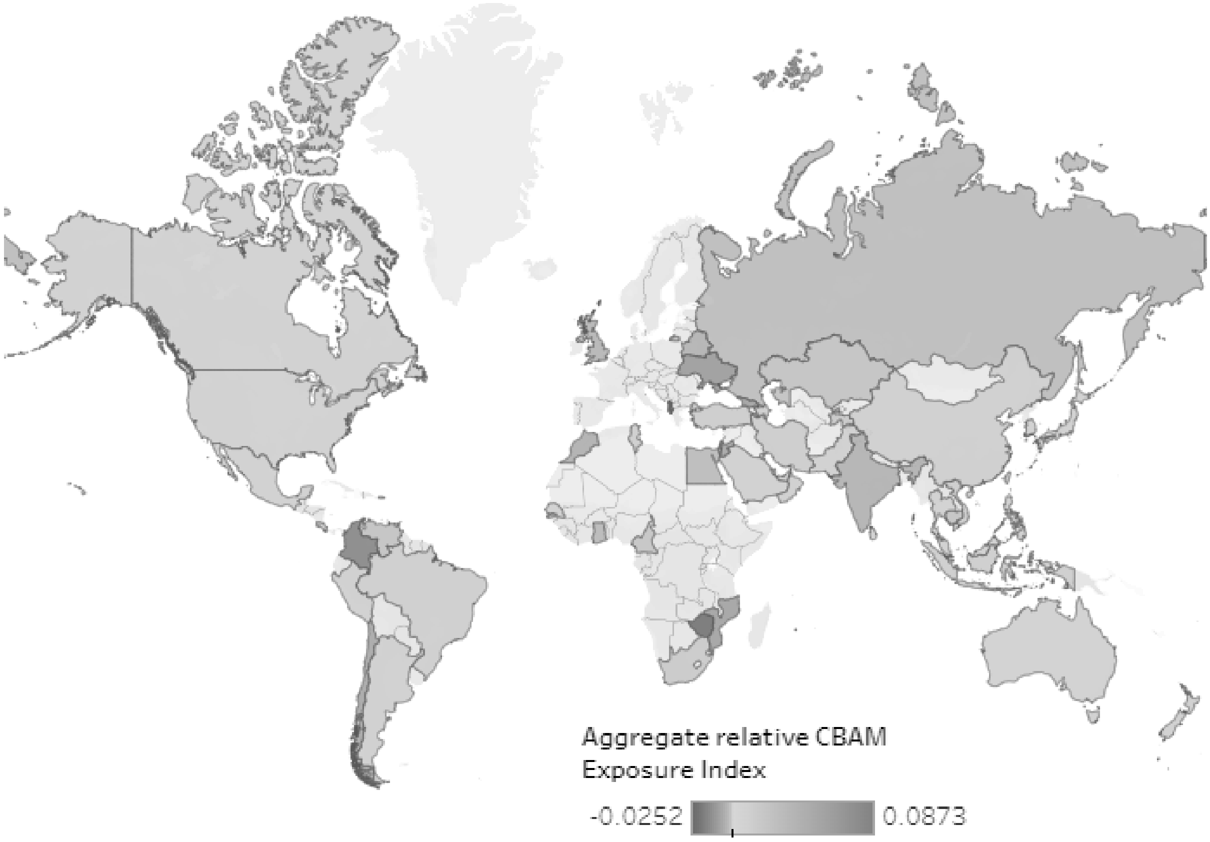

Figure 3. Aggregate Relative CBAM Exposure Index values for the observed regions.

In the rest of the article, the basic trends related to the introduction of the CBAM in the selected countries are explained. It involves an analysis of CBAM-affected product exports to the EU as a percentage of total CBAM-affected product exports to the world, CBAM-affected product exports to the EU as a percentage of GDP, and the values of the total Relative CBAM Exposure Index for the analyzed countries.

Figure 4 illustrates that CBAM product exporters to the EU, as a share of their total CBAM-affected products exported to the world, are predominantly from Africa; more specifically Cameroon (93,4 %), Zimbabwe (87 %), and Mozambique (73,7 %). European countries follow, with the United Kingdom (68,9 %), Albania (58,7 %), and Belarus (50,2 %). Among the smallest exporters of CBAM-affected products to the EU are countries from the American region, such as Senegal (1,1 %) and Costa Rica (0,9 %), as well as countries from Asia, including Singapore (1 %) and Qatar (0,8 %).

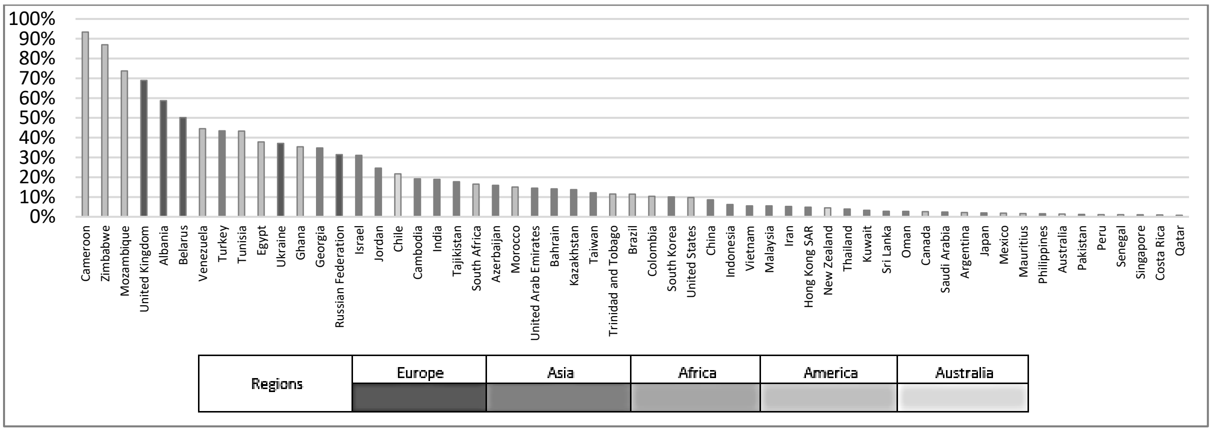

Figure 4. CBAM-affected product exports to the EU (% of total CBAM-affected product exports to the world).

Figure 5 shows the export of CBAM-affected products to the EU as a percentage of GDP. The graph excludes countries with a CBAM value as a percentage of GDP of zero. The largest exporter of CBAM-affected products relative to GDP is Mozambique (6,9 %), followed by Ukraine (2,4 %) and Belarus (1,4 %). It is noteworthy that for most of the observed countries, the export of CBAM-affected products as a share of GDP is not economically significant.

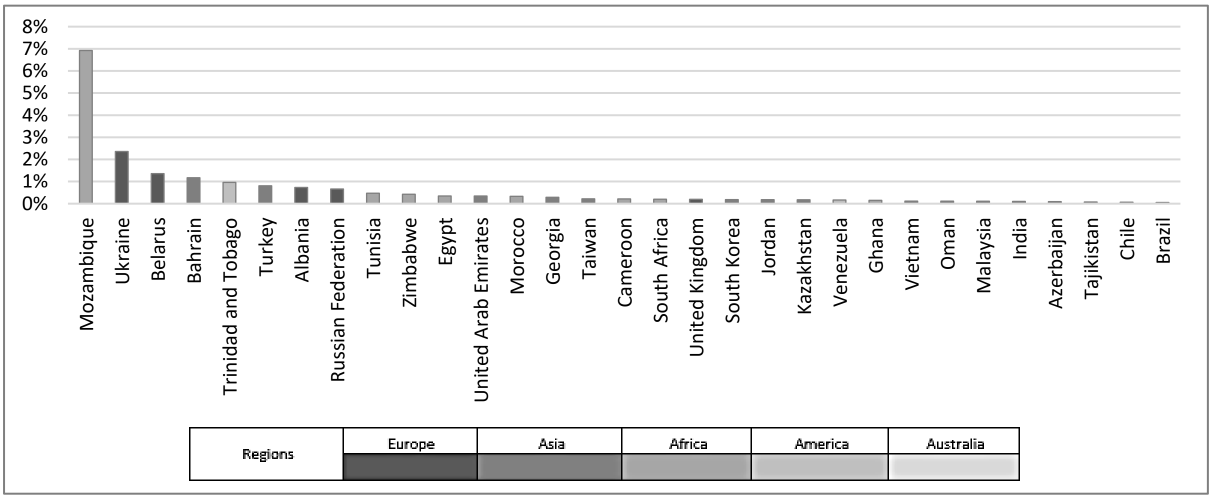

Figure 5. CBAM-affected product exports to the EU (% of GDP).

As shown in Figure 6, Zimbabwe has the highest aggregate Relative CBAM Exposure Index, with a score of 0,0873. It is followed by Ukraine, with a score of 0,525, and Georgia, with a score of 0,0464. This indicates that the additional costs of CBAM implementation for Zimbabwe will be USD 8,73 per ton of CO_2 emissions and USD 4,64 per ton for Georgia. Furthermore, Jordan, Colombia and Albania have the lowest aggregate Relative CBAM Exposure Index (i.e., negative index values less than 0,01). For the vast majority of the observed countries, additional costs from CBAM implementation are less than USD 1 per ton of CO_2 emissions.

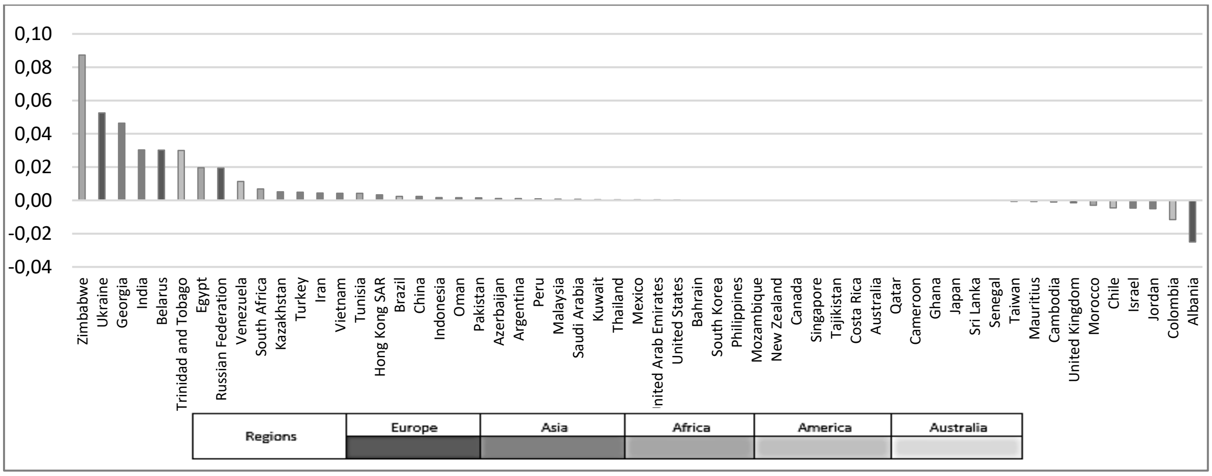

Figure 6. Aggregate Relative CBAM Exposure Index by the selected countries.

CBAM EXPOSURE OF SELECTED ECONOMIES: CROSS-SECTORAL ANALYSIS

The impact of the CBAM could be evident and significant when analyzed across specific sectors, as well as by countries or regions. Sectoral exposures are shown in Table 4, which is based on data on the export of CBAM-affected products. This table identifies the countries most exposed to these products. The analysis includes the following products: aluminum, cement, electricity, fertilizer, iron, and steel. First, the countries are categorized according to their exposure to these CBAM-affected products, followed by an analysis of the export status of these products within individual sectors.

Table 4. Most exposed CBAM-affected products by countries.

Countries	Most exposed CBAM-affected products
Ghana; Kazakhstan; Mozambique; Oman; Tajikistan; United Arab Emirates	Aluminum
Albania; Australia; Bahrain; Belarus; Cameroon; China; Colombia; Israel; Japan; Kuwait; Malaysia; Mauritius; Morocco; Pakistan; Philippines; Qatar; Saudi Arabia; Sri Lanka; Tunisia; Ukraine; United Kingdom; United States	Cement
Russian Federation; Turkey	Electricity
Azerbaijan; Chile; Egypt, Arab Rep.; Georgia; Jordan; Mexico; New Zealand; Trinidad and Tobago	Fertiliser
Argentina; Brazil; Cambodia; Canada; Costa Rica; Hong Kong SAR, China; India; Indonesia; Iran; South Korea; Peru; Senegal; Singapore; South Africa; Taiwan; Thailand; Venezuela; Vietnam; Zimbabwe	Iron and steel

Figure 7 illustrates the export of iron and steel to the EU as a percentage of the total export of these products to the world. Zimbabwe leads with 91,7 % of its total iron and steel exports. Following Zimbabwe are three European countries: Switzerland (77,1 %), Norway (73,3 %), and United Kingdom (66,4 %). Venezuela is the leading exporter of iron and steel from the Americas, with 50,1 % of its exports going to the EU, while Turkey is the leading exporter from Asia, with 43,2 %. The lowest export shares of iron and steel to the EU are recorded by Qatar and Colombia, at 0,6 % and 0,3 %, respectively.

Figure 8 represents the Relative CBAM Exposure Index for iron and steel, excluding countries with an index of zero. Only 16 countries have an exposure index greater than zero, though these countries' scores are generally low. Zimbabwe leads with an exposure index of 0,09, followed by Ukraine with an index of 0,05, and India with an index of 0,04. Only nine countries face an additional cost of CBAM implementation for iron and steel exceeding USD 1 per ton of CO_2 emissions, with Zimbabwe incurring the highest additional cost of USD 9,20 per ton of CO_2 emissions.

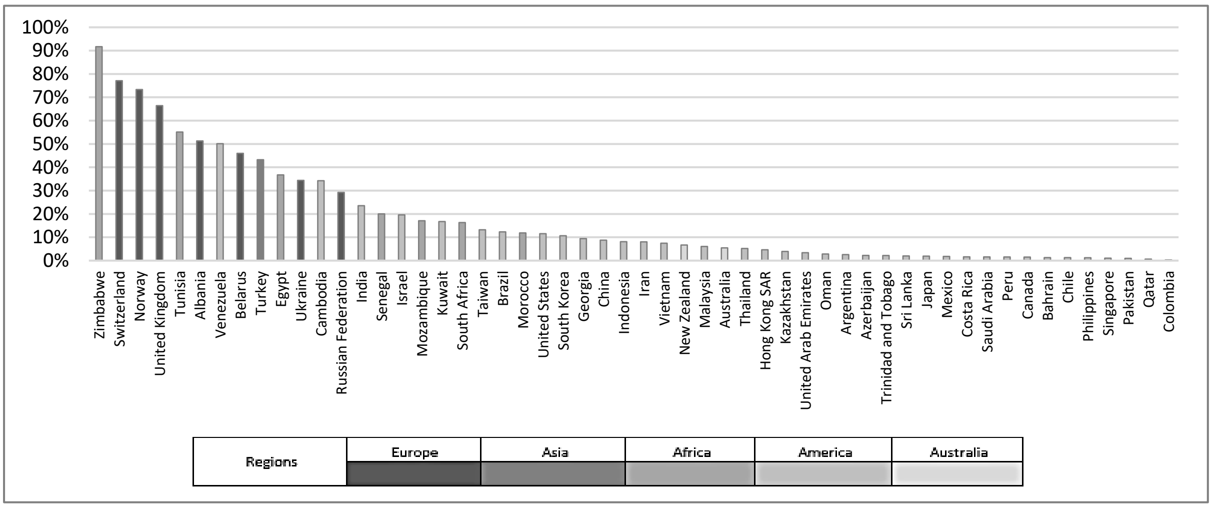

Figure 7. Exports of iron and steel to the EU (% of total iron and steel exports to the world).

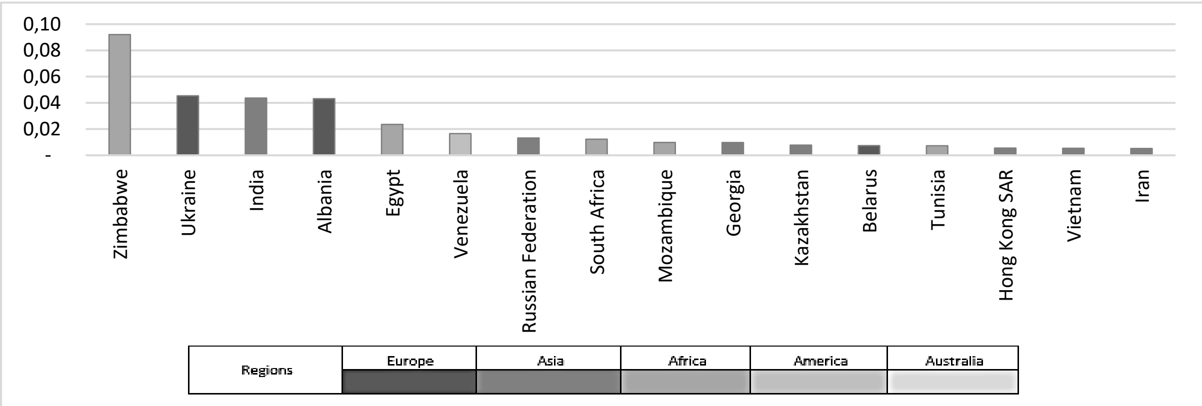

Figure 8. Relative CBAM Exposure Index for iron and steel.

As shown in Figure 9, the European region leads in fertilizer export to the EU, with Belarus exporting 75,3 % and the United Kingdom 67,6 % of their total fertilizer exports to the world. Europe is followed by the Asia region, where Georgia exports 59,5 % of its fertilizer exports to the world. Azerbaijan closely follows with 58,65 %, and Israel with 43 %. In the African region, Tunisia leads with 42,5 %, while in the Americas, Chile exports 29,6 % of its total fertilizer exports. Only 16 countries have more than 10 % of their fertilizer exports to the world.

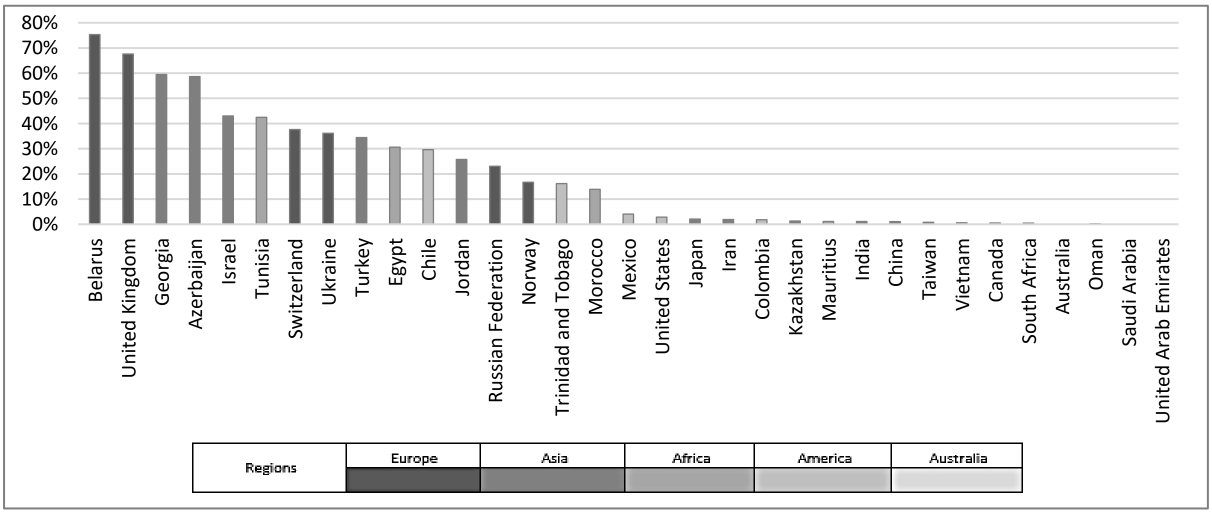

Figure 9. Exports of fertilizer to EU (% of total fertilizer exports to the world).

When looking at the Relative CBAM Exposure Index for fertilizer, as can be seen from Figure 10, Ukraine leads with the highest index of 0,0837. It is followed by Georgia from the Asian region with an index of 0,0814. From the American region, Trinidad and Tobago has the highest exposure index of 0,0436, while in Africa, Egypt has an index of 0,0268. This indicates that Ukraine faces the highest additional cost for exporting fertilizers under the CBAM, amounting to USD 8,37 per ton of CO_2 emissions. Figure 10 includes only countries with a positive exposure index, while ten countries have a negative CBAM relative exposure value for fertilizers.

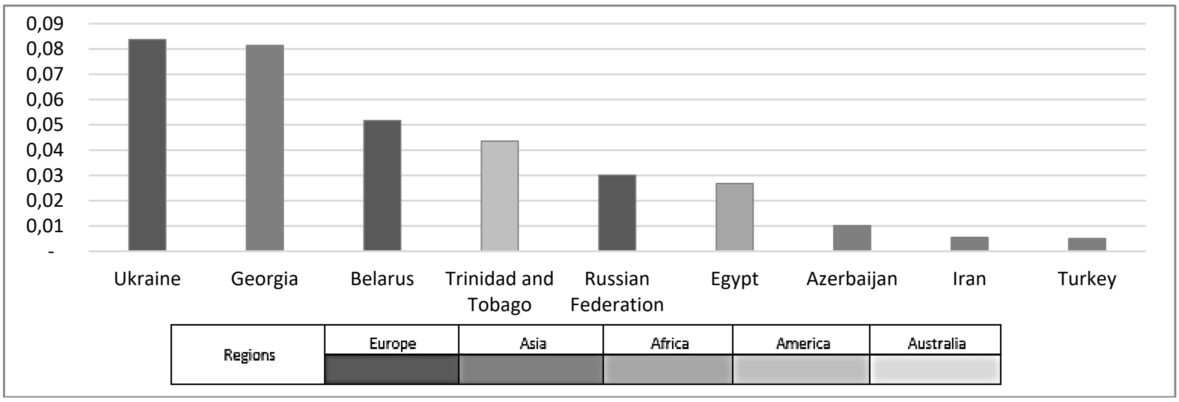

Figure 10. Relative CBAM Exposure Index for fertilizer.

The European region once again leads in terms of relative share in cement exports to the EU, with Ukraine exporting 90,6 % and the United Kingdom 72,1 % of their total cement exports. The Americas follow, led by Colombia with 67,3 %, and Africa by Morocco with 42,9 %. Notably, among 19 countries analyzed, 10 have a cement export share greater than 10 % of their total cement exports, Figure 11.

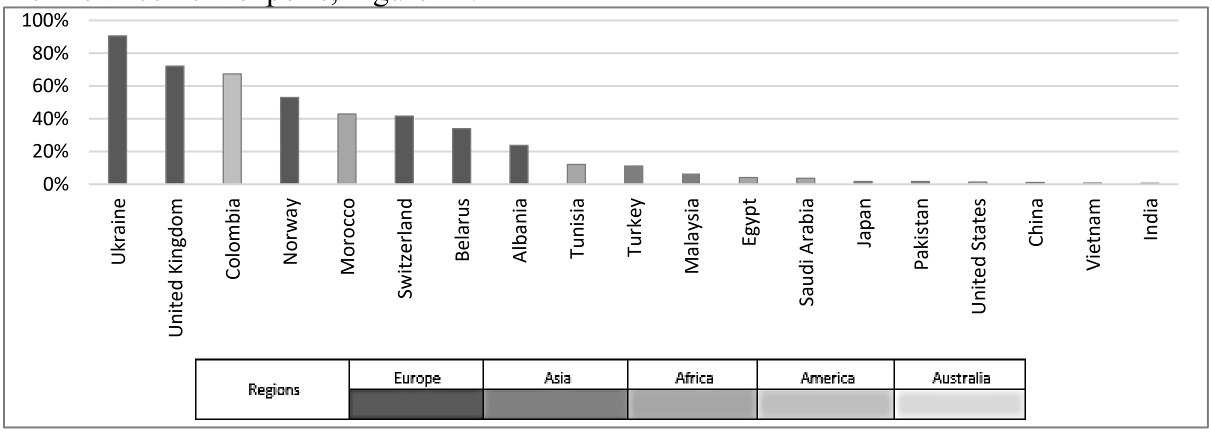

Figure 11. Exports of cement to EU (% of total cement exports).

Furthermore, as Figure 12 reveals, Belarus and Ukraine have the highest Relative CBAM Exposure Index for cement in the European region, with scores of 0,3078 and 0,2397, respectively. They are followed by Malaysia, the Asian region, with an index of 0,0256, and two countries from the African region, Saudi Arabia and Tunisia, with indices of 0,0144 and 0,0078, respectively. Belarus faces the highest additional cost under CBAM for cement, amounting to USD 30,78 per ton of CO_2 emissions.

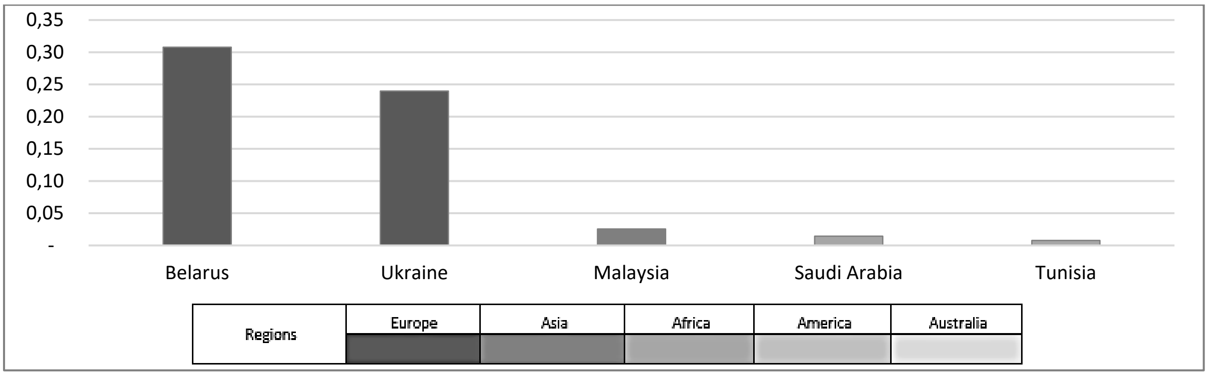

Figure 12. Relative CBAM Exposure Index for cement.

In the aluminum sector, as shown in Figure 13, Mozambique leads with the highest share of exports to the EU as far as the African region is concerned, at 96,6 %, followed by Ghana and Cameron, with shares of 94,8 % and 94,2 %, respectively. From the European region, Norway has a significant share of 93,7 %, while from the American region Venezuela has a share of 41,3 %. Among the 45 countries analyzed in this sector, 22 have a share of aluminum exports to the EU (% of total aluminum exports to the world) that is less than 10 %.

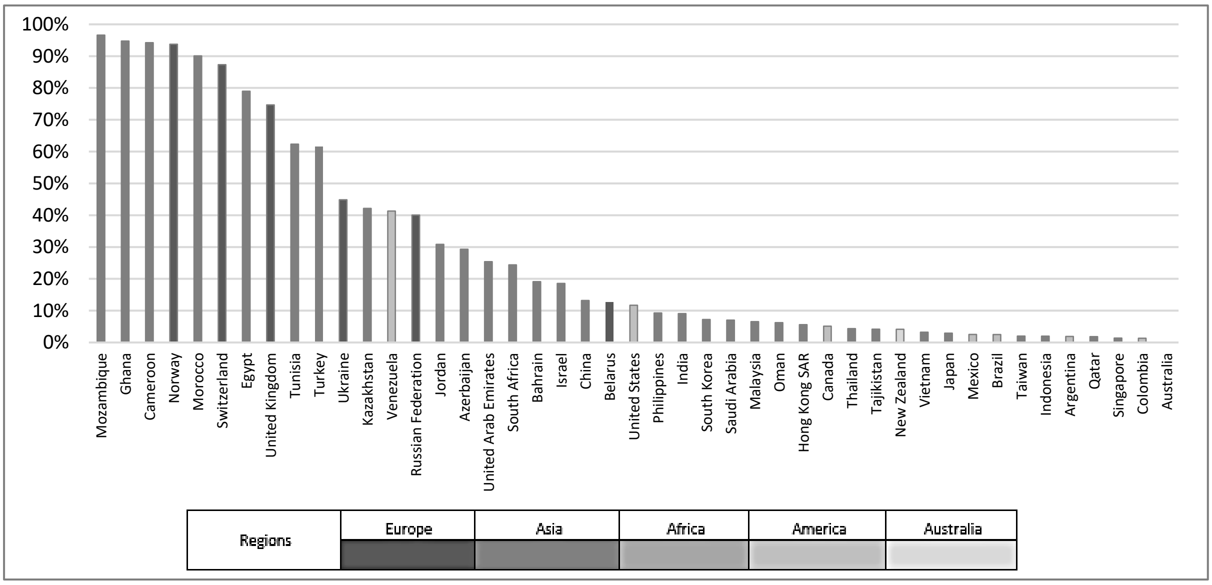

Figure 13. Exports of aluminum to EU (% of total aluminum exports to the world).

Mozambique also leads in the Relative CBAM Aluminum Exposure Index, with a score of 0,5922, Figure 14. It is followed by Kazakhstan and Egypt, with indices of 0,0404 and 0,0143, respectively. From the Americas, Venezuela has the highest exposure index at 0,0132, while considering the European region Ukraine has the highest index of 0,0121. The lowest indices are recorded by the United Kingdom and Ghana, with values of –0,0036 and –0,0046, respectively. Mozambique faces the highest additional cost under the CBAM for aluminum, amounting to USD 59,22 per ton of CO_2 emissions.

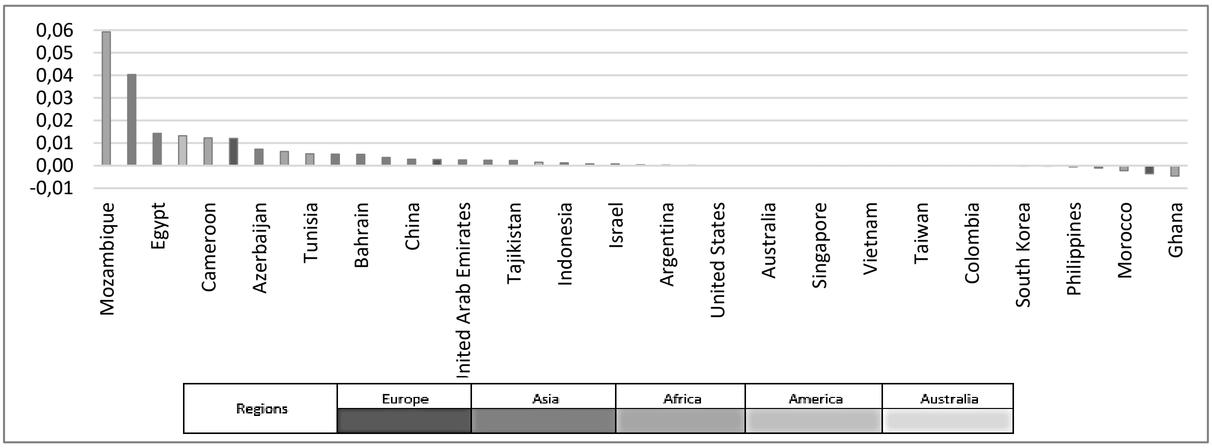

Figure 14. Relative CBAM Exposure Index for aluminum.

The export of electricity to the EU as a percentage of the total world export of electricity is illustrated in Figure 15. Analysis is limited to eight countries, predominantly from Europe and part of Asia. Notably, five of these countries – four from Europe: Belarus, Norway, the United Kingdom, and Ukraine, and one from Asia: Turkey – export 100 % of their electricity to the EU. All these countries have export shares exceeding 73 % of total global electricity exports.

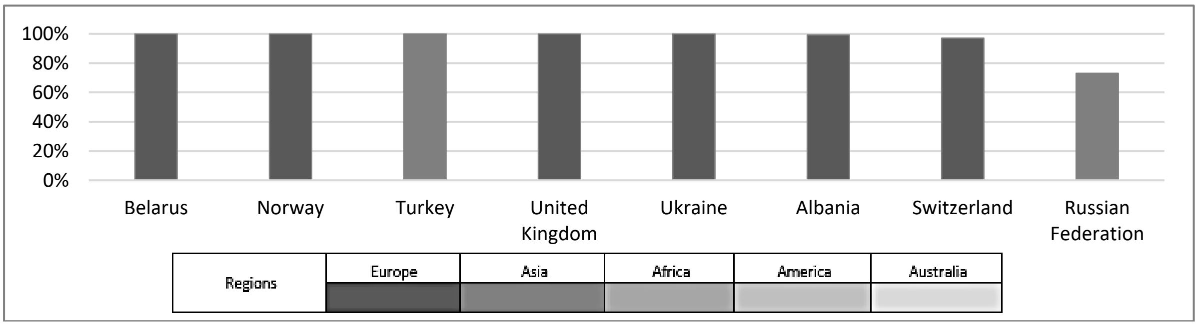

Figure 15. Exports of electricity to EU (percentage of total electricity exports to the world).

In terms of the Relative CBAM Exposure Index for electricity (see Figure 16), the European region leads with the Russian Federation and Turkey from the Asian region recording indices of 0,2257 and 0,2099, respectively. The remaining countries are from the European region, with only Albania showing a negative exposure index of –0,1454. The Russian Federation faces the highest additional cost under the CBAM for electricity, amounting USD 22,57 per ton of CO_2 emissions.

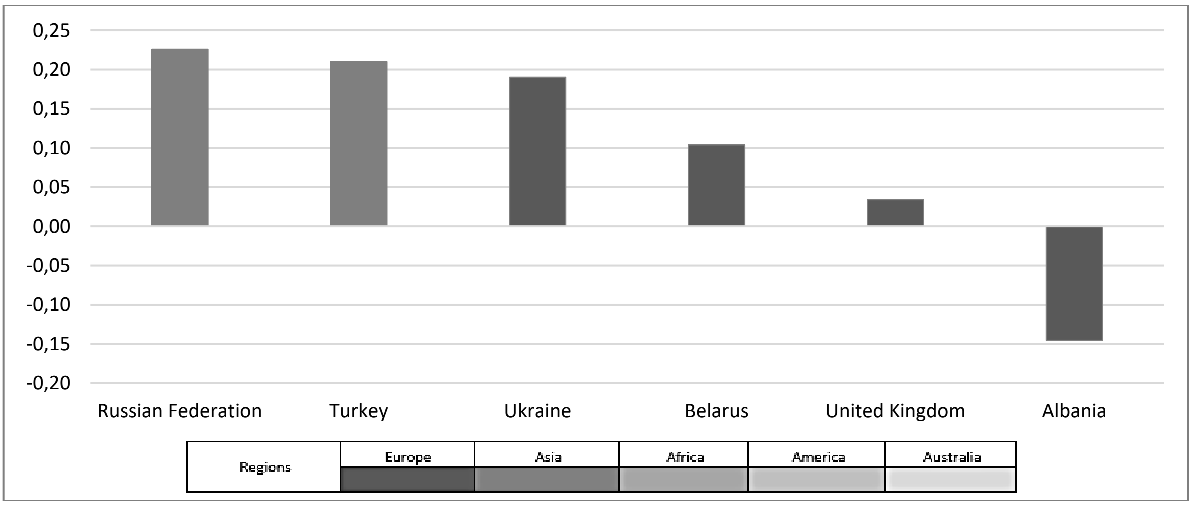

Figure 16. Relative CBAM Exposure Index for electricity.

CONCLUDING REMARKS AND RECOMMENDATIONS

The CBAM can be primarily understood as a measure designed to protect the competitiveness of EU producers in response to strict climate goals and an increase in the carbon price. This measure may favor countries that can decarbonize their production more rapidly and adhere to climate commitments, potentionally leading to trade implications that disproportionately benefit EU countries. The article analyzes the impact of of the CBAM's introduction on the EU's trade partners, with a particular focus on its consequences for a group of selected countries.

The findings indicate that the impact of the CBAM varies depending on the strength of a region's trade relations with Europe. Countries with stronger trade ties, particularly in goods with high CO_2 content, may face greater exposure. Also, some countries have a significant share of sectors that are carbon-intensive, which could result in substantial exposure to the CBAM. For example, Ukraine's fertilizer and cement industries are significantly affected, contributing to the country's overall exposure. Similarly, Zimbabwe leads in CBAM exposure scores, particularly in the iron and steel sector. The entire electricity exports of Belarus, Norway, Turkey, the United Kingdom, and Ukraine are directed to the EU, resulting in high CBAM exposure indices for these countries in the electricity sector. Mozambique stands out as the most exposed aluminum exporter, with 96.6% of its total world export destined for the EU. However, the CO_2 emission intensity of individual countries and sectors is generally lower than the EU average (for example, iron and steel exports from the United Kingdom, fertilizer exports from Israel, cement exports from Colombia, aluminum exports from Ghana, and electricity exports from Albania). The lowest exposure is observed in the Americas and Australia, as these regions are geographically distant from the EU and maintain relatively limited trade relations with the EU.

Additionally, the industrial structure of certain countries is skewed towards higher CO_2 emissions, increasing the likelihood that these countries will be subject to the CBAM in the future. Monitoring and trading of CO_2 emissions remain significant challenges due to the limited capacity for such monitoring and analysis. Possible difficulties in adapting to the CBAM may stem from the absence of mechanisms to reduce carbon emissions or inadequate capacity to measure and report emissions.

These points lead to the conclusion that the primary goal of introducing CBAM is not to reduce environmental or climate impact, but rather to enhance competitiveness and ensure more equitable distribution of income. It is expected that the CBAM will increase production costs both within domestic economies and in the EU market. Moreover, the CBAM has the potential to alter the competitiveness of exporting firms in the EU market. Developed countries generally fare better than developing ones, as their production practices are typically less carbon-intensive. The EU might consider allocating part of the revenue generated from the CBAM to accelerate the spread and adoption of cleaner production technologies in CBAM-targeted sectors within developing economies.

Future research should focus on monitoring the indices discussed in this article over time to observe how they evolve. This will help determine whether countries adopt the proposed mechanisms or develop new strategies to address CO_2 emissions. For decision makers, it is recommended to consider introducing or expanding broad-based domestic carbon pricing programs. While these programs could increase business costs, the revenues generated could suport the functioning of domestic governments and assist exporters in reducing carbon emissions. Furthermore, establishing a fixed carbon price could facilitate investment in green activities and low-carbon technologies, thereby encouraging new investment in the country, etc.

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