Subjects: ***(tick box)***	thesis : X	Thesis:	Written Assignment:
Study programme:	MSc. International Business Economics		
Semester:	4		
Exam Title:	Master thesis		
Group Number:	-		
Names + Student Nos of group member(s):	Name(s)	Student Number(s)	
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Submission date:	16/08/2021		
Project Title /Thesis Title	The Impact of Carbon Border Adjustment Mechanism (CBAM) on the Competitiveness of Cement exporters to the EU		
According to module description, maximum number of characters/words/pages of the paper	60 pages		
Number of characters/words/pages *(Standard page = 2400 characters including Tables and Figures, excluding References, Appendices, Front Page, Table of Contents)*	4200 words		
Supervisor (project/thesis):	Mohammad Bakhtiar Rana		

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The Impact of Carbon Border Adjustment Mechanism (CBAM) on the Competitiveness of Cement exporters to the EU

The cases of seven major cement exporters to the EU (Turkey, Ukraine, Tunisia, Algeria, Morocco, Colombia, and Belarus)

Table of contents

Abstract

As part of a plan to decarbonize its economy by 2050, the European Union (EU) is considering the introduction of a carbon border adjustment mechanism (CBAM) to reduce the risk of carbon leakage and to level the field for European industries working towards decarbonization of their production processes.

This thesis assesses the potential *effects of the CBAM on competitiveness of cement exporters to the EU. We quantify the cost burden of CBAM thereby cost competitiveness loss of seven major cement exporters to the EU. Then we dig into the institutional preparation of three major exporters and deeply analyze them to figure out the potential adoption of regulations which lead to adaptation to the CBAM.* The results confirm that the CBAM would have a significant negative cost competitiveness on all major cement exporters to the EU and it would increase over time as the free allocation of emission allowances would begin to phase out. Though the level of impact is lower in the countries which have lower carbon-intensive cement production than other countries. Additionally, the results show that the institutional initiatives regarding adoption of carbon pricing systems and carbon abatement regulation in the exporter country, can alter their firms adaptation to the CBAM and thereby increase opportunities to maintain their market shares in the EU.

Introduction

Even Though cement industry provided massive improvement in human life and economic development, it is also responsible for 8% of the entire greenhouse emission in the world. In other words if the cement sector were a country, it would be the third largest emitter in the world after China and the USA (Timperley, 2018). The global cement production has increased from 1.39 billion ton in 1995 to 4.1 billion ton 2020 (Garside, 2021). Estimates show that annual cement production is expected to grow moderately to 2030 (IEA, 2020). However the CO2 reduction of cement production is not growing as the production itself does. Policy makers tried to find a way to motivate industries including the cement industry to mitigate their CO2 footprint. In this regard different measures and mechanisms are set to encourage emission reduction. One of the regulations that has been conducted and implemented to reduce GHGs emission from all sectors including the cement sector in different countries is greenhouse gas (GHG) emission tax or so-called carbon tax. The carbon tax will ensure that the cost of products reflect the true cost of burning carbon which impose external costs on the society. Cap-and-trade programs, otherwise known as tradable permit systems or emissions trading systems (ETS) are other instruments that countries implement to reduce greenhouse gases (Schmalensee and Stavins, 2017).

The EU has the biggest emission treating system that has been implemented from 2005. Where firms in selected sectors have to purchase allowances for their emissions.

As the whole world doesn't implement the same policies to reduce their carbon footprint, that causes a problem known as carbon leakage. A higher carbon price (via a carbon tax, tradable certificates or simply stricter regulation) makes goods from the country implementing the policy relatively more expensive. This can lead to a shift of carbon emission intensive production to countries with laxer regulation or lower carbon prices and hence increase emissions in these countries (Felder and Rutherford, 1993).

Researchers have quantified the impact of ETS on EU’s cement producers and have found that ETS would decrease their competitiveness and lead to carbon leakage (Quirion and Demailly, 2005 and 2006 and Ponssard et al., 2008).

Since this Carbon tax and ETS has not been used worldwide, the European Union has been forced to loosen the ETS regulation for the industries that are at risk of carbon leakage including the largest emitter among other cement industries. If a sector or sub-sector is subject to a risk of significant exposure to carbon leakage, the sector is eligible for 100% free allocation (EUROPEAN COMMISSION, 2021, p47), Which leads to a higher emission than it has been targeted. Therefore, The European Council confirmed the introduction of a Carbon Border Adjustment mechanism (CBAM) by 2023. (Marcu, et.al, 2021).

The main objectives of CBAM are limiting emissions leakage from relocation of production and investment. Additionally, protecting against reduced competitiveness of domestic industries relative to foreign competitors. It can also help in incentivizing foreign trade partners and foreign producers to adopt measures comparable/equivalent to the EU's. Furthermore, it can yield revenue that can be used to fund investments in clean technology innovation and infrastructure modernization or as international climate finance.

The European carbon border adjustment mechanism would impact the cement trade between the EU and the rest of the world. Implementation of a Carbon Border adjustment mechanism (CBAM) will reduce European cement producers' risk of losing their competitiveness as well as reducing the risk of carbon leakage (Monjon and Quirion, 2011).

If we consider CBAM as a trade barrier which has the aspect of tariff barrier by imposing carbon tax on import, it affects trade partners. trade barriers according to Rangasamy (2003) leads to cost competitive advantage for local producers and cost disadvantage for exporters. Additionally, Ghodsi (2019) asserts that non-tariff barriers (technical trade barriers such as licenses) on the countries which are not complying with them, might cause some exporters exit or reduce their export quantities and values. By contrast, Bohringer (2018) asserts that the threat of carbon tariffs could cause more effective environmental policy if unregulated nations prefer to adopt internal emission controls than to face tariffs.

Referring to the impact of CBAM to the EU's trading partners Maksym Chepeliev (2021) in its study about the impact of CBAM on Ukraine, showed that Ukraine is the most impacted country among The EU's partners. The study assesses the impact of all CBAM-covered sectors together and provides a good overview about all impacted sectors in Ukraine, though it doesn't go deep into the cement sector. World Bank Group (WBG) (2021) has recently conducted a study on the economic impact of CBAM including competitiveness losses on Thailand, India and Vietnam's cement, steel and aluminum sectors. The study shows the CBAM payments share (competitiveness losses) for the cement of current prices is above 20% in all three countries.

Though those countries studied by WBG (2021) are not included in the top cement exporters to the EU. At the same time there are quite few studies which analyze the impact of the CBAM focusing on cement exporters. Thus, the question is what impact would CBAM have on the top seven cement exporters to the EU including Turkey, Ukraine, Tunisia, Algeria, Morocco, Colombia, and Belarus and which country would be affected hardest and which country can avoid the negative consequences of the CBAM on their competitiveness.

In line with the methodology that World Bank Group in their study used, we conducted our research, but we assessed the cost competitiveness impact of CBAM on seven major cement exporters to the EU. In addition, we updated the price prediction for EU ETS and CBAM correspondingly as well as the benchmark level for allocation of free emission allowances. Further, we estimate the CBAM bill for every tone of three types of cement products, namely Grey Cement Clinker, Portland Cement and other hydraulic Cements in five years from 2026 to 2030 for each of those seven countries. Additionally, we calculate the cost competitiveness of each type of cement by each country.

Whereas calculation of competitiveness losses provides a picture of the costs that CBAM impose to each EU's trade partner stated above, it would not show the EU's trade partners institutional preparation or condition in their national border to adapt to the new reality in the EU. Therefore, we also conducted a qualitative analysis to analyze institutional preparation in three major cement exporters to figure out which country has better potential for adaptation to the CBAM.

The research will be organized in five different chapters. Chapter one will present the introduction and problem formulation which clarifies justifications for the topic of the research thesis and provides a discussion on the problem formulation. Chapter two will be the literature review. It synthesizes literature review from two perspectives; 1) theoretical, where relevant theories and concepts are reviewed, and 2) empirical, where evidence on the topic is reviewed and discussed. Chapter three will draw on methodological perspectives, it discusses issues of philosophy of science i.e. ontology and epistemology, and explains the research design, research paradigm, the methods, and the overall approach adopted to conduct this research thesis. Chapter four will elaborate on analysis and present the findings of the project. Finally, chapter five will outline a conclusion on this research thesis and highlight the main findings of the project.

Research problem

The EU has claimed that there is a risk of carbon leakage in several EU's industries as well as competitiveness loss in those industries because of implementation of ETS. The solution that is planned to be implemented is CBAM in order to level the field for exporter and domestic companies and bring back the lost competitiveness and prevent the leakage and then tighten the CBAM and ETS to reduce emission. Implication of CBAM means administration preparation for cement exporter countries to the EU and eventual extra tariff on the border based on their emission level. This also means that they eventually cannot sell their products at the same price as before or if they do so, they would lose their profitability. In other words, they would lose their competitiveness corresponding with their level of emission if they cannot reduce their emission to EU level which would even be reduced by 10% every year until it gets to zero emission.

- **Research question**

1. How much competitiveness will the cement exporter country lose due to implementation of CBAM if they do not adapt to it (their emission-intensity of cement clinker remains at today's level)?

To answer the first question, we will first make some assumption:

- The quantity of Cement exported to the EU from each exporter (their market share) will remain the same after the implementation of CBAM.
- We assume that the demand and the price of cement in the EU remain the same. In other words, we assume trade patterns remain unchanged compared to annual average trade volumes and values in 2019 - 2020.
- The price of exported cement into the EU is based on the total value of cement imported to the EU divided by the total quantity of the imported cement from different exporters.

- It assumes zero pass through of CBAM costs to prices.
- The average of emission in the country will be the basis for the calculation of each country's emission instead of actual emission of each firm which is less likely to be founded.
- As CBAM covers only direct emissions, we estimate emissions and CBAM payments for only direct emission.
- Before calculation of the price, CBAM will account for credit foreign policies entailing a carbon price in exporting countries ($\Delta CO2$ price).

We will look at every country's market share in the EU which is the basis for calculation of their quantity exported to the EU at the time of imposing the CBAM. Then we calculate the amount of extra cost that CBAM eventually impose on them based on their level of cement production emission compared to the EU's benchmark. This amount of extra cost can be interpreted as the competitiveness loss. Then we calculate the amount of cost increasing due to the tightness of the CBAM emission benchmark level over time assuming if they do not reduce their emission.

2: Which exporter country would have better potential to adapt to the CBAM implemented in the EU based on their relevant regulations which lead to adaptation to the CBAM and ETS?

- We will look at the role of institutions, namely the formal (regulative) in the home country (exporter) in accelerating the adaptation into the new regulation in the host country (the EU). We will use the coercive isomorphism to analyze the existence of carbon taxation regulation in the selected cement exporter countries.

The existence of any carbon taxation can be advantageous for the exporter country, because at the EU's border CBAM costs will be calculated based on different CBAM elements that might be adopted including the carbon tax in the home country.

What factors are needed for the cement exporters to keep their competitiveness (market share) in the EU market?

Literature review

In this chapter we shredded light on several definitions of competitiveness by a number of scholars which represent different theories including trade theory, pollution haven, carbon leakage and Michael porter's regional competitiveness. Since the context in this thesis is carbon tax as an instrument/regulation to mitigate climate change, we looked at different theories through the lenz of carbon tax as a main factor affecting competitiveness. Then we discussed the results of recent ex post and ex ante studies which are conducted based on the mentioned theories. Later the gap in the literature is identified, it serves as a basis to formulate the specific research problem that we addressed in this thesis.

National Competitiveness has been defined by several scholars. Michael Porter focuses on the productivity of a nation/region (or a country) as the core of competitiveness in the international market. He defines regional competitiveness as a region's productivity by using its human, capital, and natural resources (Porter, 2002, 3). Porter developed his regional competitiveness from his previous theory of firm competitiveness which indicated that firms that can produce more output with fewer units of input than their competitors generate a 'competitive advantage' in the markets in which they compete, enabling them to grow (Bristow, 2005).

Within the context of trade theory, Rangasmy (2003), characterizes international competitiveness in goods and services, as a nation's trade advantage vis-à-vis the rest of the world, while, Bristow (2005) define Competitiveness as the ability of a firm/sector/(jurisdiction) to *survive* competition in the marketplace, grow, and be profitable.

The aforementioned definitions, emphasize the role of overall national factors that lead to competitiveness in the international market, emphasizing the role of institutions within their countries and outside of the country boundaries. Likewise, the new trade theory defines the “externalities” (e.g countries’ policies) as enabling factors which can be the alternative to the factor endowment (e.g labor, capital and natural resources) for being the source of competitiveness (Shenkar et al., 2014).

In the context of carbon tax as environmental regulation for CO2 reduction and climate change mitigation, competitiveness will be affected by differences in regulatory stringency employed across firms, sectors or countries that are competing in the same market (Dechezlepretre and Sato 2016).

A majority of literature assess the competitiveness impact of environmental regulation on the firms within those jurisdictions comparing them with firms from laxer regulated countries. Though The number of studies which investigate the impact of carbon tax (Carbon Border Adjustment) on the exporter countries are few due to newnes of such a regulation.

Dechezlepretre and Sato (2016) categorized empirical literature in two categories when they assess the effects of different carbon policies on the competitiveness of firms within the same market (country or region): the pollution haven hypothesis derived from trade theory and the Porter hypothesis. The pollution haven theory foresees the negative consequences of more stringent environmental policies such as carbon tax. They argue that such policies increase costs and, over time, shift pollution-intensive production toward regions with lower emission cost, creating pollution havens. On another hand, the Porter hypothesis predicts positive consequences of environmental policies. It claims that more stringent environmental policies promote efficiency improvements and cost-cutting through innovation in new technologies, which reduce or completely neutralize cost from environmental regulations and may help firms achieve leadership in international technology and expand market share.

The empirical studies show little evidence to support the pollution haven theory. Aldy and Pizer (2011), conducted a study to calculate the competitiveness effect of carbon price, found only 1.0 to 1.3 percent competitiveness effect from an increase in net imports using empirical data of the competitiveness impact of changes in energy price assuming that carbon price has the same effect as energy price. Similar study by Sato and Dechezlepretre (2015) found that a 10 percent increase in the energy price gap between two countries which are each other's trade partners, increases bilateral imports by 0.2 percent and that overall, energy price differences explain 0.01 percent of the variation in trade flows.

In contrast several ex-ante studies (e.i the modeling studies) provide evidence to support the pollution haven theory. Carbone & Rivers (2017) in their study assert that if competing companies differ only in terms of the environmental policy stringency they face, then those facing relatively stricter regulations will lose competitiveness due to the higher costs which are imposed by carbon tax or reducing carbon emission. For instance, in this theses case, cement producers in the EU pay carbon tax according to the EU benchmark level introduced by the EU Emission Trade System (EU ETS) which increase production cost, while cement exporters might export from countries with less stringent environmental regulation (absence of carbon tax) enjoy the advantages of lower marginal carbon emission cost compared to European cement manufacturers. In addition, cement manufacturers have to purchase electricity at a higher price due to carbon taxation, which can also be indicated as an indirect cost.

The EU-ETS is a cap-and-trade system. The cap is the limit of CO2 that an installation can emit in the system. In case an installation emits more than the introduced cap, it must buy emission allowances either through an auction or from other installations (trade) which have reduced their emission and have extra emission allowances (European commission, 2021). The cap has been tightened and continuously will be tightened as well as the number of the emission allowances reflecting the EU emission reduction ambition which now is 55 percent reduction of CO2 by 2030 compared to 1990 level. It means that the carbon price due to the tightened cap and allowance supply will increase yearly and the emission cost correspondingly, which impose extra cost on firms (Deschens, 2014) due to either reduction abatement activities or purchasing emissions allowances apart from the costs regarding to monitoring, reporting and verification of emissions.

Several other ex-ante studies have quantified the impact of EU's Emission Trade System (EU ETS) on EU's cement producers and have found that ETS would decrease their competitiveness and lead to carbon leakage (Quirion and Demailly, 2005 and 2006 and Ponssard et al., 2008). In line with a study by Felder and Rutherford (1993) before introducing the ETS who expected that stringent environmental regulation can lead to a shift of carbon emission intensive production to countries with laxer regulation or lower carbon prices and hence increase emissions in these countries.

To avoid these negative consequences of carbon reduction, the European Council confirmed the introduction of a Carbon Border Adjustment mechanism (CBAM) by 2023 (Marcu, et.al, 2021), which in the context of international trade, carbon tariff can according to the results from Bøhringer et al., (2012) study, level the playing field in the international trade of Emission-Intension and Trade-Exposed sectors including cement sector. However, it remains controversial in reality, especially as the latest studies found no evidence for carbon leakage caused by unilateral national environmental regulations (Franzer & Mader, 2008; Naegele & Zaklan, 2019).

According to the CBAM proposal exporters of cement, steel, electricity, aluminum, fertilizers have to surrender CBAM certificates equal to the embedded emissions in their imports which are priced equal to ETS. In other words it mirrors the average auction price of EU ETS allowances each week (Marcu, et.al, 2021). ETS is the European Union Emission Trading System (ETS) which was issued in 2003 and implemented in 2005.

The CBAM aims to ensure that the price of imports reflects more accurately their carbon content. CBAM will also create a common and uniform framework to ensure an equivalence between the carbon pricing policy applied in the EU's internal market and the carbon pricing policy applied on imports. Additionally, the CBAM intends to protect against reduced competitiveness of domestic industries relative to foreign competitors (European commission, 2020).

On the other hand, regardless of the justification for imposing CBAM, it might affect the EU's trade partners who must deal with the new reality of export to the EU (Bohringer et al., 2016, Svend Hollensen, 2017). If we consider CBAM as a trade barrier which has the aspect of tariff barrier by imposing carbon tax on import, it affects trade partners. However, if the trade partners have lower emission than or Equal to the EU and are able to report it on the border of the EU, they would not face any carbon tariff (European commission, 2021). Though the process of emission calculation, reporting and verification can be interpreted as non-tariff barriers which both impose extra costs and extra time consuming on the firms in the EU's trading partners.

Referring the CBAM as trade barriers, can leads to cost competitive advantage for local producers and cost disadvantage for exporters in a way that the domestic firms under the umbrella of protection (barriers for foreign producers) are able to reduce their marginal cost relative to their foreign competitor's marginal cost (Rangasamy, 2003).

Referring to the impact of CBAM to the EU's trading partners Maksym Chepeliev (2021) studied the impact of the CBAM on Ukraine using the General computable equilibrium (GCE), which shows that Ukraine would be highly impacted country among The EU's partners. The study assesses the impact of all CBAM-covered sectors together and provides a good overview about all impacted sectors in Ukraine, though it doesn't go deep into the cement sector.

World Bank Group (WBG) (2021) has recently conducted a study on the economic impact of CBAM including competitiveness losses on Thailand, India and Vietnam's cement, steel and aluminum sectors. The study assessed the potential CBAM payments as an additional fiscal burden based on forecasted CO2 emission prices and emission volumes. The share of CBAM payment to one tone of the current product price has been interpreted as the competitiveness loss. CBAM payments share (competitiveness losses) for the cement of current prices is above 20% in all three countries.

The study from the World Bank Group is one of the most updated studies in the literature considering the newness of the CBAM proposal and its content (released on 14.07.2021). Though They had to speculate some of the functions of the CBAM, because it was under preparation at the time of the WBG's study. They considered six scenarios to determine embedded emissions in the trade from the exporting countries to the EU which the CBAM authority will consider only one of them, thus we consider the one that the CBAM authority uses. Whereas we use the fundemant of the WBG's methodology, we updated some aspects of it which can be as follows. In this thesis we take one scenario for determining the embedded emission on the cement import to the EU, which is the average emission in the home country (exporting country to the EU) since the CBAM authority also considers that as a basis for its calculation regarding the embedded emission. The CBAM authority will also accept the actual direct emission in exported cement to the EU by any firm who believes that their actual emission is lower than their country's average emission (they have to verify their actual emission and report it to the CBAM authority) (European Commission, 2021).

Contrary to the World bank group study, we don't calculate indirect emissions (e.g. emission from electricity used in the process of the production). Since the CBAM covers only the direct emission (the emission during the production) we only calculate that when we determine the emission embedded in the cement imported to the EU.

The World bank group in their study considered 41 EUR per ton of CO2 emission in 2023 based on the Bloomberg EUA price forecast and Carbon Pulse analysis. We assume a higher price based on several factors which we discuss deeply in the methodology chapter.

In addition, we calculate the competitiveness of seven major cement exporters to the EU in a country with the WBG's study which calculated three countries which are not included in the major cement exporters to the EU.

Further we calculate the CBAM cost and thereby competitiveness loss for every ton of three different cement products instead of total cost and total competitiveness of cement exporters countries. The advantage of our method is that once the competitiveness loss of one tonne of cement is calculated it can be multiplied by any quantity of trade in different years.

In our calculation we distinguish countries with imposed carbon prices from countries without, because the cost of the CBAM would be higher for those countries who taxed carbon emission in their country. This is in line with Ghodsi's (2019) study who differentiate the effect of non-tariff barriers (technical trade barriers such as licenses) on the countries which are not complying with the host countries requirements and those they are complying with. He asserts that the cost might be higher on the producers who were not complying with them which might cause some exporters to exit or reduce their export quantities and values.

However, Hemous (2012), argues that carbon tariffs can be a source of competitiveness if the carbon-intensive countries prompt technological change towards greener technologies. And according to Markusen, (1975) a sufficiently large country (or group of countries) can discourage foreign production of pollution-intensive goods through the use of import tariffs. In line with that, Bohringer (2018) asserts that the threat of carbon tariffs could cause more effective environment policy if unregulated nations prefer to adopt internal emission controls than to face tariffs. Thus, assessing the extent in which a cement exporter country complies with the host country's emission regulation is one of this thesis objectives which we discuss in the next part of the literature review.

Institutional Theory

Whereas calculation of competitiveness losses provides a picture of the costs that CBAM impose to each EU's trade partner, it would not show the EU's trade partners institutional preparation or condition in their national border to adapt to the new reality in the EU. Therefore, in this section of the literature review we discuss institutional theory in the context of its impact on firms and the country's competitiveness. More precisely we look into the coercive isomorphism as the most effective pressure from institutions in a country or from other jurisdictions on the country and the firms. Then we discuss the recent studies based on this theory aming to determine a gap in the literature and build the second part of our research on it, which is analyzing the institutional readiness of three major cement exporters to adapt the CBAM through the relevant regulations they might have implemented.

Institutions being defined as the rule of the game (North, 1990), the players according to this definition have to do with political, social, legal, and economic organizations and all kinds of firms. Therefore, the level of competition is determined by the set of rules and regulations that exist within any particular country. It could be home institutions or an international organization that prescribes the intensity of competition taking into consideration the structure of domestic market openness.

According to North (1990), institutions can also be described as a set of rules generally accepted by humans to govern social interaction. The way individuals should behave, the way organizations should act to bring law and order to a particular geographical location. Industrial players particularly like firms in the cement sector from countries which participate in exporting cement to the EU, therefore, have the obligation to conform to both domestic institutional regulations as well as international institutions (Peng, 2008). In other words, institutions form the basis of how any legal entity behaves, thus having a great impact on the firm's success of competitiveness being domestic or abroad.

Jepperson, (1991) distinguishes between Formal and informal institutions. He asserts that the formal institution consists of political rules, economic standards, contracts, and as well as environmental standards whereas informal institutions can be described to contain taboos, customs and traditions (culture) that shape human behavior in the society (Jepperson, 1991). Both formal and informal forms of institutions shape human interaction in the community. Building on Jepperson formal and informal institutions, Scott (1995, 2001) defines *institutions as social structures that have attained a high degree of resilience and he divided them to cultural-cognitive, normative and regulative elements that, together with associated activities and resources, provide stability to social life*.

In the context of competitiveness both Jepperson formal and informal institutions and Scott 's *cultural-cognitive, normative and regulative* element of institution have a great influence on enabling competitiveness towards the foreign market like the EU on the evidence that firms from countries with non-supporting formal institutions would be dominated in the EU market by firms from supporting formal institutions. In contrast, countries dominated with strong informal institutions and weaker legal institutions lose the competitiveness on a foreign market because of lack of strong institutional support by the government (Jepperson, 1991).

In the context of CBAM, The competitiveness of the cement industry in the context analysis would therefore be guided by carbon pricing policies that ensure legitimization of industrial players and hence, exporters of cement products: CBAM certificates and other certifications, licenses, export and clearance, payment of tariffs, ets. The failure of any of these by an individual or actor to certify the above therefore according to Scott (1995) would attract sanctions. Those sanctions in the EU would be emission related costs for importers who cannot conform with EU ETS standards (emission benchmark level).

Institutional Isomorphism

DiMaggio and Powell (1983) calls isomorphism, a process by which an organization acts in a similar way to another organization by adopting the characteristics of that organization (Rodrigues & Craig, 2007). Structures of organization are influenced by their social and institutional environment, and therefore, companies wishing to survive tend to use isomorphism to adapt to their external context (Mayer &Rowan, 1991).

Firms are subjected to pressures from government mandates or dependence on key organizations (DiMaggio & Walter, 1983). For instance, manufacturers adopt new pollution control technologies to conform to environmental regulations.

Coercive isomorphic pressures are derived from the pressures exerted on firms by other organizations on which they are dependent such as governmental regulations (Huang et al., 2016; Hazen et al., 2017).

Many studies have focused on isomorphic pressures and organizational behavior (Liu et al., 2018). For example, Busch and Schwarzkopf (2013) indicated that car manufacturers tend to adopt similar strategies in terms of carbon reduction.

Coercive isomorphism might be a force that drives firms to demonstrate that they are addressing climate change in order to gain legitimacy (Galbeath, 2010). However, Duyster and Hagedoom (2001) found that in a highly competitive global industry, firms do not become isomorphic in terms of both their structure and strategy. Some factors that reflect the underlying nature of institutional pressures have also been explored as forces that might motivate strategic responsiveness to institutional pressures, such as constituents and control (Goodstein, 1994).

Institutional pressures derived from regulated sanctions and penalties lead organizations to adopt similar practices and firms must conform to institutional pressures if they are to gain legitimacy within an organizational field. However, coercive isomorphic pressures are strongly related to the main regulatory instruments that can impose sanctions on companies, such as legal enforcement mechanisms (Gallego-Alvarez & Pucheta-Martines, 2020). For instance, CBAM is among mechanisms that would enforce cement exporter countries to the EU to adopt carbon pricing policies in order to conform environmental regulation standards to the EU.

Whereas, previous studies have analysed how institutional isomorphism pressures firms to adapt to its external environment, there is still a lack of sufficient research on effects of external institutional pressures of CBAM on other formal institutions in the EU cement trading partner. Thus, we aimed to address this gap in literature by assessing that to what extent three major cement exporters to the EU adopted environmental regulation such as ETS or carbon price.This provides an insight on the level of readiness of cement exporters adapting to the new reality (CBAM) in the EU.

In this regard a framework is developed inspired by the International Carbon Action Partnership ICAP database and the European Roundtable on climate change and sustainable transition to assess the level of readiness of exporters to adjust to the CBAM. in the framework the existence of ETS, carbon price, CO2 reduction policies, emission penalties and some other criterias are considered. The more a country implemented above regulations the better chance will have to adjust to the CBAM and maintain its competitiveness. This assessment would provide a better picture of the competitiveness effect of the CBAM on the cement exporters countries than relying only on quantifying the cost competitiveness of CBAM impact on EU's cement trade partners.

Cement sector overview

Cement denotes a variety of substances that serve as a binding agent for different aggregates, yielding concrete, mortar, grout and other construction materials. Its main component is lime resulting from the calcination of limestone, and - depending on the type of cement - chemical reactions with other constituents of the raw materials to form an intermediary product, clinker. There are different types of cement (for instance 5 types of Portland Cement), each of which has different clinker content and therefore different embodies greenhouse gas emissions. All cements must be certified as a specific type to enter into commerce in Europe. This makes it relatively straightforward to determine the direct (process) emissions associated with any given batch, particularly since direct emission intensity for cement is more or less uniform across different installations.

In the EU, the cement sector is dominated by a small number of large producers distributed across various Member States. Several of larger producers are multinational corporations, although private ownership predominates: only the four largest producers are owned by shareholders. It is a mature sector, with clinker and cement production highly integrated from quarry to clinker grinding and blending, although the downstream production of concrete and other cement-based products is largely carried out by smaller local companies. Cement is almost exclusively traded between businesses (B2B), with the main consumers being ready-mixed concrete producers, prefab element producers, construction companies, and to a much lesser degree, Do-it-Yourself (DIY) market. Trading primarily occurs directly from producers to these consumers, although international trading can occur via trading companies. Often, smaller companies with storage silos near trading ports will import clinker and operate nearby grinding mills to convert the clinker to cement.

- *Cement Trade Patterns of EU*

Clinker and cement are imported into the EU, with the main channel situated alongside the southern, southeast and eastern borders and coastal area (notably the Netherland and Belgium). Relevant trade partners include Morocco in the south, Turkey in the southeast is the main cement exporter into the EU (more than ⅓), and Russia, Belarus, and Ukraine in the east. These countries are significantly increasing their production capacity. An increasing amount of clinker and cement is also arriving from other countries at the large European ports in Rotterdam, Ghent, antwerp and Marsille. Though, unlike in some sectors, the high cost of transporting cement relative to its value limits the number of overseas trade partners that would be meaningfully affected, including political heavyweights such as the US, India or China.

Overall, the trade balance of the European cement sector is currently positive (whereas it was largely negative before 2009), with exports exceeding imports, although the trend is reversing fast. Typically, imports progressed rapidly since 2016, while exports decreased significantly over the same period. While other factors than carbon prices have likely contributed to this rise in imports, there is significant potential for leakage in the cement sector in the face of increasing carbon prices in the EU, mostly concentrated on coastal markets, given the high cost of inland transport.

- *Environmental considerations.*

For the Cement sector, In Europe, the environmental performance of cement manufacturing is relatively homogeneous, given that about 60% of emissions stem from the calcination process that converts limestone to quicklime. Differences within Europe primarily arise from the fuels used to generate heat in the cement kilns, with some plants - primarily in the north and northwest of Europe - firing partly biomass waste rather than the more widely used and carbon-intensive traditional fossil based fuels. Other substitutes for fossil fuels include fractions from municipal waste, Sewage sludge or tires.

Because of the high share of process in overall emissions, however, alternative heating technology - based, for instance, on electricity or hydrogen - can only contribute to partial decarbonization, as only the emissions caused by the combustion process (30% of overall CO2 emissions) are reduced. European productition has already largely shifted from wet to less energy-intensive dry production methods. Carbon capture and sequestration will therefore be an essential element in any pathway towards full decarbonization of the cement sector, alongside the development of alternative cements not based on clinker.

In sum, Europe's cement production is generally lower in GHG emissions than most global production. While the process emissions are more or less the same worldwide, EU producers use a relatively higher share of lower-carbon fuels: waste materials, natural gas, and in some cases biomass.

- *The future of cement production*

There are projects all over the world in the R&D phase looking for decarbonization of cement, by clinker substitution as well as carbon capturing and storage projects (CCS). While carbon capture technologies are emerging A commercial-scale CCS facility in Texas using chemical absorption, capturing 15% of emissions (IAEA, 2018). A pilot project in China has achieved CO2 capturing by (50 ktCO2/yr). As the CCS technologies develop, electrification of cement production could also help reduce emissions by using green energy and by simplifying the capture of CO_2 in cement production.

Possible CBAM impacts on Cement industry

Kuusi et al. (2020) described the markets that are potentially subjected to the tariffs, they saw that the manufacturing of cement products (cement, lime, and plaster) play a very small part in the total EU economy. Its total value added was 7 billion Euros in 2017 and its share in total business economy value added was just 0.11%. On the other hand, cement is of course very important as an intermediate good for the construction sector.

In terms of trade, the value of extra-EU imports of cement, lime, and plaster is very small. Kuusi et al. (2020) found that the cement derived products have a very limited impact on overall gross imports, partly because the products contribute such a small share of extra-EU imports. However, in relative terms, the impact is larger for cement, lime, and plaster where they found a 23% decline in imports when both direct and indirect CO2 emissions are included. The overall impact on total extra-EU imports is a little less than three billion euros.

Central elements of the CBAM Proposal

Design element	**Proposed design in European Commission (EC) proposal**
Trade of coverage	Only imports to the EU are covered. There are no export rebates, but free allocation of EU ETS allowances is maintained (and gradually phased-out by 2035)
Policy instrument	'Notional ETS' without a cap, whereby importers of covered products have to surrender CBAM certificates (price on the basis of EU ETS allowances) equal to the embedded emissions in their imports.
Effect on free allocation of EU ETS allowances	The CBAM is put forward as an alternative to free allocation of EU ETS allowances in the covered sectors, and would therefore replace free allocation over time. To allow producers, importers and traders to adjust to the new regime, the reduction of free allocation will be implemented gradually while the CBAM is phased-in. Sectors covered by CBAM will eventually stop receiving free allocation. The Commission proposes a 10 years transition period before free allocation is fully phased-out. The share of free permits for the sectors affected will still be 100% in 2025, and will gradually decline by 10 percentage points each year to reach zero in 2035. During the period when the free allocation is maintained, the CBAM will only apply to those emissions above the free allocation received by domestic

	producers. The methodology for calculating the reduction in the number of CBAM certificates to be surrendered by importers to reflect free allocation will be determined by implementing acts.
Geographical scope/extensions	Countries that are part of or linked to the EU ETS (current Iceland, Liechtenstein, Norway and Switzerland) are exempted. Some special territories of the EU are also exempted. Additional exemptions may be provided for imports of electricity from countries that fulfill certain conditions.
Sextorial/product scope	Five sectors are to be covered initially: cement, steel, electricity, aluminium, fertilizers. Covered products within these sectors include both ‘simple’ goods (i.e. primary materials) and more ‘complex’ goods (i.e. semi-manufactured goods that use primary materials as inputs). The EC can add products/sectors to the list through delegated acts.
Emission scope	Only direct emissions (scope 1) are covered, including emissions attributed to covered goods and those embedded in input goods deemed to be within the system boundaries of the production process. Indirect emissions from electricity (scope 2) are not covered, though a review will make recommendations in 2026 on whether to include these going forward.
Determination of embedded emissions	Based on actual emissions at installation level verified by accredited verifiers, with fallback default values set the average emission intensity of each exporting country for each of the goods, increased by a mark-up (to be determined in implementing acts). When reliable data for the exporting country cannot be applied for a type of goods, the default values shall be based on the average emission intensity of the 10 per cent worst performing EU installation for that type of goods. During the initial transitional phase (2023-2025), where importers may not

	yet be able to produce the data required on actual emissions, default values could also apply
Level of adjustment (CO2 price)	The level of adjustment will mirror the average auction price of EU ETS allowances each week. Crediting of policies in the country of origin will only recognize explicit carbon pricing policies (e.g. a carbon tax or ETS), with prices paid deducted from CBAM.
Use of revenues	The CBAM will not generate revenue in the transitional period 2023 to 2025. Revenue generated as of 2026 will be collected nationally by competent authorities, and the intent is that most of it will accrue to the EU budget. No mention of earmarking of revenues for specific purposes (e.g. for climate purposes domestically or abroad)
Implementation timeline	- 2023-2025: Transitional CBAM entailing no financial adjustments - 2026: Full implementation of the CBAM

Source: European Roundtable on Climate Change and Sustainable Transition (ERCST), 2021

Methodology:

The analysis of a problem can be conducted in several ways and is strongly related to the structure of the problem formulation as well as the objective of the research-based answer. To understand the logic about how and why the problem analysis in this project is performed, the way it is, this chapter illustrates the philosophical position as well as the methodological perspective of this research. First, the philosophical assumption upon which the research is based will be stated. Followed by an explanation about the research design, research method and data collection as well as research approach and data analysis.

Philosophical assumptions

This section of the project describes our views as researchers with regards to the ontological, epistemological and the choice of paradigm concerning the research. The themes are illustrated to better understand how the research group the reality and how we gain or perceive knowledge on the topic.

Ontology

To better understand the ontological stand of the research, thus considering where our focus is on what we as researchers seek to know (i.e. the 'knowable' or 'reality'), we referred to Burrell & Morgan, 2017) and (Kuada, 2012). They argue that an objective approach to ontology should be seen as Realism whereas a subjective approach to it could be considered as Nominalism. While realism is seen to postulate that the social world is real and external to each persons' cognition, nominalism on the other hand draws an assumption that reality is constructed by individuals interacting with one another and that one can therefore consider multiple realities in social science.

Moreover, realism suggests that the world is made up of hard, tangible, and relatively immutable structures while with nominalism the individuals who interact with each other do that by presenting themselves in the form of names, concepts, and labels.

The aim of this is to create a conceptual framework which provides a justifiable solution for the research question. The theories utilized in our literature were based on the studies of other researchers who had tested and tried to understand what needed to be done to mitigate or overcome the effects of external factors of competitiveness. After a critical consideration, the research group will be able to draw an analog between philosophical assumptions. The assumptions were inclined towards a more subjective ontological approach and other signs of an objective ontological approach as well. The generated framework illuminates essential elements which guide cement exporter countries to the EU to mitigate the effects of CBAM as an external factor.

To develop the conceptual framework, a thematic literature review was conducted focusing on articles elaborating the ETS adoption to help us identify key important features. Also, the World Bank and European Commission reports of 7 non EU cement exporter countries' information were analyzed and discussed. These countries would have almost common ways to adopt this carbon trade mechanism but the ways they adopt it are different. The reason for this analysis is based on the logic that the literature's theoretical consideration alone isn't sufficient and may lead to a bias in the framework's applicability.

As per above elaboration, it can first be argued that the research group sides with a subjective ontological approach indicating the existence of multiple realities. To us, reality can be shaped by its context and must be taken into consideration. This motivated us to examine the framework using the World Bank and European Commission reports of the aforementioned countries each to assess insights from the target policy mechanism (ETS) implementation. Moreover, the research group considered the fact that the decision for selecting essential elements to create a framework based on individual assessment which cannot be only objectively measured even if reality is observed from the outside. However, it is to not surprise that research also has an objective ontological standing because it believes that reality can be observed from outside of themselves . This is known by the fact that various articles were examined to give a clear understanding on what cost competitiveness entails in the presence of ETS and CBAM. These articles' existence is independent of themselves or their interaction and are thereby observed from the outside. In general, it could be assured that the ontology position for this research lies between an objective and more subjective perspective of reality as elaborated above.

Epistemology

Like that of ontology, there are several definitions for epistemology, but the research group sided with that of Bryman and Bell (2011). According to them, 'an epistemological issue concerns the question of what is (or should be) regarded as acceptable knowledge in a discipline. A particularly central issue in this context is the question of whether or not the social world can and should be studied according to the same principals, procedures, and ethos as the natural sciences'. Generally, there are several epistemological positions in different literatures indicated by various scholars. But then again, the research group stands with that of Bryman and Bell which considers epistemology in two common perspectives namely Positivism and Interpretivism as the terms completely oppose each other.

To define positivism, Bryman and Bell suggest that positivism is an 'epistemological position that advocates the application of the method of the natural sciences to the study of social reality and beyond. But the term stretches beyond this principle, though the constituent elements vary between authors'. Contrary to positivism, they described interpretivism as ' taken to denote an alternative to the positivist orthodoxy that has held away for decades. It is predicted upon the view that a strategy is required that respects the difference between people and the objects of the natural sciences and therefore, requires the social scientist to grasp the subjective meaning of social actions' (Bryman & Bell, 2011).

The creation of the conceptualized framework has been the goal of this research as stated initially. As such, it can be argued that the study group follows an interpretivist epistemological position. This is because the result of the framework is drawn from the various interpretations of the examined articles coupled with the study group as well as the discussions had, have led to an interpretive understanding of the acquired research and to the creation of a framework. Moreover, to answer the research question and develop a conceptual framework, the process utilized in knowledge gathering was based on;

- Mixture of subjective interpretation from the articles,
- The individual experience of each researcher within the group, and
- The interactions with one other.

To sum up, rather than testing or measuring an already existing framework to verify or falsify its validity, the researcher group pursued an approach that seeks to understand and answer the research question.

Choice of paradigm

As for the term paradigm, Bryman & Bell, 2011) defined it as 'a cluster of belief and dictates which for scientists in particular discipline influence what should be studied, how research should be done, and how results should be interpreted. The research group's awareness of the ontological and epistemological considerations allows us to identify the appropriate philosophical paradigm. Moreover, this paradigm also supports the stated assumptions in the most appropriate way as mentioned in the pathological and epistemological section above. After thorough reflections, the research group sides with the philosophical paradigm called 'critical realism'. In defining critical realism, (Haigh, et al., 2019) elaborates that 'critical realism is a relatively new paradigm position. It represents a combination of views that contrast with those associated with traditional positivist and interpretivist positions'

As mentioned above in the ontological section of this literature, the assumptions were inclined towards a more subjective ontological approach. However, not disregarding some signs of an objective ontological approach, the research shows elements that tend to move it also a bit towards a positivist position as well but not more than the latter. To place the research between a less traditionally positivist and interpretivist positions would be considering it as a Critical realism position. Critical realism indicates an ontology position between those two views, which matches with the researchers' assumptions. Furthermore, it allows an interpretivist epistemology, which also reflects this research consideration.

Research approach

From our ontological and epistemological perspective, a qualitative approach to the research has been used. By adapting the positivist perspective, we believe that CBAM will affect the export competitiveness position of cement exporter countries to the EU, and this can be studied based on the causes and effects (Kuada, 2012). Based on our belief that there is no one true way for business to sufficiently adapt to external factors in all circumstances, we will therefore implore a more **abductive approach**. Bell, et al. (2018) discuss two approaches in trying to understand a phenomenon. One where theory is the focal point for data collection and analysis, and another where theory is generated after the analysis has been done. These are the deductive and inductive approaches respectively.

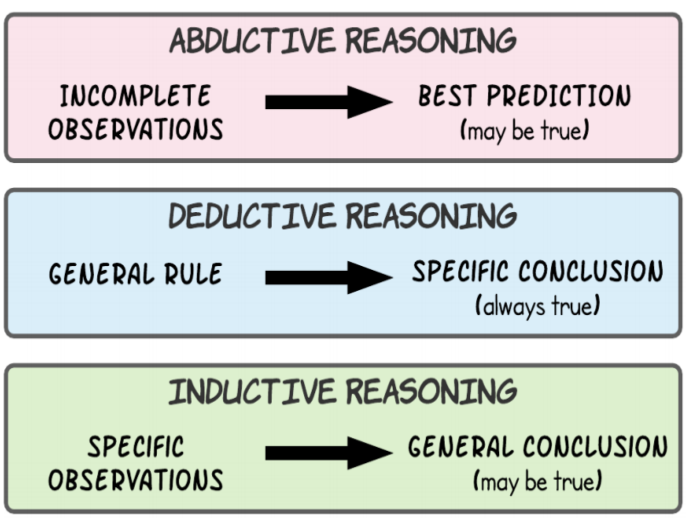
The abductive approach that we adopt for this research provides us a blend of both the deductive and the inductive methods. This will enable us to offset the shortcomings that come with the two main approaches. According to (Dudovskiy, 2021), an abductive approach seeks to find the 'best' explanation in an attempt to clarify 'surprising facts' or 'puzzles'. These puzzles could be events or phenomena that are mostly unexpected or difficult to understand.

Considering the nature of CBAM and all uncertainties surrounding it, generating a specific conclusion as to how best countries can adapt to it would be inadequate at this moment. Despite all the knowledge currently available on the CBAM, it is still a relatively new field for some countries with regards to how it would affect their competitiveness in the EU's market. Therefore, an abductive approach will help us generate the best possible prediction after observing and taking into account the various incomplete information.

Research in this area is still ongoing and developing with the introduction of new policies. An abductive approach therefore allows us to investigate institutional theoretical frameworks and provide an insight based on countries' data in an attempt to predict the best possible solution to how countries can adapt their carbon price relevant policies that conform to the EU's CBAM.

For the abductive approach, we first analyze the literature on institutional theory in relation to exogenous pressures though a thematic literature review. For this, we develop a conceptual framework based on which the data would be analysed (CBAM as an institutional coercive pressure vs competitiveness). The data from the EC, ERCST,World Bank.. reports is analyzed on the conceptual framework to identify and present best predictions for Competitiveness of cement exporters to the EU. After that, additions, deviations, and similarities from the analysis are looked at and used to further develop and explain the framework.

First we analyze the recent literature and identify some of the general characteristics of CO2 pricing policies (or ETS) adoption strategies based on CBAM. We then describe case studies to illustrate the practical context and supplement the literature analysis to derive relevant determinants for building of a conceptual framework and construction of a formal model. In the conceptual framework, we show how the ETS type in a third country can be aligned with the CBAM viability, encompassing the level of emission reduction (ETS size, sectors covered, scope of emission, type of instrument -ETS, CO2 policy, allowance level, cap, ETS status, benchmarks, offsets…). In the general conclusion, we formalize the impacts that CBAM implies to the third country's institutional change that would result in the competitiveness gain or loss. We assess the ETS adoption strategies of countries to categorize them into competitiveness completed, under-process and loss. We close by proposing some open research questions and outline future research directions.



Three different research approaches (Dudovskiy, 2021)

Research Process

A well-structured and a step-by-step procedure is taken for conducting this study.

No.	Steps	Execution
Step 1	Objective identification	Objectives of this study were to investigate, identify, and assess the impact of CBAM on the cement exporters to the EU as well as assessing exporters countries' readiness to adapt the CBAM
Step 2	Problem definition	The problem was defined to conduct the study. The main problem statement of this research is: to what extend CBAM affect the competitiveness of cement exporters to the EU
Step 3	Literature Review	Related literature review was conducted to preview the previous literature relating to our study and research gap. Literature review focused on Institutional theory, and trade theory.
Step 4	Determining data need	The research problem and research questions create data needs. The required data was collected from different secondary sources.
Step 5	Developing the database	After finalizing, the data needs a detailed and comprehensive database to be prepared. Data is to be collected by following some predetermined data collection procedures.
Step 6	Qualitative and	The database was used to conduct qualitative and quantitative data analysis. So, different analysis techniques were used to analyse the data.

	quantitative data analysis	
Step 7	Decision making	With the data analysis and hypothesis testing, this research expect concrete findings which will be used for the research decision making of cement exporters to EU

Research process (source: own composition)

Data collection

This section presents the data collection procedures of this study.

Types of data sources: researchers generally rely on two types of data, i.e. Primary data and Secondary data. This research uses the data which is already collected and found in different trade related reports, databases, and other papers. Therefore, this study conducted secondary data sources.

Selection of Case: for calculation of competitiveness effect of the CBAM, seven major cement exporters to the EU are chosen systematically (based on the size of their market share (export) in the EU). For assessing the institutional readiness, three major cement exporter countries are chosen systematically based on their size of market share and deeply analyzed. Since that part of research required a lot of data analysis, we chose only three major countries.

Method: calculation of Competitiveness loss due to imposing of CBAM:

To quantify the potential competitiveness loss of each cement exporter to the EU, we modified a method that the World Bank Group has used which is presented at the end of this section. The formula has a straightforward objective to calculate the costs related to CBAM on cement exporters and the proportion of the cost in the price of cement is interpreted as cost competitiveness loss. This means that the extra cost by CBAM should be either compensated by profit loss or increasing the price which might lead to market share loss. Though it has been assumed that everything remains the same including the technology and the emission rate of the country.

Some researchers used General Computable equilibrium as their method for data analyzing, which calculates the overall impact of a policy change (here CBAM) on the welfare, trade flows and employment. This method requires heavy data and complex modelling and a significant time. In addition, the assumption of this method is based on the Armington trade theory, which assumes that products are not homogeneous throughout the world thus cannot perfectly be substituted by other products. This assumption cannot be applied in the cement industry as cement is a relatively homogeneous product throughout the world. Another assumption of Armington is that consumers have national preferences which is neither the case in the cement sector. On the other hand, the formula that has been used in this thesis answers the research question quite effectively.

Before presenting the formula, it's worth to dig into issues which this thesis considered:

First, we calculate competitiveness loss for every three types of cement products based on each of seven major cement exporter's national data rather than firms, from 2026 to 2030.

Second, to determine the emission embedded in imported cement, we consider the average direct emission of each country (the default value) which is the case in the CBAM regulation unless a firm calculates its actual emission, verifies, and reports it to CBAM authorities. Additionally, the amount of eventual carbon emission that is obligated to the tariff payment would be ascertained through the difference between the average direct emission in the exporter country and the emission benchmark in the EU. The benchmark in the EU means that cement producers in the EU receive free emission allowances equal to a certain level in the EU. The cement Exporters obtain the same level which is 0.693 ton CO_2 per ton grey cement clinker (cement products linked to it) and 0,957 ton CO2 per ton white cement clinker (the level of 2021 to 2025) and would decrease by 10% yearly from 2026 and would be fully phased out in 2035. In other words, the emission embedded in imported cement is the amount of emission that goes above The EU ETS's benchmark.

Third, we consider the average volume of imported cement to the EU for every country in 2019 and 2020 to estimate the country's cement price which is further used in determining the percentage of CBAM cost (competitiveness loss) in the price of one tone cement products. That price is assumed to be static over time, namely in the period of 2026 to 2030. Though in the real world, the volume of cement imported to the EU can change over time corresponding to the demand and supply condition, domestic competition in the EU and in the home country as well as international competition (Demailly and Quirion, 2005). We decided to assume the volume of imported cement based on the previous imported volume, instead of going into this heavy data driven simulation to estimate the volume (due to lack of data availability and our time limitation). Though our main objective of the research (quantifying the competitive loss per ton cement) is still achievable because we find the competitiveness loss for one ton, which is the fundament for the calculation of competitive loss for any quantity of imported cement. Additionally, In the real world, CBAM payments could alter the level of commodity prices depending on the rate of the cost pass-through to the customers. The CBAM can also affect the level of trade flows depending on price elasticity (World Bank Group, 2021, p14).

Fourth, the scope of the products which are covered based on their Nomenclature (CN) codes level code under category cement are as follow: Cement clinkers: 2523 10 00, Portland cement: 2523 29 00, Other hydraulic cements: 2523 90 00 and White Portland cement, whether or not artificially colored: 2523 21 00. Though the benchmark for allocation of free allowances in the EU ETS is not categorized based on NC codes nor based on the cement products. Instead, *cement clinker* is recognized as the product. In other words, European cement producers do not pay for their emission from the entire process of cement production (total carbon footprint), but only for clinker production, which are recognized as grey and white cement clinker. Thus, the benchmark level of allocation of free allowances in the EU ETS for these two types of clinkers are linked with the four imported cement products in the CBAM. Namely, the grey clinker emission benchmark linked to specific imported products determined at Combined Nomenclature (CN) codes level such as cement clinkers (2523 10 00), Portland cement (2523 29 00), and Other hydraulic cements: 2523 90 00, And white clinker is linked to the White Portland cement, whether or not artificially colored: 2523 21 00 (European commission, 2021, p22). Regarding the white cement clinker, the data was not available based on the country's average. The alternative was the world average, though, since it does not provide any differences between countries, it excluded from the data analisis.

Type of cement/clinker	Nomenclature (CN) codes
Cement clinker	252310 00
Portland cement	2523 29 00
Other hydraulic cements	2523 90 00
White Portland cement	2523 21 00

Source: owne composition

Fifth, the price of ETS allowances is updated. The World bank group in their study considered 41 EUR per ton of CO2 emission in 2023 based on the Bloomberg EUA price forecast and Carbon Pulse analysis. We assume a higher price based on several factors. Since the CBAM implementation will be in the transitional period without imposing any tariff from 2023 to 2005, we cannot take the estimated price used by World Bank Group into account for 2026 when the CBAM will impose tariffs (carbon border adjustment) on the imported cement. It is worth mentioning that the CBAM price would be based on the weekly average price of the EU ETS market which at the time of writing of this section (07.08.2021) is Euro 56.62, which is already higher than the predicted price for 2023 used by the world bank group. Forecasting the price of CBAM which mirrors the EU ETS (in other words European union allowances EUAs) is associated with high level of complexity and uncertainty, because of factors that affect the EU ETS price including markets' conditions such as the energy market, electricity market, and financial market as well as governments 'policies which can significantly affect carbon price (Li, et.al., 2021).

The International Emissions Trading Association (IETA) predicted European Union Allowances (EUAs) prices through a survey which was conducted from 19 April to 5 May 2021. According to the IETA's survey the expected carbon prices in the EU ETS would on average be 47.25 euros a ton between 2021 and 2025, and 58.62 euros a ton between 2026 and 2030, which is higher than the price that the WBG used. The actual current price in the market is higher than the predicted price by both the World Bank Group and International Emissions Trading Association predictions. At the same time *independent commodity intelligence services* ICIS (2021) estimated carbon prices on the EU ETS market will hit €90 per tonne By 2030. One of the reasons for such an increase of EUAs' entails the supply condition which is dominantly affected by European commission policies regarding climate change. Namely, the commission would withdraw around 300 million allowances annually during 2021-2023 in order to reduce the oversupply of allowances on the market (*Frédéric Simon, 2021*; European commission, 2021). Additionally, Bank of America anticipated that the price of EUAs will continue rising in order to drive the necessary carbon abatements, which could push prices to €100 by 2025 (Szabo, 2021).

Since most new predictions are higher than the prediction of World Bank Group study, we need to take them into consideration. However, predicting an accurate price is almost impossible. Thuse, we are forced to rely on some assumptions that are something in between the literature's predictions. We consider an average of Euro 70 for 2026 and a price increase of Euro 5 yearly that reach to Euro 90 by 2030. This assumption is based on the three considerations related to the supply condition of the EU ETS market. First the EU's abatement policy which considers tightening the cap of allocation of emission allowances (linear reduction factor of 2.2% from 2021 to 2030 compared to 1.1% reduction in phase three) (European commission, 2021). Second, the European commission decision regarding squeezing of allocation of free emission allowances which start from 2026 by reducing 10% yearly until it will be fully phased out by 2030 (Marcu, et.al, 2021). Third, introducing the market stability reserve which its objective is to prevent price shock (Especially decreasing the price because of the surplus of allowances in the market) through intake of a percentage of allowances in circulation and putting them in the reserves market. The percentage of intake rate was 12% in 2018, though it would increase to 24% by 2023 (European commission, 2021).

Taking to account the aforementioned considerations, the formula for measuring the cement exporter's eventual competitive losses is as follow:

CL= PC   or   Competitive loss=percentage of the CBAM's direct cost

Where the CL denotes Competitiveness losses and PC stands for percentage of direct cost of CBAM in the price of one ton cement imported to EU. Then PC can be calculated as follow:

PC= (DC/ CP) * 100   or (direct cost/cement price)*100

CP is the exporters price of one ton cement at the EU borders, where, DC stands for direct cost of CBAM, which is the level of adjustment (carbon tariff) that the EU would levy on different cement exporters to the EU based on either country's average emission or the actual emission of the firms. In this thesis as explained previously we only consider the average emission of the country. The calculation of the direct cost of cement exporters for one ton cement is as follow:

$DC = \text{CBAM price}_{\text{Year n}} * (EE_{\text{year n}} - EUE_{\text{year n}})$

Where $EUE_{\text{year n}}$ stands for EU ETS Emission benchmark (in 2026 in the first year of full implementation of CBAM) which reflects the level of free allowances that cement producers in the EU receive. The cement Exporters obtain the same level. And $EE_{\text{year n}}$ is Exporters Emission which contains the embedded emission in one ton cement/clinker based on the type of the cement and the average emission of the particular country. And the CBAM price according to the estimated price as in the literature review explained is Euro 70 in 2026, Euro 75 in 2027, Euro 80 in 2028, Euro 85 in 2029 and Euro 90 in 2030. Since the CBAM authority in the EU credits the carbon pricing in the exporter countries and adjusts the CBAM payment based on the difference in the price, we calculate the difference as follow:

CBAM price= EU ETS $P_{year\ n}$ – $ECP_{year\ n}$

The EU ETS $P_{year\ n}$ stands for the price of the EU emission's allowances in the first year. And the $ECP_{year\ n}$ stands for eventual carbon price levied in the exporter country (Exporter's carbon price).

This formula can lead to bias if the charged carbon price in the exporter country was higher than the EU level. Thus, we adjust that manually, because The EU would not compensate firms who paid a carbon price higher than the EU ETS level.

The final version of formula is as follow:

$$CL= [((EU\ ETS\ P_{year\ n} - ECP_{year\ n}) * (EE_{year\ n} - EUE_{year\ n}))/ CP] *100$$

Data collection for calculating the competitiveness loss

For the competitiveness loss chapter, the emission data and the clinker to cement ratio collected from well-known and broadly-used database "Getting the Number Right" (GNR) which is the provide emission data in a collaboration between World Business Council for Sustainable Development (WBCSD) and Global Cement and Concrete Association (GCCA) under the name of Cement Sustainability Initiative (CSI) . In the GNR database, emission data for Turkey is not separately available, though it's mixed with the Middle East. The domestic literature provides different data. For the clinker emission, one domestic study suggested 849 kg per ton clinker (Çankaya, 2018) where a study by Cementis (Cementis, 2018) showed 813 CO2 per clinker production. Cementis study also suggests 87% clinker to cement ratio for Turkish cement production (Cementis, 2018). Since the domestic data indicate different amounts of emission, the middle east average data is considered for Turkey.

the data for Belarus and Ukraine is also the average of the Commonwealth of Independent States (CIS). In the same way, the data for Algeria, Morocco and Tunisia are average as well as the data for Colombia is based on the average of South America's countries.

For those countries who export in one year and not in the other year, we consider the price based on just one year instead of the average of two.

For trade data the Eurostat database is used which is the statistical office of the European Union and provides world bilateral trade data based on product Nomenclature (CN) codes and indicators such as import and export. The dataset of DS-045409 - EU trade since 1988 by HS2-4-6 and CN8 is used.

Data Analysis

The study with both quantitative and qualitative data was analyzed using thematic analysis by identifying and assessing different CO2 emission reduction policies and their impact of CBAM on selected top three cement exporters countries to the EU as well as making comparison of their competitive advantage to the EU market. Thematic analysis enables us to have an in-depth analysis of different factors which are associated with research questions as well as identifying different patterns in the qualitative data.

We analyzed also quantitative data where we used data extracted from different databases such as IPCC, World Business Council for Sustainable Development (WBCSD), WBCSD, Global Cement and Concrete Association (GCCA) was analysed using MS Excel in which data of the 7 countries were coded corresponding to the different factors of capacity, emission rate, geographical distance, technology advancement, cement price and trade agreement and tariffs policies between selected countries.

- Emission rate has been chosen as a criteria due to its relevance as a policy change effect (the carbon charge on the border) which has a direct impact on companies' trade costs as well as their profitability/competitiveness and their willingness to Export to the EU.
- Geographical distance also has a huge impact on trade costs especially in the cement sector which is a heavy product and dramatically costly to transport in long distances. The distance tells which countries could have a better chance of export to the EU.
- Technology used in cement production is not only relevant criteria as a factor of production, but due to its relation to the emission rate, the production costs, the price and profitability of each trade partner to the EU.

- Price of the cement: price of cement in different countries, reflects the production costs and the profit and it is a baseline before trade occurs. The lower the price the higher chance of winning the international competition with other conditions remaining the same.
- Trade agreements: countries levy Most-Favored Nation Tariffs (MFN) or Preferential Tariffs on imports based on their particular agreement with each other. In most cases the preferential tariff is lower than the MFN tariff. The form of tariff has a direct effect on trade costs thus the competition in the host country. Form of tariffs would be analyzed for all 5 cement exporters to the EU in order to assess the degree of their cost competitiveness in the EU market.

Reliability and Validity

"Reliability refers to the extent to which the data collection techniques or analysis procedures will yield consistent findings" (Saunders, M., Lewis, P. and Thornhill, A.(2009)). Reliability and validity of any study is a major methodological issue for data driven research. This study is conducted using both qualitative and quantitative methods backed by secondary data. The analysis of the study developed typologies after studying case countries. The frameworks used analysis backed by the established literature of the international business field. These justify the reliability of the methodology of this study. Data collected for conducting the study will be taken from valid secondary sources such as official annual reports. Data sources are already published in accredited platforms and accepted by the peers and critics of the industry. These make the data that used for this study as valid.

Data collection process:

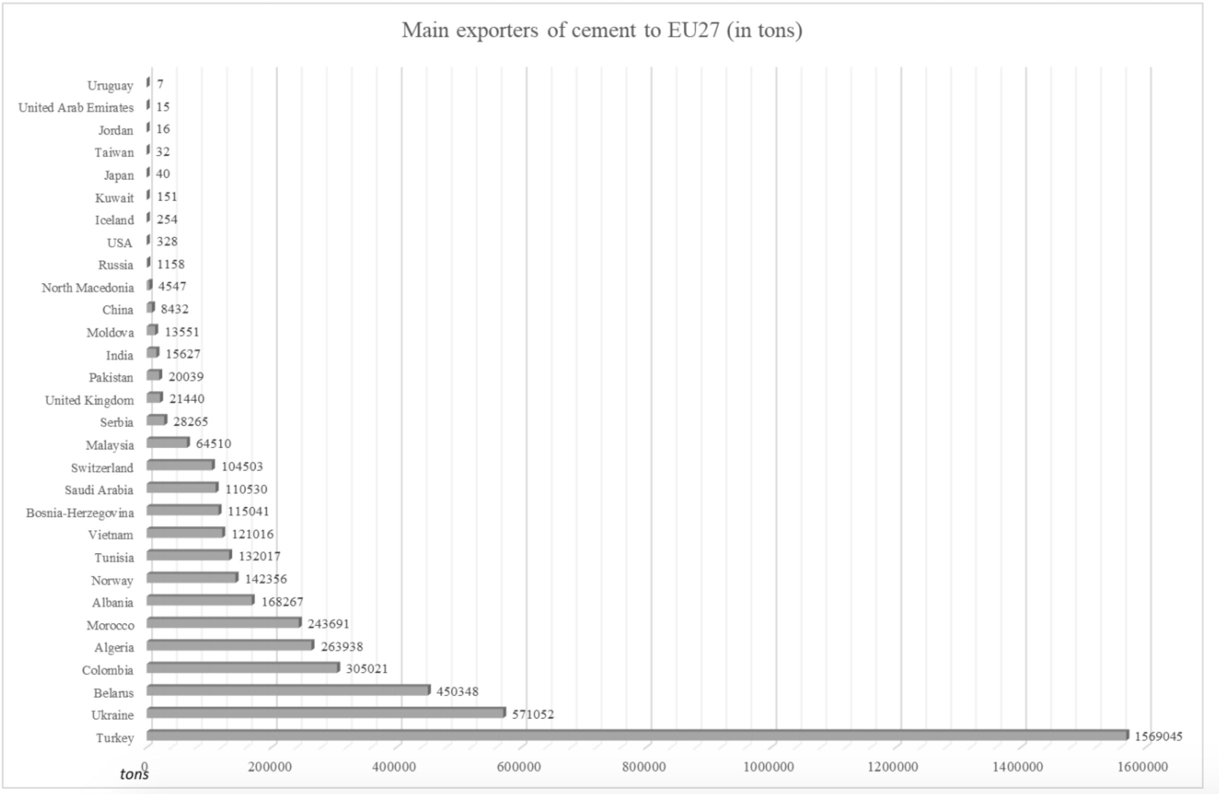
Our purpose to collect secondary data from the EU's official website and databases was that sources should be used to assess how CBAM as a regulator of our research's independent variables - CBAM elements - could influence the change of policies in importer's countries that would result to losing or maintaining the cement export competitiveness - dependent variables - position to the EU. CBAM primary data was mainly resolutions of European Commission (EC) on Climate Change, and this gives it its validity and credibility while Competitiveness primary data was collected by World Bank authorities when they complete their reports into their official databases. Those reports give information of countries' position in different ways of transactions including their position concerning climate change policies and firms value chain that is mostly responsible for CO2 emissions which is a concern of CBAM.

- **Data sources**

Internal and external data was available on the internet for official authorities websites and databases were used for the research. The data was extracted from a variety of public domain documents as done by Turner (2002). ERCST 2021 in their EU Carbon Border Adjustment Mechanism (CBAM), ERCST 2021: implications of EU Carbon Border Adjustment Mechanism for sampled countries (Turkey), IMF Climate Change Dashboard

- CBAM data: internal data this data
- Cement exporters data: external data

Main exporters of cement to EU27 (2019)



Source: EC (2021) analysis based on data from Eurostat CMEX

Impact on main trade partners would differ depending on the importance of respective CBAM sectors in bilateral trade with the EU (EC, 2021). Overall, based on a simple descriptive analysis of current trade flows, the countries that would potentially be most exposed to the CBAM in the cement sector include primarily Turkey which accounts for 35% of the sector's total imports. Along with Ukraine (13%), Belarus (10%), Columbia (7%), Algeria (6%), Morocco (5%), Albania (4%), Norway (3%) - excluded -, and Tunisia (3%), they account for about 80% of the total cement imports to the EU (EC, 2021).

The reports and databases contained the relevant information on the overview of CBAM policies in the EU and the ETS adoption level of countries exporting cement to the EU. This information will be assessed and show us the status at which those countries are to conform their environmental protection policies with CBAM procedures.

Although these sources of data are authentic and meaningful, they are subject to issues of credibility and representativeness (Bell, et al., 2018). To account for this, **triangulation** (Guba & Lincoln, 1994) was adopted to verify extracted information from multiple sources.

- Sampling

This research applied a non-probability sampling method (Babbie, 2004) because we selected cement exporter countries based on our subjective judgement and it is a less stringent method and the type of qualitative data we used. The nature of our population also has not equal chances to participate in this research, they are different in their geographical locations, institutional efficiency, quantity exported, etc.The sample for the research was chosen from different cement exporters to the EU from 2019 to 2020 period of time and we selected top dominant cement exporters to the EU. Thus, we used this method because it was impossible to draw random probability sampling due to time, therefore the judgemental or purposive sampling was considered.

Results of competitiveness effect of CBAM

Turkey

We calculated CBAM cost on seven major cement exporters to the EU for three cement products namely Grey Cement Clinker (with the NC code of 25231000), Portland Cement (NC code: 2523900) and Other Portland Cement (NC code: 252390). The timeline of the results starts from 2026 where CBAM would fully phase in the force until 2030 (five years). The percentage of the CBAM costs in this thesis would be interpreted as competitiveness loss (more accurately cost competitiveness loss) as an extra charge on the firms from different countries whose export cement products to the EU.

The result shows a significant cost competitiveness for all seven major exporters but varies between different exporters. The hardest impacted country is Turkey both in terms of the amount of the cost which is Euro 15.31 per ton clinker and in terms of the portion of that cost in its cement price (competitiveness loss) which is %36.52 in 2026. This impact would increase every year as the benchmark level of allocation free allowance starts to phase out and as thereby the price of EU ETS allowances increases. Thus, the CBAM cost on one ton clinker produced in Turkey in 2027 increases to EURO 21.64 (%51.5 competitiveness loss) until it reaches EURO 44.68 in 2030 which (the CBAM costs) is even higher than the price of the clinker itself. In other words, the clinker from Turkey would lose 106% percent of its competitiveness due to imposing CBAM. The impact of CBAM is also significant on other Turkish cement products, though slightly less significant. For example, in Portland Cement, the CBAM cost starts at EURO 13.35 (%26 competitiveness loss) in 2026 and reaches EURO 38.87 (%75.78 competitiveness loss) in 2030. Where the other hydraulic cements have a slightly better situation though still hardly impacted. The CBAM bill for one-ton other Turkish Portland cement would be EURO 10.59 in 2026 (% 8.45 competitive loss) and gets to EURO 38.87 (% 31 competitiveness loss).

Turkey is the largest cement exporter to the EU, though those severe impacts that Turkish cement products experience is not because of the size of its market share in the EU, but it results from the high emission associated with clinker production as well as the high ratio of that carbon-intensive clinker in the cement. Turkish cement manufacturers on average emit 843 kilogram CO2 per ton clinker which is highest between the seven cement exporters to the EU as well as the ratio of clinker in the cement which is %87. Clinker production is the most carbon-intensive part of cement production, which accounts for percent of the total emission in the cement industry. Companies try to substitute clinker with other cementitious products as fly ash in order to minimize their emission and costs.

Ukraine and Belarus

Since the data for Ukraine and Belarus wasn't available separately, we used the "getting the number right" database data which has categorized Ukraine and Belarus in among The Commonwealth of Independent States (CIS) countries. Therefore, the emission data for these two countries is average of all of CIS countries. Thus, the emission from them is identical, but their carbon pricing system and as well as their cement prices are different which make a difference in their CBAM bill and their competitiveness loss.

Belarus and Ukraine would, according to our results, be obligated to pay Euro 14.58 and EURO 14.51 respectively in their CBAM bill for exporting every ton of grey clinker to the EU in 2026. The CBAM cost would impose %36.52 and %34.29 respectively extra burden (competitiveness loss) on their clinker prices in the EU. That would double as their clinker price thereby losing more than 100% of their competitiveness in 2030.

Their emission average after Turkey is the second highest emission among the cement exporters to the EU. They emit 832 kg CO2 per ton clinker production, and their cement consists of 83% clinker. The major factor regarding the CO2 emission that distinguishes Ukraine from Belarus is the fact that they implemented a carbon price, though it's quite low EURO 0.3 compared to the EU (EURO 56).

Colombia

Colombia is also one of the cement exporters to the EU which would be impacted by the CBAM. According to our results, The EU would impose EURO 12.18 on every ton Colombian clinker from 2026 and it would increase to EURO 39.65 in 2030 which decreases Colombian clinker competitiveness by 43%. The data collected about Colombia is sourced from the GNR database which categorized Colombia among South America's countries. Thus, the CO2 emission data for Colombia is the average of all South America's countries. Though the carbon price and trade data are particularly belonging to Colombia. What makes Colombia different among cement exporters is the carbon price of that country which is the highest (4.26 EURO) among cement exporters to the EU implemented carbon price. In the calculation of the CBAM bill, the difference between carbon price paid in the exporter country would be distracted from the price of EU ETS allowances. Therefore, Colombia's bill is quite lighter than others.

Tunisia, Algeria and Morocco

The impact of CBAM would be tinier on Tunisia, Algeria and Morocco, though still substantial. According to our results the CBAM authority in the EU would impose EURO 11.85 to every ton clinker coming from aforementioned countries in 2026, and it gets to EURO 17.89 in 2030. Even, this amount is considerably lower than the other exporters, the proportion of the CBAM cost in their price would be the highest (%113) due to its low price (Euro 35 dramatically lower than the average price (EURO 51)) among other exporters.

Method: the readiness of cement exporters to adapt to the CBAM

To analyse the qualitative data, we employed a backcasting scenario method to explore various carbon reduction measures in three countries such as Turkey, Ukraine and Colombia. Robinson (1982) in the description of a method of policy analysis, defines the backcasting like a normative and designed oriented method which works "backwards from a particular desire end point to the present in order to determine the feasibility of that future and what policy measures would be required to reach that point" (Robinson, 1990 p.823). More recent studies have been carried out with similar approaches, in sustainable transport, recycling and waste management (Dreborg & Steen, 1994; Jungmar et al, 1995). The EU-POSSUM project (Banister et al., 2000) was the first project to assess European Transport policies as their consistency and feasibility, using qualitative scenario based on a backcasting approach. The OECD project on Environmental Sustainable transport (EST) (OECD, 2000; 2002a; 2002b) used a backcasting method to consider what the transport system would look like in Europe if current transport emissions were reduced. Thus this research used this method basically from the EU ETS policy measures and this picture would be similar in the countries where the ETS would be adopted.

Data analysis

As discussed in the previous sections, the focus of this research is to assess how exporters, mainly cement exporters to the EU, are able to adopt EU's formal institutions' practices to impact CBAM on their trade competitiveness. Considering the different trade tariffs and carbon taxes that are put in place in different countries, this thesis intends to identify the level of countries' commitment to contribute to carbon efficient production in order to sustain their competitiveness especially to the EU's market. Based on our conceptualization, and after gone through the literature on institutional coercive pressure/isomorphism, we analyze and assess how top 7 cement exporter countries to the EU would lose or gain their export competitiveness due to the level at which they try to conform their carbon pricing policies to the EU CBAM practices.

The analysis is done on the Carbon Pulse, World Bank, ICAP, EC, ERCST reports and databases on the top 7 countries of 2019 and 2020 period. These reports and databases served to provide us with the information on how CBAM pressures forced them to adopt new changes in environmental protection policies concerning CO2 emission reduction. It is also important to mention that some secondary information from new articles were used to supplement the information that was deduced from the reports and databases.

We analyzed the country's institutions based on the three types of institutional isomorphism which are Coercive, Mimetic, and Normative. We try to identify how countries are under pressure from CBAM while adopting ETS and or carbon pricing, and other CO2 emission related policies in order to avoid their export competitiveness losses in the EU.

We will provide an overview of top 7 countries having cement market in the EU, and identify their environmental protection current positions to conform to the EU ETS basen on ETS existence, ETS size, ETS sectors, ETS status, Scope of emissions, period of ETS, type of instrument, existence of bilateral agreement/integration with the EU, country geographical location, CO2 reduction policies, allowances level, resistance of cap, existence of benchmark or sealing, revenue use (offsets) and rebate, and all these elements were used for the analysis. After that, each country would be analyzed to determine whether it adopted and conform to the EU ETS procedures that would be based on to confirm that a country would gain and sustain its export competitiveness or not, to the EU's market.

- Countries' Coercive Isomorphism overview

As we stated above, countries that have strong benefits of exporting cement to the EU might adopt EU ETS in order to stabilize the competitiveness they currently have in this market. Its a coercive pressure or isomorphism that those countries are under, and we found that this pressure has influenced countries to adopt new changes in environmental protection policies. We have chosen three among the top cement exporters to the EU based on their quantity imported and their current status under way to conform rules, regulations as well as sanctions applied in the EU ETS.

We categorized the competitiveness of countries based on their level of EU ETS conformity where the green color shows an element that is full enforced or conform with EU ETS element, the yellow color shows the conformity of the element under development, and the red color shows the element that is under consideration or does not exist in an exporter country

European Union

Based on the reports of World Bank Group (2020, 2021), we tried to give an overview of EU ETS in short. In 2019, policymakers worked on implementing provisions in line with the revised ETS Directives ahead of the trading phase (2021-2030). In 2018, new legislation was adopted on the carbon leakage list, free allocation rules, the Innovation Fund, auctioning, MRV and accreditation, and the Union Registry. In January 2019, the Market Stability Reserve (MSR) - the instrument to address the supply-demand imbalance of allowances in the EU ETS and improve its resilience against future shocks - became operational. In 2019, 397 million allowances that were intended for auctions were placed in the MSR, thereby reducing the supply of allowances in the EU ETS market.

From January to August 2020, another 265 million allowances were placed in the reserve. Allowances held in the MSR were not permanently withdrawn from the market, although from 2023, the total number of allowances in the MSR will be limited to the auction volume of the previous year. The introduction of the reserve has helped stabilize the EU Allowances (EUA) price around €25/tCO2e over 2019, after increasing from €5-10/tCO2e over the previous two years. However , the economic downturn caused by COVID-19 has seen a drop in EUA prices in the first quarter of 2020 to €17/tCO2e.

As part of the EU's Green Deal in line with the EU's commitment to reach carbon-neutrality by 2050, as placed in the proposed European climate law, the European Commission (EC) reviewed all relevant climate-related policy instruments in June 2021. This included the EU ETS and an extension of emission trading sectors. Moreover, discussions were held on Carbon Border Adjustment Mechanism (CBAM) for selected sectors to reduce the risk of carbon leakage and a legislative proposal has been approved and will be implemented in 2023. Sectors include those traditionally vulnerable to carbon leakage including the cement industry. The CBAM is to form an alternative measure - free allocation and compensation for indirect carbon costs in electricity prices

- of addressing the risk of carbon leakage due to EU ETS. Various options include carbon tax on selected products, a new carbon customs duty or tax on imports, or the extension of the EU ETS to imports. Considerations for implementing a CBAM are similar to those already existing as part of the EU ETS, i.e. an adjustment based on benchmarking. The CE also decided on the alternative approach of taking into account the interaction of the carbon content of products with existing and future climate policies.

EU - ETS in force

Country Location	Under 1000 km	1000 km - 2000 km	2000km - 3000 km	over 3000 km
Type of Instrument	Carbon tax	ETS	Carbon tax & ETS	Undecided
Existence of ETS	Yes	No	N/A	
ETS size (scope)	Direct Emission	Indirect Emission	Other Indirect	
ETS Cement Sectors	Covered	Uncovered		
ETS Status	In Force	Under Development	Under Consideration	
Monitoring, Reporting, Verification (MRV)	Required	Not required		
Scope of Emission	Direct Emission	Indirect Emission	Other Indirect	
CO2 reduction policy	Implemented	Scheduled	Under Consideration	
Carbon price	Yes	No		
Bilateral trade agreement/integration with EU	Yes	No	N/A	
Allowance Price level	> €56	€56	< €56	
Allowance Price Type	Spot Price	Auction Price		
Existence of Cap/limit	Yes	No		
Existence of Benchmark	Yes	No		
Emission Penalties	Enforced	Not enforced		
Institution involved	Yes	No		
Links with other systems	Yes	No		
Rebate/Offsets	Yes	No		

In fact, the EU ETS operates in all EU countries plus Iceland, Liechtenstein and Norway (EEA-EFTA states) and each country EU ETS has to conform to those above elements that we have quoted in green which might be basic element that other non-EU countries adopt for to be competitive on the EU market. We categorized different countries according to their level of commitment in conforming and implementing ETSs. The first category - ETS in force - would be in the green category where countries outside the EU have already adopted the ETS to guarantee the stability of their exports based on the environmental product standards and EU market conformity, therefore their competitiveness position would be higher than other categories. The second category - ETS under development - includes non-countries that have adopted the system but are still under the process of developing the instruments composed in their ETS. These countries are in the yellow category to mean that they are in a good position for their competitiveness in the EU's market. The third category - ETS under consideration - includes countries with a low ambition of CO2 emission reduction. Those countries are categorized in red to mean their low chances to maintain their competitiveness in the EU's market. Their lack of commitment can also be caused by their internal institutions that do not actually support or influence their firms to adopt new changes in protecting the environment.

Turkey

According to ICAP (2021), Turkey's ETS is under consideration status. Tukey adopted a new regulatory framework for a comprehensive, mandatory MRV system in 2012. Monitoring started in 2015 and Reporting (of 2015 emissions) began in 2016. Since 2012, Turkey has:

- Been studying the possible use of carbon pricing instruments to help achieve its mitigation targets; and
- Worked with the PMR to enhance the MRV regulation through pilot studies in the cement, energy, and refinery sectors.

A synthesis report outlining carbon market options for Turkey was submitted to the Climate Change and Air Management Coordination Board in November 2018. The PMR First Phase Closure Meeting was in November 2018 and the PMR Second Phase officially began in February 2019.

With additional funding under the PMR Second Phase, Turkey has developed draft legislation as well as improved technical and institutional capacity to prepare the groundwork for piloting a suitable carbon pricing policy. By the end of 2020, the country had held a series of workshops, conducted technical analyses, and organized stakeholder meeting which culminated in:

- The final draft legal and institutional framework for pilot ETS, published in December

2020;

- The identification of the emission cap and development of the national allocation plan;
- The development of Turk-SIM, an ETS simulation with gamification feature;
- The development of a transaction registry for the pilot ETS;
- The assessment of options for Turkey.

Following the formal end of the PMR Second Phase in February 2020, Turkey is currently considering its participation in the Partnership for Market Implementation (PMI), the successor to PMR. Turkey is also a candidate for EU accession and thereby aims to complete the environmental obligations of the EU accession (including the EU ETS directives) (ICAP, 2021).

Turkey - ETS under consideration

Carbon pricing initiatives are considered 'ETS under consideration' if the government has announced its intention to work towards the implementation of a carbon pricing initiative and this has been formally confirmed by official government sources.

Turkey's ETS elements design

Country Location	< 1000 km	1000 km - 2000 km	2000km - 3000 km	> 3000 km
Type of Instrument	Carbon tax	ETS	Carbon tax & ETS	Undecided
Existence of ETS	Yes	No	N/A	
ETS size (scope)	Direct Emission	Indirect Emission	Other Indirect	Under consideration
ETS Cement Sectors	Covered	Uncovered		
ETS Status	Implemented	Under Development	Under Consideration	
Monitoring, Reporting, Verification (MRV)	Required	Not required		
Scope of Emission	Direct Emission	Indirect Emission	Other Indirect	N/A
CO2 reduction policy	Implemented	Scheduled	Under Consideration	
Carbon price	Yes	No		
Bilateral trade agreement/integration with EU	Yes	No	N/A	
Allowance Price level	> €56	€56	< €56	N/A
Allowance Price Type	Spot Price	Auction Price	N/A	
Existence of Cap/limit	Yes	No	N/A	
Existence of Benchmark	Yes	No		

Emission Penalties	Enforced	Not enforced		
Institution involved	Yes	No		
Links with other systems	Yes	No	N/A	
Rebate/Offsets	Yes	No	N/A	

Despites a limited number of EU ETS elements design, Turkey remains the only G20 country that has not ratified the Paris Agreement (CAT, 2021). Excluding LULUCF emissions, the target in the INDC is equivalent to a 90% increase from 2018 level.

Turkey, one of the countries that improved most in the GCI rankings, does not sustain its good performance once sustainability matters are taken into account (The Global Competitiveness Report, 2020) . High inequality, vulnerable employment, and a large informal sector place pressure on the country's social sustainability. Similarly, high pollution and intensive water use for agriculture, as well as lack of protected land area and low commitment to international environmental agreements remain areas of concern from Turkey's environmentally sustainable competitiveness.

In our interpretation of the data, it shows that Turkish geographical location is positively their main factor to have easy trade with the EU. The reason why Turkey is the first non-EU country exporting cement products to the EU with ⅓ of the total cement imports of the EU. Although this position has a high opportunity to access and sustain their position, they do not show their commitment to prevent climate change. Apart from our findings The Climate Action Tracker (2021) also rated Turkey's Intended Nationally Determined Contribution (INDC) target 'Critically Insufficient' e.i. Turkey's commitment is not in line with interpretations of a 'fair' approach in keeping warming below 2°C, let alone with the Paris Agreement's 1.5°C limit. This means that if most other countries followed Turkey's approach, global warming would exceed 3-4°C.

In our part of qualitative analysis, there are EU ETS elements design to categorize countries in terms of competitiveness loss. Turkey was categorized in ETS under consideration, due mainly to their lack of institutional commitment to set rules, laws and regulations. This lack of institutional design would affect the whole country's export when we talk about EU ETS and CBAM. EU CBAM was designed as a fundamental environmental protection mechanism that non-EU countries would conform to, to be able to maintain their export position in the EU. Thus the coercive pressure over Turkish domestic firms in implementing the environmental protection policies is low, and we categorized this country as ETS under consideration due to the delay of ETS implementation. Therefore this delay would led them to be vulnerable or to competitiveness loss.

Ukraine

According to the ICAP (2021) report, its ETS is under development status. Ukraine plans to establish a national ETS in line with its obligations under the 'Ukraine-EU Association Agreement' which was intended into force in September 2017. Issues related to climate change have officially outlined steps for the implementation of a national ETS, including:

- Adopting national legislation and designating competent authority (ie);
- Establishing a system for identifying relevant installations and GHGs;
- Establishing a system for issuing allowances to be traded domestically among installations in Ukraine;
- Developing a national allocation plan to distribute allowances; and
- Establishing MRV and enforcement systems, as well as public consultations procedures.

The country has developed the main elements of the national MRV system to provide a solid basis for the upcoming ETS. in 2019, Ukraine adopted a framework law on MRV. The MRV law entered into force in 2020 and applies to installation from the start of 2021. To establish its ETS, Ukraine plans to develop separate legislation based on at least three years of data from the MRV system. According to the Ministry of Environmental Protection and Natural Resources (2021), the ETS launch could take place as early as in 2025. Ukraine is working on its ETS plans with the assistance of the PMR and the German Corporation of International Cooperation (GIZ).

Ukraine - ETS under development

Carbon pricing initiatives are considered 'under development' or 'scheduled for implementation' once they have been formally adopted through legislation and have an official planned start date.

Ukraine's ETS elements design

Country Location	Under 1000 km	1000 km - 2000 km	2000km - 3000 km	over 3000 km
Type of Instrument	Carbon tax	ETS	Carbon tax & ETS	Undecided
Existence of ETS	Established	Scheduled	N/A	
ETS size (scope)	Direct Emission	Indirect Emission	Other Indirect	Under consideration
ETS Cement Sectors	Covered	Uncovered	N/A	
ETS Status	Implemented	Under Development	Under Consideration	
Monitoring, Reporting, Verification (MRV)	Required	Not required		
Scope of Emission	Direct Emission	Indirect Emission	Other Indirect	
CO2 reduction policy	Implemented	Scheduled	Under Consideration	
Carbon price	Established	Scheduled	N/A	
Bilateral trade agreement/integration with EU	Yes	No	N/A	
Allowance Price level	> €56	€56	< €56	N/A
Allowance Price Type	Spot Price	Auction Price	N/A	
Existence of Cap/limit	Yes	No		
Existence of Benchmark	Yes	No		
Emission Penalties	Enforced	Not enforced		
Institution involved	Yes	No		
Links with other systems	Yes	No		
Rebate/Offsets	Yes	No		

It has already instituted a carbon tax to incentivise abatement and intends to implement an ETS on large emitters in industry and power and heat generation to support its more ambitious goals in 2020 and beyond. In January 2020, the Ministry of Energy and Environmental Protection published Ukraine's 2050 Green Energy Transaction Concept (Ukraine Green Deal). Overall the concept focuses on reducing GHG emissions through improving energy efficiency and boosting the deployment of renewable energy. While this is a step in the right direction, the 2050 phase-out date for coal is too late, and under the current plan Ukraine will achieve carbon-neutrality only by 2070. To become effective the concept will still need to be supported by concrete policy measures through the National Energy and Climate Plan, which was completed in 2020 (CAT, 2021). There is some uncertainty surrounding Ukrain's NDC and its implementation of its climate policies in part because of its political instability, but the work on updating the NDC is ongoing (Mykhailenko et al., 2019).

Ukraine has stated that it will actively participate in current and future international market mechanisms, but its current emissions reduction target does not take these market mechanisms into account.

Association Agreement with the EU, which became the part of National Legislation in 2014 after its ratification, envisioned gradual approximation of Ukraine's legislation to EU Laws and policies in energy efficiency, renewable energy, energy products taxation, waste treatment, and climate change, including implementation of GHG allowances trading system in accordance to Directive, 2003 on establishment of GHG emission allowance trading system (ETS) within the Community. In 2016, the Cabinet of Ministers of Ukraine, approved the Concept of Implementation of the State policy on Climate change up to 2030. The Concept determines the tasks in the following areas:

- Strengthening the institutional capacity for development and implementation of state policy on climate change;
- Prevention of climate change through reduction of anthropogenic emissions and increased GHG absorption to ensure gradual transition to low-carbon development of the country;
- Adapting to climate change, increasing the resilience and reducing the climate change related risks.

In addition, tax on carbon dioxide from fixed sources, which was introduced in 2011, is the current fiscal instrument to reduce GHG emissions (UNCCC, 2021).

As we have shown above, our data indicate that Ukraine is located in a good geographical position vis-a-vis its cement market in the EU because it does not require a long distance for transportation to export the cement to the EU. The conformity of EU ETS elements design looks great where almost all elements were applied except the existence of cap and carbon benchmarks. Their current ETS status would increase their competitiveness when the EU ETS will be fully implemented in 2026 i.e. they have been prepared for the new change related to the climate change standards where CBAM would not affect their cement export to the EU because they are ready even better compared to other cement export competitors such as Turkey, Belarus, Albania, etc. In our data analysis, Ukraine is categorized in ETS under development. This shows their strong institutional design and the coercive pressure is visibly applied to domestic firms in order to adopt EU ETS standards that would benefit Ukraine's export expectations in a sustainable way. Thus, despite their political instability and low carbon tax, Ukraine is among non-EU cement exporters to the EU that show its effort to conform their production process to the EU ETS.

Colombia

According to ICAP (2021), Colombia's ETS is under development status. In 2018, Colombia adopted a law for climate change management, which outlines provisions for establishment of a National Program of GHG Tradable Emission Quotas' (PNCTE in spanish).

The law outlines the basic provisions for the PNCTE. The Ministry of Environment and Sustainable Development (Minambiente) will determine the number of allowances, in line with Colombia's national mitigation targets. Minambiente is also in charge of allocation, which will take place primarily via auctions. Noncompliance is to be punishable by a fine up to two times the auction price. Auction revenues will be directed to the National Environmental Fund and will be used for GHG reductions and mitigation projects, as well as to manage the information needed for the implementation of the law. The bill also includes crediting provisions: voluntary actions of non-regulated entities that generate GHG emissions reductions or removals could be issued allowances if they are verified, certified, registered,in the National Emission Reductions Registry, and deemed eligible for the program.

Further regulations required to operationalize the PNCTE are yet to be finalized. With support from the Partnership for Market Readiness, Colombia now has the main inputs to form the technical design of the ETS. These inputs are currently under internal revisions. Public discussions on the policy will then follow, as well as the development of the system infrastructure, such as an emission reporting program. The final regulations for the ETS are expected to be concluded and a pilot phase expected to start between 2023 and 2024.

The PNCTE will complement other mitigation instruments, such as the country's existing USD 5 carbon tax and its offsetting program, both of which have been in place since 2017. The 2018 Climate Change Law states that the government may recognize carbon tax payments as part of the compliance obligation of regulated entities under the PNCTE.

Colombia - ETS under development

Ukraine's ETS elements design

Country Location	Under 1000 km	1000 km - 2000 km	2000km - 3000 km	over 3000 km
Type of Instrument	Carbon tax	ETS	Carbon tax & ETS	Undecided
Existence of ETS	Yes	No	N/A	
ETS size (scope)	Direct Emission	Indirect Emission	Other Indirect	
ETS Cement Sectors	Covered	Uncovered		
ETS Status	Implemented	Under Development	Under Consideration	
Monitoring, Reporting, Verification (MRV)	Required	Not required		
Scope of Emission	Direct Emission	Indirect Emission	Other Indirect	
CO2 reduction policy	Implemented	Scheduled	Under Consideration	
Carbon price	Yes	No		
Bilateral trade agreement/integration with EU	Yes	No	N/A	
Allowance Price level	> €56	€56	< €56	N/A
Allowance Price Type	Spot Price	Auction Price		
Existence of Cap/limit	Yes	No	N/A	
Existence of Benchmark	Yes	No		
Emission Penalties	Enforced	Not enforced		
Institution involved	Yes	No		
Links with other systems	Yes	No		
Rebate/Offsets	Yes	No		

Colombia is located in Latin America, their geographical position does not benefit them more like other cement exporters to the EU. Despite Colombia's long distance to the EU's cement market, their ETS is considered as 'under development' status because they conformed their ETS to EU ETS except where the information concerning allowance price, benchmark, and cap are not given. All other ETS elements such as the existence of carbon price, CO2 emission policies are implemented, and the cement sector is covered as well as institutional involvement that supports firms to adopt a sustainable cement production process that is carbon efficient at the level accepted in the EU. Another exception of Colombia is the rebate of revenues where those revenues collected from carbon tax would be used to facilitate the firms innovation and fund environmental protection projects. The Colombian institutional commitment is the coercive pressure that the government put under their domestic firms for the reason of maintaining the cement export competitiveness they have in the EU and we can assume that Colombia is among countries that have a good position to prepare for the CBAM impacts because they have already implemented the Colombia ETS which is a result of strong formal institutions that involve in predicting competitiveness as well as reaching to the government expectations.

Countries	**Competitiveness loss (percent per ton cement products**		**Loss reasons (why)**	**Adoption conditions**	**Strategies to adopt to the CBAM**
	2026	**2030**			
Turkey	36.52 clinker - 26 Portland cement - 8.45 hydraulic cement	106 clinker - 75.78 Portland cement - 31 hydraulic cement	- 843 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) - high clinker ratio in cement (87%) above EU's average (75%) Absence of carbon tax compared to 70 Euro in the EU	- Turkey remains the only G20 country that has not ratified the Paris Agreement (CAT, 2021) Absence of ETS, but the adoption of ETS is under consideration. lack of institutional commitment to set rules, laws and regulations for CO2 mitigation. Turkey is classified as a red country which means that it's readiness to adjust to the CBAM is very low.	- Imposing carbon price to the EU level - reducing CO2 emission through substituting clinker with other cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2 Higher commitment to international environmental agreements

Ukraine	36.52 clinker 26.90 portland cement	102.86 clinker 80.69 portland cement	- 832 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) - high clinker ratio in cement (82%) above EU's average (75%) - carbon tax (0.3 Euro) is significantly below the EU price (70 Euro)	Ukraine's Carbon pricing initiatives are considered as 'under development' or 'scheduled for implementation' once they have been formally adopted through legislation and have an official planned start date. Effective collaboration with the EU regarding the environmental regulations Existence of ETS, though without cap and benchmark for emission. Existence of carbon prices, though it's very low. Active institutional initiative regarding climate change and transformation to green energy, though the 2050 phase-out date for coal is too late. Plane for carbon neutrality in 2070. Ukraine is classified as a yellow country which means that it's readiness	- increasing carbon price to the EU level -Putting a cap on the emission - reducing CO2 emission through substituting clinker with other cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2

				to adjust to the CBAM is at an accepted level.	
Belarus	34.29 clinker 24.42 portland cement	85.04 clinker 85.04 portland cement	- 832 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) - high clinker ratio in cement (82%) above EU's average (75%) Absence of carbon tax compared to 70 Euro in the EU		**Shifting clinker to peat** Imposing carbon price to the EU level - reducing CO2 emission through substituting clinker with other cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2 Higher commitment to international environmental agreements
Colombia	13.23 clinker	43.27 clinker	- 809 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) The clinker ratio is below the EU (73%)	Colombia's Carbon pricing initiatives are considered as 'under development' or 'scheduled for implementation' once they have been formally adopted through legislation and have an official planned start date.	- clarifying the allowance price, benchmark, and cap in the ETS - increasing the carbon price to the level of EU - reducing CO2 emission through substituting clinker with other

			- carbon tax (4.26 Euro) is significantly below the EU price (70 Euro)	Existence of carbon price, though it's very low compared to the EU level. National Environmental Fund used for GHG reductions and mitigation projects allowance price, benchmark, and cap are not well clarified. Colombia is classified as a yellow country which means that it's readiness to adjust to the CBAM is at an accepted level.	cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2
Algeria	33.42 clinker 26.51 hydraulic cement	113.34 clinker 89.90 hydraulic cement	- 793 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) Absence of carbon tax compared to 70 Euro in the EU The clinker ratio is below the EU (72%)	**According to the Sustainable Development Report, Algeria needs to take urgent action to combat climate change and its impacts, the are still in significant challenges with CO2 emissions from fossil fuel combustion and cement production**	Imposing carbon price to the EU level - reducing CO2 emission through substituting clinker with other cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2 Higher commitment to international

					environmental agreements
Morocco	26.69 clinker	90.53 clinker	- 793 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) Absence of carbon tax compared to 70 Euro in the EU		Imposing carbon price to the EU level - reducing CO2 emission through substituting clinker with other cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2 Higher commitment to international environmental agreements
Tunisia	20.68 clinker	70.15 clinker	- 793 kg CO2 emission per ton grey clinker which is above the the EU's benchmark in 2026 (624 kg) and in 2030 (346 kg) Absence of carbon tax compared to 70 Euro in the EU		Imposing carbon price to the EU level - reducing CO2 emission through substituting clinker with other cementitious material, unifying green energy instead of fossil fuel combustion Capturing and storing CO2

Discussion:

Taking departure from the studies based on pollution haven derived from trade theory, which estimates the negative consequences of climate change mitigation regulation (carbon price and carbon tariff), our quantitative results confirm the above studies' findings. In fact, the competitiveness loss in our study is much higher than the previous studies which was based on a lower carbon price and higher emission benchmark. Though, since we also took the institutional preparedness of cement exporters countries into account, the competitiveness loss might be not as severe as the quantitative part shows. The reason is that the already adoption of relevant regulations in the exporter countries might lead to carbon reduction and higher carbon pricing, which would offset the competitiveness loss in the long term.

Since the imposing tariff through the CBAM will begin from 2026, and cement exporters countries would experience a three-year transition of CBAM, a lot of things can change. One of those things is the implementation of the carbon-efficient technology in the exporter countries which can alter the emission embedded in their cement export to the EU. This is in line with Porter’s hypothesis which predicts positive consequences of environmental policies. Porter claims that more stringent environmental policies promote efficiency improvements and cost-cutting through innovation in new technologies, which reduce or completely neutralize cost from environmental regulations. Though The delay of introducing ETS in a country would be a main factor that would lead a country to competitive loss.

In terms of institutional involvement, we found that political instability can affect the implementation of ETS where the lack of transparent institutions, would lead to the lack of decisions to laws legislation that would put firms under coercive pressure to change their production processes. Institutions are most important when a country wants to sustain its export position. With CBAM, countries who are ready to conform CBAM standards will gain cement export competitiveness in the EU than a country whose institutions would not initiate the carbon mitigation policies.

The assessment of countries readiness based on coercive pressure from CBAM confirms that some countries (e.g Ukraine and Colombia) took the green transition and CO2 neutralization very seriously and went through an active cooperation with the EU and implemented the elements of the EU ETS preventing competitiveness loss in trade with the EU. Although the regulative institutions can pressure the firms to adjust to the new reality, the flexibility/adaptability of firms is another concern which determines to what extent firms face the changes as the firm's dynamic theory suggests.

From the resource-based view perspective, Firm resources to adapt to the new competitive advantage would not only be the green technology, but also the ability to forecast the CBAM price in EU to the timing of the export. According to Driving Sustainable Economic (CDP) Over 1,300 companies reported to CDP in 2017 that they are currently using an internal price on carbon or plan to do so within the next two years.

According to Markusen, (1975) who argued for the magnitude of a large economy in terms of its impact on foreign production of pollution-intensive goods through the use of import tariffs, The EU is dictating its ambitions, values and regulations to the rest of the world. When the EU As a largest exporter in the world and as of 2008 the largest importer of goods and services (Wikipedia, 2021), regulates a policy which is related to its trade, the world cannot just ignore it. With that huge bargaining power, the EU can force other countries to come along with its policy. The Carbon adjustment mechanism is one of the examples, that the EU is trying to use it to set a benchmark level for CO2 emission in the world for firms who will have a sort of business with the EU. From 2023 all international firms in five selected carbon-intensive sectors must conform with the EU’s rules. They must four times a year calculate their actual CO2 emission embedded in their exported product to the EU, verify and report to the CBAM authority. Otherwise, the CBAM authority would penalize them.

On the other hand, the EU is about to rewrite the criteria of competitive advantage for the rest of the world. From 2026 only those firms which could adopt low-carbon-intensive technology especially in the carbon-intensive sectors as cement, aluminum, steel and fertilizer would gain cost competitiveness advantage in the EU. That would alter the pattern of trade between The EU and the rest of the world. The firms/countries which do not adapt to that new reality, would lose their cost competitiveness extremely. The main reason is the high carbon price which is continuously increasing. On the other hand, the free allocation of emission allowances would begin to phase out from 2026. This has a huge impact on carbon-intensive industries such as cement that emits 834 kg Co2 (GNR, 2019) producing one ton cement clinker. Our thesis' results also confirms that the price of one ton carbon paid by cement producers in 2030 would be ahead of the price of cement itself. That means if the extra cost from CO2 emission was not got through to the customers, the firms which have not reduced their emission, would lose their cost competitiveness as well as their market share in the EU, but the firms who strategized low-carbon-intensive production method, would have competitive advantage (in other words, carbon competitive advantage) and extend their market share in the EU.

A side effect of "the carbon competitive advantage" can be trade pattern change in a way that countries with low carbon technology get the opportunity to trade with each other without extra carbon tax. At the same time the countries with pollutant technology, would rather trade with each other to avoid carbon tariff and not investing in greener technology.

Conclusion

through a mixed methodology we found that the competitiveness of cement exporters to the EU would be strongly affected by the CBAM if the exporters do not adjust to the requirements of the CBAM. Though we also found that the negative consequence of the CBAM can be neutralized by cooperation of firms and domestic institutions on one hand and cooperation of the EU and exporters countries on the other hand. In other words, the more the cement exporters countries facilitate the adjustment to the CBAM the higher chance they will get to prevent the negative side of CBAM and even move forward to a green transition in their economy.

Further research

In our study we only assessed cement exporters' competitiveness loss compared to each other in the EU market and we ignored the impact of CBAM on the domestic cement producers. CBAM will also reduce the allocation of free allowances for the domestic producers which also has an impact on their cost competitiveness in the EU and in the foreign markets. A more comprehensive study that assesses the impact of CBAM on both sides together provides an insight in overall competitiveness changes after the implementation of CBAM.

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