Cross-border carbon taxes and shareholder wealth

Marta Alonso
IESE Business School
malonsos@iese.edu

Martin Jacob
IESE Business School
mjacob@iese.edu

Gaizka Ormazabal
IESE Business School
gormazabal@iese.edu

Robert Raney
IESE Business School
rraney@iese.edu

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Abstract

This paper explores the effect of cross-border carbon taxes on shareholder wealth. For identification, we analyze stock price reactions to news about the introduction of the Carbon Border Adjustment Mechanism (CBAM) in the EU. We find that stock prices of EU importers of CBAM products respond more negatively to the announcement of the CBAM than those of similar non-European firms. The results from cross-sectional tests support the interpretation that the documented patterns reflect EU firms' limited ability to pass on the tax cost in commercial relations with non-EU counterparts. Collectively, our results shed doubt on the ability of cross-border carbon taxes to level the playing field between local and foreign firms.

Keywords: Carbon pricing, market reactions, border adjustment, climate regulation

1. Introduction

Over the past years, few topics have dominated the political,[1] societal,[2] and academic debate more than climate change and the emissions of greenhouse gases, particularly those of carbon dioxide. Many countries have taken actions to reduce carbon emissions. Recent regulatory developments include disclosure regulations and carbon pricing schemes in the form of emission taxes and cap-and-trade systems. The European Union (EU) is at the forefront of the current regulatory efforts to curb carbon emissions. Notably, EU firms are subject to carbon pricing through a cap-and-trade system called the EU Emission Trading System (EU ETS).

A key concern regarding the effectiveness of putting a price on carbon is the possibility that affected firms lose competitive edge vis-à-vis foreign competitors that are not subject to the same regulatory requirements. To avoid this disadvantage, firms have an incentive to relocate their production to countries with less strict environmental regulation or to outsource production to non-EU suppliers (e.g., Naegele and Zaklan 2019, Borghesi et al. 2020, Dechezleprêtre et al. 2022a, Colmer et al. 2024). This type of regulatory arbitrage—commonly referred to as "carbon leakage"—is not only detrimental to the economy of the home country (e.g., among other things, it would result in a loss of jobs in home countries), but also undermines efforts to reduce worldwide emissions as it would not result in a decrease in aggregated worldwide emissions (Kanzig et al., 2024).

To address this problem, the European Union has recently established the so-called "Carbon-Border Adjustment Mechanism" (CBAM). Under the CBAM, EU firms importing carbon intensive goods from non-EU sources will have to pay a carbon price on those imports as

[1] For example, the agenda of the 2023 Group of Twenty (G20) meeting listed "*Green Development, Climate Finance & LiFE*" as the first of six priorities (see https://moes.gov.in/g20-india-2023/moes-g20?language_content_entity=en).
[2] The OECD paper by Dechezleprêtre et al. (2022b) based on respondents to a large-scale international survey shows that 84 (88) percent of respondents in high (middle) income countries view climate change as a key problem.

of 2026. The goal is to "*reduce the risk of carbon leakage*" by ensuring "*a level playing field between EU and non-EU businesses*".[3] CBAM is a new and unique economic phenomenon; no jurisdiction has ever before imposed a cross-border tax on the import of carbon intensive goods.

Although there is a heated debate surrounding the CBAM, there is still little empirical evidence on the consequences of this regulation. This is understandable, as the CBAM has not yet been implemented; it is currently in a transitional "disclosure only" phase until the end of 2025. Payments for imported carbon will be phased in starting in 2026. In this paper, we take a first step to understand the welfare implications of the CBAM by exploring its effect on shareholder wealth. Specifically, we examine whether the regulation differentially affects shareholder value across EU and non-EU firms. Understanding the presence and directionality of such variation is important for the debate on the CBAM's ability to level the playing field between EU and non-EU firms.

To address our research question, we analyze cross-sectional variation in stock market reactions to news on the introduction of the CBAM. Given the anticipatory nature of stock prices (i.e., they impound market expectations), this empirical approach — which has been used in recent research exploring the effects of other important tax legislations (e.g., Gaertner et al. 2020; Gomez-Cram and Olbert 2023) — allows us to provide insights into the consequences of the regulation before its actual implementation.

The potential cross-border effect of the CBAM on stock prices is empirically intriguing. In line with the notion that the regulation levels the playing field between EU and non-EU firms, one could expect that non-EU firms exhibit stronger negative market reactions than EU firms. This

[3] These quotes are from the European Commission – Questions and Answers press release on CBAM from July 14, 2021 (https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_21_3661/QANDA_21_3661_EN.pdf). Of course, the purpose of the regulation is stated in more general terms. In words of Valdis Dombrovskis, who is the European Commission's Executive Vice-President for "an Economy that Works for People", the general purpose of the CBAM is "*to achieve [the] ambitious emission reduction targets and achieve climate neutrality by 2050*" (see https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4685).

would be consistent with prior literature on optimal tariffs, which documents that countries can strategically increase tariffs if they have market power (Broda et al. 2018). In this way, foreign firms exporting goods to the country would bear the burden of a tariff hike, while leaving local firms' costs unaffected.

Nonetheless, the opposite pattern is also theoretically possible. Critically, the effect of a cross-border tax depends on whether importing firms can pass the economic burden of the tax onto their foreign suppliers via lower prices for imports. If the additional cost of carbon imposed on imports cannot be passed on to non-EU firms, the regulation would add to the cost of imports by EU firms, thereby putting EU firms at a disadvantage. This is particularly critical considering that—in contrast to most of their competitors—EU firms are already burdened by the costs of carbon associated with the EU ETS and by a variety of carbon taxes. Moreover, EU firms are subject to additional administrative and compliance costs due to the CBAM. As such, it is possible that the CBAM induces stronger negative stock returns among EU firms relative to non-EU firms in the same industry. Such evidence would be in contrast to the intended purpose of the regulation as a mechanism to level the playing field between EU and non-EU firms. It would also be at odds with the "polluter pays principle" underlying the environmental policies of the European Commission and the United Nations.

It is also plausible that the CBAM has little effect on the market value of EU or of non-EU firms. One possibility is that EU firms make up for this incremental cost increase by passing this cost onto their customers. Moreover, there may be no market responses because the verification, compliance, and enforcement of the CBAM could prove difficult, resulting in the expectation of no material shift in the competitive dynamics of EU versus non-EU firms. Among non-EU firms, CBAM could lead to a positive stock reaction if extending carbon pricing to a broader range of

products indirectly lowers the global price of high emission fuels benefiting non-EU firms with value chains not impacted by EU carbon pricing mechanisms (Fontagné & Schubert 2023). It thus appears to be an empirical question whether stock prices of EU or non-EU firms are more affected by cross-border carbon pricing.

We analyze stock price patterns around the key regulatory events associated with the CBAM. Using press releases from the European institutions responsible for the CBAM, we identify three significant unconfounded events for our study; the European Commission' proposal for the CBAM, the EU Parliament's adoption, and the voting in the EU parliament. Using these three events and stock returns of listed firms from 75 different countries, we calculate cumulative abnormal stock returns (CARs) and analyze cross-sectional variation based on the potential effect of the new regulation.

Our tests consistently exploit two sources of variation: whether the firm is headquartered in a European country and whether the firm imports the products covered by the regulation (referred to as "CBAM products"). To identify firms with a higher probability of being importers, we classify a firm as importer of CBAM products if the firm i) operates in at least one of the six sectors producing CBAM products (there is frequent within-industry supply of these products) or ii) does not operate in those sectors but sources from them.[4]

We first observe that, on average, firms producing or purchasing CBAM products exhibit negative abnormal returns, suggesting that the market views cross-border carbon pricing as costly. Importantly, the negative stock market reaction is stronger for EU compared to non-EU importers of CBAM products. Aggregating across the three events, the difference in stock returns around the

[4] Due to data limitations, we cannot directly observe if a given firm imports CBAM products. Instead, we infer the likelihood of a firm being an importer based on its industry affiliations and its supply chain relationships. That said, in section 4.3 we partially address this limitation by exploiting variation in the number of non-EU suppliers.

event date between the two groups ranges between 2 and 3 percentage points (depending on the specification). The difference in stock returns remains statistically significant when comparing importing firms directly affected by the CBAM (e.g., a truck manufacturer buying steel) to non-importers of CBAM products, which are not directly affected by the tax (e.g., a logistics company purchasing trucks from the manufacturer). The results do not depend on a specific model for CARs or on a particular length of the window used to accumulate CARs.

We next test the empirical validity of our explanation for why EU firms may respond more negatively to the introduction of the CBAM than non-EU firms. That is, even though goods exported by non-EU firms to the EU will have a carbon price imposed on them at the border, the more negative stock market reaction by EU firms can reflect that EU firms are unable to pass on the cost induced by the CBAM to non-EU firms. Using the supply chain data from FactSet Revere, we find support that the market appears to expect that the CBAM will increase the price paid by EU firms for inputs from non-EU sources. EU importers of CBAM products with more suppliers from outside the EU exhibit significant negative market reactions in response to the CBAM compared to firms with fewer suppliers from outside the EU.

To corroborate the notion that the capital market anticipates that EU firms are unable to shift the CBAM burden to non-EU firms, we explore differences in supply and demand elasticities to proxy for the pass-through of taxes (in our case, cross-border carbon tax) to stakeholders (Weyl and Fabinger 2013). We follow prior empirical literature and use profit margins as a comprehensive measure to proxy for the ability to pass on taxes (e.g., Jacob, Michaely, and Müller 2019, Jacob and Zerwer 2024). Firms with low profit margins are more likely to bear the cost of the CBAM to the extent that these firms have less price elasticity and thus relatively lower market power than their commercial counterparts. Consistently, we find that EU importers of CBAM

products with low margins (i.e., less market power) exhibit stronger negative market reactions to the CBAM than non-EU importers. Critically, this finding is concentrated among firms with suppliers from non-European countries. These results give credence to the idea that the documented return patterns reflect that EU firms have relatively less bargaining power than their non-EU counterparts (which is consistent with the general perception that many EU firms critically depend on the supplies and imports from non-EU countries).

Finally, we contemplate alternative explanations for the documented patterns. First, we address concerns about differences in firm fundamentals (via matching) and business models (via focusing on firms with a sustainability focus). Second, we address the concern that the introduction of the CBAM comprises also a stepwise decline in free carbon allowances for EU firms regulated by the EU ETS. Our results could thus reflect the expected additional cost due to fewer free allowances in the future. Moreover, our results could reflect the limited ability by EU firms to engage in carbon leakage.[5] Using data on free allowances as well as data on the coverage ratio of firms' total emissions via the EU ETS, we show that, when controlling for free allowances or for the historical coverage of emissions via the EU ETS, the negative stock market reaction continues to be related to having external suppliers from outside Europe and to having low market power. We thus conclude that our results are unlikely to be fully attributable to the phase-out of free carbon allowances or to the prevention of carbon leakage.

Collectively, our findings suggest that—unless the EU intended to disproportionally burden low margin EU firms with suppliers from outside the EU—EU policymakers may not reach

[5] Firms historically receiving high amounts of allowances for free are those deemed by the European Commission to have the highest risk of re-allocating (i.e., leaking) production outside of the EU. Highly exposed firms are placed on a carbon leakage list by the EC and, during phase 4 of the EU ETS (2021-2030), were expected to receive free allowances equivalent to 100% of a relevant benchmark compared to the 30% free received by less exposed sectors (https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en#carbon-leakage-list).

the intended goal of the CBAM. At least, the evidence does not seem consistent with the notion that the regulation levels the playing field between EU and non-EU businesses. EU firms across all countries appear to suffer from the CBAM. While we also observe negative stock price reactions among non-EU firms, these reactions are modest compared to those among EU firms.

With these findings, our paper complements recent literature on the effects of emission trading systems and emission taxes on emissions (e.g., Naegele and Zaklan 2019, Borghesi et al., 2020, Dechezleprêtre et al. 2022a on ETS and, e.g., Li et al. 2021, Pretis 2022, Metcalf and Stock 2023, Erbersteder et al. 2024, Martinsson et al. 2024 on emission taxes). We complement these papers by exploring capital market reactions to carbon pricing mechanisms. Our findings suggest that the cost of pricing carbon may not be borne by firms exporting the products (in our case, non-EU firms exporting goods subject to the CBAM), but that customers may bear the burden of carbon pricing (in our case, EU importers of CBAM products) as reflected in lower stock prices in response to CBAM announcements. Our findings thus imply that, in addition to climate change exposure (Sautner et al. 2023), indirect exposure to regulation and carbon pricing mechanisms along the supply chain is also priced in equity markets.

With our findings, we also contribute to the literature on the distributive effects of carbon pricing mechanisms such as CBAM. While some studies suggest that EU firms might experience competitive losses (e.g., Bellora and Fontagné 2023), other studies suggest that the competitive position of advanced economies in the EU might improve at the cost of Asian and Eastern European economies (e.g., Ward et al. 2019) or of China, India, and Russia (e.g., Zhong and Pei 2022). Our findings indicate that EU importers of CBAM products disproportionally lose from the CBAM. This finding is also related to prior research on tariffs that add a price on cross-border transactions. This literature suggests that countries impose tariffs when they have high market

power (e.g., Broda et al. 2008).[6] Our results suggest that the EU did not choose the CBAM sectors in a way to make non-EU firms pay as EU firms are losing most in terms of stock prices in response to the enactment of the CBAM.

Our findings have important policy implications. To begin, our evidence suggests that, in a globalized and interconnected world, policymakers' actions to impose a carbon price on imports may have unintended negative financial consequences on their own economy. Moreover, the finding that the CBAM induces lower relative stock returns for shareholders of EU firms that import CBAM products and, in particular those firms with less pricing power, is inconsistent with the regulatory objective of leveling the playing field between EU and non-EU firms (unless the EU intended to put a disproportionate burden on these EU firms to level the playing field). Interestingly, this effect also runs against the fundamental principle of the United Nation's environmental policy that "*the polluter should, in principle, bear the cost of pollution*" (United Nations 1992, principle 16).[7]

Our paper calls for further research to understand the economic consequences of cross-border carbon taxes. As the CBAM is in a transitional "disclosure only" phase until 2026, our tests explore market expectations on the effect of the CBAM. Future research could examine firm behavior around the implementation of the CBAM, both ex-ante (i.e., in anticipation of the rule) or ex-post (i.e., once the rule enters into force). This behavior includes actual price changes on

[6] Moreover, our results are also related to the evidence that the 2018 tariffs set by the U.S. reduced the welfare in the U.S. (e.g., Amiti et al. 2019, Fajgelbaum et al. 2020). Importantly, these findings do not imply that firms' stock prices should react most negatively to tariffs set in their home country. This is because firms can also pass on the cost induced by tariffs to consumers (e.g., Trefler 2004, Amiti et al. 2019, Flaaen et al. 2020, Fajgelbaum et al. 2020) or suppliers. Cavallo et al. (2021) show that U.S. firms reduced export prices in response to the retaliatory tariffs by the EU or China around the 2018 suggesting that U.S. firms bear part of the burden induced by retaliatory tariffs. Our results suggest that, even without any retaliatory CBAM by non-EU countries, EU firms already bear more of cross-border carbon pricing.

[7] The principle of "making the polluter pay" is also present in the environmental policy issued by other major political institutions. For example, the European Commission states that *"[t]he polluter pays principle is a simple idea at the core of EU environmental policy: those responsible for environmental damage should pay to cover the costs*" (https://environment.ec.europa.eu/economy-and-finance/ensuring-polluters-pay_en).

imported goods, changes in consumer prices (which are informative about the extent to which customers may bear the burden of cross-border carbon pricing), and relocation of production or investments in production technologies.

2. The Carbon Border Adjustment Mechanism and the Legislative Process

2.1 The Carbon Border Adjustment Mechanism

When implemented, the Carbon Border Adjustment Mechanism (CBAM) will be the world's first carbon border tax. The taxation scheme is intended to level the playing field between EU firms and non-EU firms exporting to the EU and avoid "carbon leakage" (i.e., relocation of production to countries with less strict environmental regulation). In Appendix A, we provide a detailed explanation of the CBAM, its background and scope, the measurement and reporting of embedded emissions, the timeline, as well as detailed information on the monitoring and verification process. In this section, we only briefly cover these topics.

Once the CBAM is active, importers located in the European Union need to buy carbon certificates on emissions embedded in imported goods covered by the CBAM. The embedded emissions will be calculated at the product level and these emissions need to be verified by an accredited entity. Hence, EU firms importing goods from non-EU countries must organize the product-level carbon accounting, including assuming the verification and compliance costs and providing the liquidity to buy carbon certificates. The price of the CBAM certificates for imports into the EU will be calculated based on the weekly average price of EU ETS allowances.[8] Importantly, the European Commission monitors the enforcement processes, but each EU country designates a national competent authority that conducts monitoring and administration functions for the CBAM. For example, these national authorities have the responsibility for examining

[8] If the imported good is subject to carbon pricing in the respective country of origin, this carbon price can be deducted.

suspicious cases identified by the European Commission and can impose penalties.

On October 1, 2023 the CBAM entered a transitional "disclosure only" phase. The obligation to purchase and surrender CBAM certificates will start in 2026. Initially, a fraction of emissions of imported products will be subject to the CBAM price, with the percentage covered increasing through 2034 in parallel with the reduction of free EU ETS emission allowances given to EU producers.[9]

In its current form, the CBAM applies to products produced mostly in the following six sectors: iron and steel, cement, aluminum, fertilizers, hydrogen and electricity generation. For brevity, we refer to these sectors as "CBAM sectors" and to the products covered by CBAM as "CBAM products". To determine whether a product is covered by CBAM or not, an importer needs to check whether the imported product is listed on the Combined Nomenclature (CN) list specified in Annex II of the EU CBAM implementing regulation (Commission Implementing Regulation (EU) 2023/1773). For example, if a car manufacturer in Europe imports steel products such as flat-rolled steel or steel bars (CN codes 7208 to 7214) or aluminum plates (CN code 7606) from a non-EU company, this import is covered by the CBAM. If, however, the car manufacturer imports a processed product, e.g., a welded aluminum car door, this is not subject to the CBAM because it is a different product with a different CN code. Another exemption from the CBAM exists for exporting companies. That is, for products that are exported to non-EU countries, EU importers can deduct the CBAM price on the non-EU imports to produce the exported goods. For example, if an EU car manufacturer produces cars in Europe and exports these cars to a non-EU country, then this EU firm will effectively be exempt from the CBAM on the imported aluminum

[9] In the EU Emissions Trading System (ETS), regulators grant free emissions allowances to firms that face significant risk of carbon leakage and external competition from non-EU firms (i.e. competition from firms not paying a price for emissions via the EU ETS). The EU authorities plan to gradually reduce these free allocations.

or steel from outside the EU to produce these exported cars. However, EU importers face significant compliance and administrative costs to obtain these deductions.

2.2 The Legislative Process and Selection of Events

To identify the relevant events associated with the development and ultimate adoption of the CBAM regulation, we examine the press releases and websites of the European Parliament (EP), Commission (EC), and the Council of the European Union (CEU). These three institutions are responsible for the proposal and adoption of the CBAM. In addition, we search for the words "CBAM," "carbon border tax" and "carbon border adjustment mechanism" in Factiva and Google. Using this procedure, we identify 12 potentially relevant events (see Table 1).

We apply two filters to this list of events. First, we identify and exclude events with confounding information. For this reason, we drop 12/11/2019 because, in addition to proposing the CBAM, the Green Deal included a wide array of impactful policy proposals including ambitious targets for carbon neutrality by 2050, substantial financial support for green technologies, and stringent regulations on emissions and energy efficiency. We also exclude 3/4/2020 because this event falls right in the emergence of COVID in Europe, and we exclude 12/13/2022 because the FED and ECB both announced 50 basis points interest rate increases on December 14 and 15 respectively.[10] Second, we eliminate events where the implications for either the substance or the probability of implementation of the tax scheme are expected to be immaterial. This excludes 7/16/2019, as the cross-border carbon tax is simply mentioned in the context of the election of the EC president Ursula von der Leyen in 2019. The news on that event date includes

[10] Note our inferences on the differential impact on EU versus non-EU firms remain similar if we add this event to our tests (see Table A.1 of the Online Appendix). We note that on March 4, 2020, there is a negative stock market impact on EU firms, but this effect is unrelated to the CBAM as the stock market reaction of importers is not significantly different from that of non-importers (untabulated). This suggests that event captures the impact of COVID but not the inception of impact assessment of the CBAM.

many other potential ideas and policy items. This also excludes 7/22/2020, which relates to the launch of the consultation phase for the CBAM, which was previously announced. Also based on this criterion, we leave out 2/5/2021, 3/10/2021, 12/8/2021, and 3/15/2022, as they correspond to minor adoptions and resolutions that are unlikely to have a material impact (the European Commission (EC) has the de-facto monopoly on initiating legislative processes).[11]

The event dates that pass the above filters are as follows. The first date is 7/14/2021. On that day, the EC adopted the proposal for a carbon border adjustment mechanism within the Fit-for-55 climate legislative package. With this proposal, market participants obtained information on the proposed timeline and some information on the administrative processes, covered industries, and reporting requirements. While this event also covered other items, the Financial Times described the CBAM as "by far the most important part of all the bits of the [green recovery] package".[12] At that time, there remained significant uncertainty whether the CBAM would eventually be approved and specifics of the regulation were still unclear.

The second date is 6/22/2022, which is when the EU Parliament adopted its position on the CBAM regulation. On that day, politicians made progress regarding the timeline, the scope, the phasing out of granting free allowances through the EU ETS, and how revenues from the CBAM would be used. Despite the substantial progress in the political process, there was still some uncertainty left about key items such as the compatibility with the World Trade Organization.

[11] As we show in Figure 1, the media did not pick up these events in as material of a manner as our selected events. Consistent with this notion, we find similar results when including the other events to our three selected events, if not more negative (see Table A.1 in the Appendix). One notable exception is that on March 10, 2021, there is a negative market reaction among *Importers of CBAM products* in the EU, which could be due to the EU Parliament adopting a proposal on a WTO-compatible CBAM. However, we do not include this event in our main analysis because the European Commission has the de-facto monopoly on initiating legislative processes. Importantly, our inferences on the differential impact on EU versus non-EU firms remain similar and do not show a market reaction reversal when adding these events to our tests (see columns 9 and 10 of Table A.1).

[12] See https://www.ft.com/content/de7d12e2-0d04-43d4-b38c-cf795854a4a2. We note that all our results qualitatively similar when excluding July 14, 2021 from the sample (Table A.2 of the Online Appendix).

Moreover, several industry representatives expressed concerns about adverse economic impacts on the EU market, increased costs, and a loss in competitiveness.

The third date is 4/18/2023. On that day, the CBAM regulation was voted and passed in a plenary session of the European Parliament. While the vote was eventually strongly in favor of the CBAM, there was some uncertainty about the probability that the CBAM regulation would be passed on the day before because members of the Socialists and Democrats (S&D) group in the EU parliament were still discussing the position and the French Green party were against the CBAM.[13] With this event, the uncertainty regarding the legislative process was de facto resolved.

To validate our selection of events, we systematically collect media articles covering the CBAM from 2019 to 2023. We retrieve news articles from Factiva containing the terms "carbon border adjustment mechanism" and "CBAM".[14] Figure 1, Panel A shows the monthly volume of news articles over the period from 2019 to 2023. In Panels B to D, we zoom into a 20-day window around the three dates selected for our empirical analysis (i.e., 7/14/2021, 6/22/2022, and 4/18/2023). The data support the notion that news coverage of the CBAM spiked around these three dates. Importantly, Panels B to D indicate that there was little media coverage on the days preceding the three dates. In Figure A.1 of the Online Appendix, we find very similar patterns using Google high interest scores based on Google Trends. Taken together, the analyses in Figure 1 and Figure A.1 provide comfort on the validity of our event selection criteria; this descriptive evidence points at 7/14/2021, 6/22/2022, and 4/18/2023 as the key informational events on CBAM.

[13] On that day, the EU parliament also voted for an extension of the EU ETS for the housing and the maritime sector and voted in favor of a social climate fund. These decisions should not affect our inferences because we select treated firms based on the exposure to inputs covered by the CBAM sector.
[14] The news patterns are very similar when extending the search terms to include "EU carbon border tax".

3. Research Design

3.1 Data and Sample Selection

We obtain daily stock prices and financial statement information from Compustat North America and Compustat Global. We require stock price information for all firms and drop observations with missing financial information on total assets, net income, or cash holdings in 2019. We collect information in 2019 to avoid the effects of the COVID-19 pandemic on these controls. We exclude firms with assets below USD 100 million to ensure that our results are not driven by small firms.[15] As shown in Table 2, Panel A, this procedure yields 17,488 firms, 1,908 firms from EU countries, and 15,580 firms from non-EU countries. The sample includes 834 EU importers of CBAM products and 8,096 non-EU importers of CBAM products. Table 2, Panel A, also reflects that, as explained before, importers of CBAM products include firms inside and outside the six CBAM sectors. The sample also includes 1,074 EU firms and 7,513 non-EU firms that are not importers of CBAM products. As shown in Table 2, Panel B, our tests include firms from 29 EU countries and 81 non-EU countries

We include firms from Iceland, Norway, and Switzerland in the group of EU firms. While these three countries are not members of the EU, they have agreements with the EU regarding the ETS and the CBAM. We exclude UK firms from our sample. There is no agreement between the UK and the EU regarding the ETS and the CBAM, so UK firms could be included as "non-EU". However, because the UK's ETS was originally part of the EU ETS and has a complicated divergence and similarity since 2021 and because the UK is considering its own CBAM expected to share some design features with the CBAM, we exclude UK firms from the sample. Our findings remain the same when including UK firms as "non-EU" firms (untabulated).

[15] Our results are robust to reducing or increasing the cutoff, e.g., to USD 10 million, 50 million, or 1 billion (see Table A.3 in the Online Appendix).

We obtain supply chain data for our sample firms from FactSet Revere to identify non-EU firms which have EU customers and EU firms with non-EU suppliers. Supply chain data from FactSet Revere are hand-collected, verified, and updated by analysts relying on a range of primary sources of information, including companies' annual reports and SEC filings, investor presentations, company websites and press releases, supply contracts, and purchase obligations (Pankratz and Schiller, 2021). FactSet Revere includes only a subsample of the global supply-chain relationships, but it covers a global sample of firms, and it improves previous research relying on the SEC's regulation S-K, which only includes U.S. firms' customers representing at least 10% of their total sales.[16]

3.2. Identifying Likely Importers of CBAM Products

As explained in Appendix B, the CBAM affects firms that source products on the list specified in Annex II of the EU CBAM implementing regulation (as in section 2, we refer to these products as "CBAM products"). We refer to these firms as "importers of CBAM products". As illustrated in Figure 2, there are two types of such importers (highlighted in gray). The first type are firms that are not in one of the six "CBAM sectors" (as explained in section 2, these are sectors where firms produce CBAM products). As an example, consider a construction company that purchases cement—a CBAM product—and then sells the construction product to a real estate management company. The second type are firms in CBAM sectors that source from other firms in CBAM sectors (as we show in Figure A.2 of the Online Appendix, this occurs very often). As an example, consider a European producer of cement clinkers (CN code 2523 10 00) that buys kaolinic clays (CN code 2507 00 80) from a non-EU cement company.[17] Accordingly, we classify

[16] The analysis using supply chain data for the sample of importers of CBAM products is based on 697 EU firms and 6,825 non-EU firms.

[17] Figure 2 also illustrates that the customer of the importer could be directly affected by CBAM if the transaction involves a CBAM product from outside the EU. In the case of within-EU transactions or transactions of non-CBAM

a firm as having a higher probability of being an importer of CBAM products if the firm i) operates in at least one of the six sectors producing CBAM products or ii) does not operate in those sectors but sources from them.

3.3 Measuring Stock Market Reactions

To estimate market reactions to the CBAM regulation, we compute abnormal returns as the difference between the actual stock return ($r_{i,t}$) and the expected return ($\hat{r}_{i,t}$) for firm *i* in day *t*. Our baseline specification estimates $\hat{r}_{i,t}$ using the daily Fama-French three factor model. Because the CBAM may affect a large subset of firms in the global equity market—with a primary focus on European firms—specifying an appropriate market index for use in the Fama-French three factor model is an important research design choice. We use the Russell 3000 daily return, as selecting too narrow of an index from a specific firm's market could remove some of the effect we seek to identify. We rely on a pre-event estimation period of [-120, -30] day window (with t=0 being the event date) and calculate the abnormal returns using the three daily Fama-French factors, namely market risk, size, and value.[18] In Table A.4 of the Online Appendix, we show that our main findings are robust to using alternative estimation methods for abnormal returns such as market-adjusted returns or residuals from the market model (see, e.g., Kotter & Larkin 2024).

Using our baseline approach, we obtain cumulative abnormal returns (CARs) as follows:

$$CAR(t_1, t_2)_i = \sum_{t_1}^{t_2}(r_{i,t} - \hat{r}_{i,t}) \quad (1)$$

where t_1, t_2 are the starting and ending day of the event window. First, we accumulate the abnormal return over days [0, 2], where day 0 is the event date when the CBAM news were released. Second,

products the regulation could have an indirect effect downstream the supply chain to the extent that the CBAM costs are passed on to the customer.

[18] The daily Fama-French factors are obtained from Kenneth R. French's online Data Library (Kenneth R. French - Data Library (dartmouth.edu)). We use the daily factors for the developed markets, Asia-Pacific, and North America for the respective samples.

consistent with prior literature (Armstrong et al. 2010, Grewal et al. 2019), we aggregate the CARs across the three identified events. Aggregation is appropriate for our study because the regulatory process takes some time and is uncertain. Aggregating different events relevant for the adoption of the CBAM allows us to obtain a more complete and precise inference of the effect of the regulation on shareholder wealth. In supplemental tests, we show that our results are robust to taking alternative windows around the event dates that include the effect of information leakage (we repeat the analysis using ([-1,1], [-2,2], and [-3,3] days around the event dates).

3.4 Multivariate Tests

Our multivariate tests are based on the following baseline model:

$$CAR_i = \alpha + \beta_1 EU\ Importer\ of\ CBAM\ product + \beta_2 ROA_{2019,i} + \beta_3 Cash_{2019,i} + \beta_4 TA_{2019,i} + \beta_5 MTB_{2019,i} + Industry\ Fixed\ Effects + \varepsilon_i \quad (2)$$

where CAR_i is the aggregated CAR (0,2) across the three events for firm i. The variable of interest is *EU Importer of CBAM product*, which equals to one if the firm's headquarters are located in the EU countries, in Iceland, Switzerland, or Norway, and zero otherwise.

To understand whether the effect of CBAM hinges on the importer being inside/outside the CBAM sectors, we repeat the analysis replacing *EU Importer of CBAM product* with two alternative variables. *EU Importer of CBAM product in CBAM sector* (an indicator for importers in the six CBAM sectors), and *EU Importer <u>not</u> in CBAM sector* (an indicator for importers that are not in the six CBAM sectors). This specification allows us to test two things at the same time.

Equation (2) also includes a vector of firm-level controls: return on assets (*ROA*), cash to assets (*Cash*), the natural logarithm of total assets (*TA*), and the market-to-book ratio (*MTB*). These variables are measured in 2019, that is, before the Covid-19 crisis and the three considered CBAM

events. We also include industry fixed effects to ensure that we are comparing returns of EU versus non-EU firms within industries.

3.4. Descriptive Statistics

In Table 3, Panel A, we present simple descriptive statistics for our sample firms. On average, firms have a market value of USD 2.89 billion, but the distribution of size is skewed due to some very large firms. The average market-to-book ratio for our sample firms is 2.8. Firms have, on average, a return on assets of 2.1% and hold 12.8% of their assets as cash. On average, firms have close to 8 non-European suppliers and 8 non-European customers.

In Panels B and C, we split the sample into EU firms and non-EU firms. Panel B shows the descriptive statistics for the subsample of importers of CBAM products, while Panel C for non-importers of CBAM products. EU importers are larger, have a larger market-to-book ratio, and higher profitability. EU importers have more EU customers, but also more non-EU suppliers, and non-EU customers than non-EU importers. This is consistent with EU importers being larger on average but could also reflect a supply chain dependency on non-EU firms.

4. Empirical Results

4.1. Average Market Reaction to the CBAM

We start by exploring the average stock market response to the CBAM without distinguishing between EU and non-EU firms. Table 4, column 1, shows that, after adjusting for return co-movement, the stock price of our sample firms declined by about 0.56% across the three selected events. This suggests that the market expects that, on average, the CBAM will impose a net cost on all our sample firms, that is, including EU and non-EU firms. Columns 2 and 3 show that, while the negative reaction is larger for importers of CBAM products, non-importers of CBAM products also exhibit a decline in capitalization. One possible explanation is that non-

importers may be indirectly affected by higher carbon prices passed on by importers of CBAM products. For example, the regulation could affect a logistics company purchasing trucks because the CBAM increases input prices on steel for the truck manufacturer.

4.2. EU versus Non-EU

We next examine whether there is a differential stock market response to the CBAM between EU versus non-EU firms. Figure 3, Panel A plots the aggregate cumulative abnormal returns for the importers of CBAM products over a window of [-5,+5] trading days around the event dates. We plot the CARs separately for EU importers of CBAM products (solid black line) and for non-EU importers of CBAM products (dashed gray line). As shown in Figure 3, on the days leading up to the respective event days both groups of firms have a parallel trend in CARs. However, the trends diverge after the CBAM events. While CARs for both groups are negative, EU firms' CARs decline more strongly and the difference between EU and non-EU firms persists. In Figure 3, Panel B, we examine whether the difference in CARs persists over a longer time horizon (we cumulate returns over a window of [-1,+20] trading days around the event dates). The results suggest that for at least 20 trading days after the event, the difference in CARs appears to persist with similar magnitudes.

To corroborate the findings that EU importers of CBAM products exhibit a more negative stock market reaction than non-EU firms in these sectors, Figure 4 presents a histogram of the CARs for EU firms (black line) and non-EU firms (gray line). While there are firms with positive CARs, most firms exhibit negative CARs around the events. Consistent with the findings in Figure 3, the distribution of *CAR(0,2)* for EU firms exhibits lower values, indicating larger negative returns for EU firms (i.e., there is a higher proportion of observations with negative values).

Table 5 reports the difference in average CARs between EU and non-EU firms. Table 5,

Panel A, focuses on importers of CBAM products. Columns 1 to 3 report CARs around each of the three selected events. Column 4 reports CARs by pooling the three events and, for robustness, column 5 repeats the analysis using a [-2,+2] window around the event dates. While EU importers of CBAM products consistently exhibit negative returns, the results are not clear-cut for non-EU importers (the sign of CARs is sensitive to the length of the return window and flips across events). In all cases, the difference between EU and non-EU importers of CBAM products is statistically significant. In terms of magnitude, column 4 suggests that, relative to non-EU firms, EU firms lose 2.79% in market capitalization around the announcement of the CBAM.

Table 5, Panel B, repeats the analysis for non-importers of CBAM products. The results are qualitatively similar than those of Panel A, but significantly weaker. In fact, *CAR(0,2)* for EU non-importers is not statistically different from zero, and the sign of CARs for non-EU non-importers is sensitive to the length of the return window. In all cases, the difference between EU and non-EU importers is statistically significant and of a magnitude of close to 2 percentage points.

To delve deeper into the comparison between EU and EU non-importers of CBAM products, Figure 5 plots CARs cumulated over a window of [-10,+10] days around the event dates. Again, we aggregate CARs over the three selected events. In Panel A, we conduct the analysis including all importers. To sharpen identification, Panel B repeats the analysis restricting the subsample of EU importers to those with at least one supplier from non-EU countries. In both panels, we observe a parallel trend prior to the event, followed by a sharper decline in stock market prices for importers relative to non-importers. Collectively, these findings support the notion that EU importers of CBAM products were the most negatively affected firms by the CBAM (at least in terms of equity value).

Figure A.3 plots differences in CARs between importers and non-importers (of CBAM

products) by country. In cases of relatively few observations by country, we group firms by geographic area. In Panel A, we find negative CARs for importers in all European countries. The results are not statistically significant for all countries, conceivably because of the small number of observations in the test (e.g., Greece has only 29 observations). We find the largest negative and statistically significant market reaction for Sweden (-6.2%) and Germany (-4.9%), followed by Italy, the Benelux countries (Belgium, Netherlands, and Luxembourg), and Norway. In most EU countries importers show significantly more negative CARs than non-importers.

In non-EU countries, the distribution of CARs is heterogeneous, with the largest negative values for Canadian and Korean firms. We do not observe significant stock market responses for Chinese, Australian, and African firms. We find positive CARs for India, Japan, and Russia. This could reflect the EU firms' dependence on inputs from these countries, although the CARs for importers are not significantly different from those of non-importers (see Figure A.3, Panel B).

Figure A.4 plots differences in CARs between EU and non-EU importers by industry.[19] For EU firms, we consistently find negative stock market reactions across all industries. We observe the largest difference for Utilities (-9.6%), Automobile (-5.1%), Iron and Steel (-4.7%) and Fertilizers (-4.6%). For non-EU firms, we find a marginal stock price reaction in all sectors, except for the Energy sector (-4.9%), Healthcare (-1%), Consumer Durables (+1.1%), and Transportation (+1.3%). In sum, the results in this section suggest that the differential effect of CBAM on EU/non-EU firms extends to a wide range of sectors of the economy.

Table 6 presents the results of estimating equation (2) (i.e., a multivariate test on the difference in CARs between EU and non-EU importers of CBAM products). This test includes observations corresponding to importers of CBAM products (i.e., we exclude non-importers of

[19] We do not report statistics for the hydrogen sector due to the small number of observations (our sample includes only 3 EU firms from this industry).

CBAM products). Columns 1 to 6 show results for each of the three selected events and columns 7 and 8 shows results by aggregating the three events. We find significant differences in CARs between EU and non-EU importers. Columns 2, 4, 6, and 8 show that the negative stock market reaction extend to importers inside and outside the six CBAM sectors (we do not find a statistically significant difference between the coefficients corresponding to these two groups).

Consistent with our previous tests, the magnitude of the estimated difference in CARs between EU and non-EU importers is between 2 and 3 percentage points. Considering that EU firms' aggregated market value at the end of 2019 was $3.4 trillion, a decline in stock prices of roughly 3% (column 7) translates into a decline in market value of about €100 billion. This magnitude seems reasonable given that estimated revenues from the CBAM are about €1.5 billion per year until 2028, increasing to more than €9 billion per year by 2030 with the phase out of free allowances.[20] The market reaction may thus reflect the present value of the capitalized tax payments passed on to EU firms in addition to other costs such as potential losses in competitiveness in response to the CBAM or expenses related to compliance with the CBAM.

4.3. Variation Based on Supply Chain Linkages

To further explore the validity of our interpretation of the previously documented patterns, we next analyze additional sources of cross-sectional variation in our results. We start by focusing on supply chain linkages between EU and non-EU importers (of CBAM products). We collect data on supply chain links from FactSet Revere for the sample of the CBAM firms.

For the subsample of EU importers of CBAM products, we regress *CAR (0,2)* on *Many Non-EU Suppliers*, defined as an indicator for whether the EU firm is in the top tercile in the

[20] See https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3329 and https://www.woodmac.com/horizons/how-the-cbam-will-change-the-world/. Moreover, the aggregate stock market reaction may also capture the phasing out of free allowances. We address this notion in Section 5.

distribution of the number of non-EU suppliers. We expect the cost of the CBAM for EU importers to increase with the number of non-EU suppliers, as purchases from EU suppliers are not directly affected by the regulation. The results are reported in Table 7. The results in column 1 show that EU importers with more suppliers from non-EU countries respond more negatively to the announcement of the CBAM as indicated by the negative coefficient on *Many Non-EU Suppliers*. These results corroborate that our main findings are related to the CBAM being a potential burden to EU firms when they have external suppliers from outside Europe.

For the subsample of non-EU importers of CBAM products, we regress *CAR (0,2)* on *Many EU Customers*, defined as an indicator for whether the non-EU firm is in the top tercile in the distribution of the number of EU customers. A number of these firms transform CBAM products into other CBAM products that they sell to EU clients. We do not expect these firms to be negatively affected by the CBAM if their EU customers are not able to pass on a significant part of the carbon tax cost to them. Consistent with this, column 2 shows that non-EU importers of CBAM products with a higher number of EU customers do not exhibit relatively lower CARs than those with fewer EU customers. Restricting the analysis to non-EU importers in the CBAM sectors yields qualitatively similar results (untabulated).

Finally, again for the subsample of EU importers of CBAM products, we regress *CAR (0,2)* on *Many Non-EU Customers*, defined as an indicator for whether the EU firm is in the top tercile of the distribution of the number of non-EU customers. A number of these firms transform CBAM products into other CBAM products that they sell to non-EU clients. We do not expect these firms to be negatively affected by the CBAM if they are able to use the inward processing regime of the EU to avoid paying CBAM prices.[21] The results in column 3 show that CARs do not exhibit a

[21] The inward processing regime is a customs procedure that allows businesses to import goods into the EU for processing without paying customs duties and other taxes. These goods can be processed, transformed, and then either

significant cross-sectional difference based on the number of EU customers. This suggests that the market participants do not expect the CBAM to put an additional burden on EU importers of CBAM products that are heavy exporters, which is consistent with the inward processing regime being effective.

Collectively, the results in Table 7 suggest that EU firms with many external suppliers from outside the EU are disproportionally hit by the CBAM relative to EU importers with few external suppliers and to non-EU importers selling to EU customers.[22] As such, these patterns are hard to reconcile with the notion that EU firms are able to adjust for CBAM costs in their commercial relationships with non-EU firms.

4.3. Variation Based on Market Power

Our interpretation of the previously documented patterns is that EU importers (of CBAM products) have limited ability to pass on the cross-border carbon tax to their non-EU suppliers. That is, the negative stock market reaction experienced by EU firms can reflect that these firms bear a greater portion of the expected regulatory costs (e.g., cost of CBAM certificates, administrative and compliance costs, negative competitive effects) than their non-EU counterparts. This reasoning is consistent with prior literature showing that the burden of environmental taxes is not always borne by the polluting entity (Jacob and Zerwer 2024).

To further explore the validity of the above interpretation, we build on prior literature and use profit margins as a comprehensive measure to proxy for the ability to pass on taxes to commercial counterparts such as customers or consumers (e.g., Jacob, Michaely, and Müller 2019,

re-exported out of the EU or released for free circulation within the EU, with duties and taxes applicable only upon the release for free circulation within the EU.

[22] Note that this conclusion holds even in the unlikely scenario that EU firms have external suppliers from outside the EU *only* because of carbon leakage. That said, our results cannot reflect carbon leakage. Factset includes information on external suppliers and not on suppliers within the same company group. Hence, our measure of number of suppliers does not include cases where the firm moves production facilities outside the EU to circumvent the EU ETS.

Jacob and Zerwer 2024). The premise is that the ability to pass on taxes to other stakeholders goes hand in hand with the relative elasticities of supply and demand. Firms with low profit margins, (i.e., firms with less price elasticity), have less ability to pass on taxes to stakeholders and likely will be forced to bear the cost of the CBAM in the form of higher input prices on goods supplied by non-EU firms. Accordingly, we define *Low Margin* as an indicator variable for whether the firm's profit margin is in the bottom quartile of the profit margin distribution (we calculate the bottom quartile by industry to account for industry specifics).

Table 8 presents the results of exploring whether the documented return patterns exhibit variation based on profit margins. As in prior tests, we conduct the analysis separately for European firms (columns 1 to 3) and non-European firms (columns 4 to 6). Columns 1 and 4 use the pooled sample of EU and non-EU importers of CBAM products, respectively. In column 2 (column 5), we conduct a placebo test using EU (non-EU) firms without non-EU suppliers or with missing supplier data (without EU customers or with missing customer data). Finally, in column 3 (column 6) we use EU firms (non-EU firms) with non-EU suppliers (EU customers).

Consistent with our interpretation of the previously documented return patterns, the response to the CBAM events is more negative for EU importers with low profit margins and with non-EU supply chain links (column 3). We find a parallel pattern for non-EU importers, but the magnitude of the market reaction is more modest (column 6). Also consistent with our interpretation of the previously documented return patterns, we find no significant patterns in cases where the EU importer does not have observable supply chain links to non-EU suppliers (column 2). These findings are inconsistent with the notion that the CBAM levels the playing field between EU and non-EU firms, unless the regulators' intention was to impose additional costs on low profit margin EU-firms with external suppliers from outside Europe.

For robustness, we repeat the analysis using the Herfindahl-Hirschman Index (HHI) of market concentration (3-digit industry level) as a comprehensive measure to proxy for the ability to pass on taxes to other stakeholders (see Table A.5 of the Online Appendix). Prior theoretical research suggests that, when taxes are increased, the adverse impact of taxes on profits is stronger in more concentrated markets (i.e., the high profits in concentrated markets decline more due to taxes than the profits in competitive markets), suggesting that in concentrated markets firms bear more of the tax burden. Hence, we expect the negative market reaction to be stronger in more concentrated markets. The results are presented in Table A.5. We replace *Low Margin* with *High HHI*, defined as an indicator variable for whether the HHI is in the top quartile of the sample distribution. The coefficient estimates are consistent with our findings in Table 8. As such, this additional test supports the notion that the documented return patters reflect the inability of EU importers of CBAM products to pass on the costs of the CBAM to other stakeholders.

Collectively, the above findings show that the differential effect of the CBAM between EU and non-EU importers crucially hinges on these firms' market power. The results also suggest that EU firms have less bargaining power than non-EU firms, conceivably because a significant number of EU firms are highly dependent on the supplies and imports from non-EU countries.

5. Alternative explanations

In this section, we systematically analyze plausible alternative explanations for the findings documented in previous sections. First, we address concerns that a lack of comparability of EU versus non-EU importers of CBAM products explains the patterns shown in Table 6. To this end, we use one-to-one propensity score matching based on firm fundamentals in 2019. Using a sample of comparable EU and non-EU importers of CBAM products mitigates the concern that differences in firm fundamentals between EU and non-EU firms drive our results. The coefficient estimate on

EU of 3% in column 1 of Table 9 is close to the baseline estimate suggesting that the differences in firm fundamentals do not explain the negative market reaction by EU firms. In column 2, we repeat our main analysis using value weighting rather than equal weighting to give large firms more weight. While the economic magnitudes are somewhat larger, inferences are unaffected.

Second, we address the concern that the documented patterns are driven by a lack of exposure to Europe among the non-EU firms in our sample. To do so, we limit the sample of non-EU importers to those with at least one supply chain link to Europe using the data from FactSet Revere (see column 3, Table 9). We find similar patterns as in the previous tests. We also replicate Figure 2 using this restricted sample and find a very similar trend in CARs (see Figure 6).

Third, we explore the possibility that our results are driven by a difference in EU versus non-EU firms' investment in transitioning towards more sustainable business models. To do so, we use global mutual fund equity holdings data from FactSet to identify CBAM firms in our sample that are held in the portfolios of Mutual Funds designated as Article 9 under the EU Sustainable Finance Disclosure Regulation (SFDR).[23] Funds classified as Article 9 have a mandate to invest in companies that contribute to specific environmental or social objectives, such as renewable energy systems or sustainable infrastructure projects. Limiting our sample to firms held in the portfolios of Article 9 funds results in a subsample of firms that are more likely to have a focus on sustainability. As shown in column 4 of Table 9, using this subsample we continue to find evidence of a stronger negative stock market reaction among EU importers of CBAM products vis-à-vis non-EU importers.[24]

[23] We obtain SFDR classification information from Refinitiv. Article 9 fund indicators were retrieved on February 6, 2023. For a more detailed discussion of SFDR see Dai et al (2023).

[24] In the tabulated specification we require at least one Article 9 fund hold a firm in its portfolio for that firm to be classified as an Article 9 firm. In additional tests (untabulated), we find similar results using a variety of more restrictive specifications including that a larger number of Article 9 funds hold a firm or that the concentration of Article 9 investors for a firm exceed a threshold relative to other mutual fund investors.

Another potential concern about our previous results is that the difference in returns between EU and non-EU importers of CBAM products could be explained by lack of attention in non-EU markets. To explore this concern, we expand the analysis of media coverage around the key event dates in Figure 1 by breaking down the media articles based on the geographical origin of the news. As shown in Figure A.5, there is significant media coverage outside the EU around the three CBAM events. Specifically, there are 200 news articles in North America and 1,146 news articles in the Asia-Pacific region in the 20 days around the respective events (see Panel A). This corresponds to more than one third of the news on those days being published by non-European newspapers. Even when - to be consistent with the period over which we measure the CAR- we take a two-day window around the event, we find more than 50 news articles in North America and over 300 news articles in the Asia-Pacific region (as shown in Panel B). We conclude that it is unlikely that the results in Tables 4-6 are driven by lack of attention by non-EU markets.

Finally, we address the concern that the patterns in Tables 6 to 8 are confounded by the fact that the EU will not only price carbon on imports from outside Europe through the CBAM, but they will gradually reduce free carbon allowances for EU firms. As such, our results could reflect the expected additional cost of carbon emissions for EU firms that will have their free allowances phased out beginning in 2026 when the CBAM becomes effective. Relatedly, our negative results for the sample of EU importers of CBAM products could also reflect that EU firms' ability to engage in carbon leakage is curbed by the CBAM. Firms historically receiving high amounts of allowances for free are those deemed by the European Commission to have the highest risk of re-allocating production (i.e., of leaking carbon) outside of the EU.[25]

[25] Firms with high potential exposure to carbon leakage are placed on a carbon leakage list and, during phase 4 of the EU ETS (2021-2030), were expected to receive free allowances equivalent to 100% of a relevant benchmark. This list of firms is provided by the European Commission (see https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en#carbon-leakage-list).

We collect data on firms' allocations of free carbon allowances from euets.info, a website processing the European Union Transaction Log (EUTL) data. The EUTL provides European ETS data at the emitting installation level. We merge the data to our sample EU firms through the ISIN identifiers complemented by a manual matching procedure based on firm name (there are many installations with missing firm identifiers). We then define an indicator variable *High Free Emissions* equal to one if the ratio of free emission allowances to total emissions regulated by the EU ETS in 2019 is above the sample median. The results are presented in Table 10. The coefficient on *High Free Emissions* is not statistically significant. When we add *Many Non-EU Suppliers* from Table 7 (columns 2 and 4) and *Low Margin* from Table 8 (columns 3 and 4), the coefficients on these two latter variables are negative and significant, which suggests that the results in Tables 7 and 8 are not confounded by the granting of free allowances.

As an additional test, we collect data on EU firms' estimated total Scope 1 and Scope 2 emissions from Trucost. We then calculate the ratio of a firms' total emissions in 2019 that were subject to carbon pricing through the EU ETS to the total Scope 1 and Scope 2 emissions of the firm as reported by Trucost. We then calculate *Low % ETS Coverage* as an indicator variable equal to one for firms below the in-sample median ratio of Total ETS Emissions to Total Scope 1 and 2 Emissions in 2019. Firms with *Low % ETS Coverage* could represent those firms who have successfully shifted emissions to areas isolated from EU ETS pricing.

The results are presented in Table 11. Consistent with Table 10, the coefficient on *Low % ETS Coverage* is not statistically significant. When we add *Many Non-EU Suppliers* from Table 7 (columns 2 and 4) and *Low Margin* from Table 8 (columns 3 and 4). As in Table 10, the coefficients on these two latter variables are negative and significant, which again suggests that the results in

Tables 7 and 8 are not confounded by ETS pricing.[26]

6. Conclusion

We study the stock market reaction to key developments of the Carbon Border Adjustment Mechanism (CBAM) in Europe, which imposes a carbon price on imports by EU firms from non-EU sources. We find that the stock price of EU importers of CBAM products responds more negatively to news on the regulation than that of similar non-EU importers. Our cross-sectional analyses support the notion that the more negative stock market reaction among EU firms can reflect the inability of EU firms to pass on most of the CBAM burden to their non-European suppliers. First, we observe that the patterns are more pronounced among EU firms with more non-EU suppliers. Second, we find that the negative stock price reaction in response to the CBAM is concentrated among EU firms with lower profit margins.

Collectively, our findings suggest that—unless the EU intended to disproportionally burden low margin EU firms with suppliers from outside the EU—EU policymakers may not reach the intended goal of the CBAM. At least, the evidence does not seem consistent with the notion that the regulation levels the playing field between EU and non-EU businesses. Rather, our results indicate that attempts to impose a cross-border carbon price on imports may have unintended negative financial consequences on the own economy of the jurisdiction raising the tax.

We close with a call for future research. In this paper, we analyze the effect of the CBAM on market capitalization, but the welfare effects of the regulation extend beyond shareholder wealth. For example, price changes on imported goods induced by the CBAM may eventually trickle down to consumer prices. Moreover, the regulation could induce important corporate

[26] Another potential alternative explanation for the documented return patterns is that the CBAM might increase the price of ETS allowances for EU firms. In untabulated analyses, we do not find any evidence of significant carbon price changes around the three CBAM events, which undermines the credibility of this alternative explanation.

decisions, including changes in the supply chains or changes in location decisions of global firms. Another potential avenue for future research is to consider potential effects on the M&A market. If the CBAM hits EU firms more disproportionately, then this might increase the likelihood that EU firms with lower stock prices become takeover targets, which could result in more industry concentration. Exploring the effect of the CBAM on the market structure and competitiveness in the light of our findings once the CBAM comes into effect seems to be important for academics, practitioners, and policymakers. An empirical examination of these questions is currently not possible, as the CBAM is in a transitional "disclosure only" phase until 2026.

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Appendix A: Variable definitions

Variable	Description	Source
$CAR(t_1, t_2)$	Cumulative abnormal returns over the windows [0,2], and [-2,2]. In our baseline specification, we compute CARs by cumulating the residuals of the Fama-French three factor model, estimated over the [-120,-30] days before the event day. We also use alternative models to calculate CARs: market model, or market adjusted model.	Compustat
EU Importer of CBAM products	Indicator variable equal to one if the importer of CBAM products headquarters are located in one of the EU countries, Iceland, Norway, or Switzerland.	Compustat
(Idem) in CBAM sector	Indicator variable equal to one if the importer of CBAM products is in one of the six CBAM sectors listed in the EU Regulation: aluminum, cement, electricity, fertilizers, hydrogen or iron and steel.	Compustat
(Idem) not in CBAM sector	Indicator variable equal to one if the importer of CBAM products is in one sector that imports products from one of the six CBAM sectors listed in the EU Regulation.	FactSet Revere and Compustat
MV_{2019} *(in million $)*	Natural logarithm of market value at the end of 2019, calculated as the shares' closing price multiplied by the number of shares outstanding, adjusted by the average 2019 exchange rate of the country's currency.	Compustat
MTB_{2019}	Market to book value at the end of 2019, computed as the firm's market value divided by the firm's equity value.	Compustat
ROA_{2019}	Return on assets at the end of 2019. Earnings before extraordinary items divided by total assets (ib/at).	Compustat
$Cash_{2019}$	Ratio of cash to total assets at the end of 2019 (ch/at).	Compustat
TA_{2019} *(in million $)*	Natural logarithm of total assets at the end of 2019 (at), adjusted by the 2019 corresponding exchange rate.	Compustat
Many non-EU suppliers	Indicator variable equal to one if the number of non-European suppliers is in top tercile of the number of non-European suppliers' distribution. We calculate the bottom tercile separately for European and non-European countries.	FactSet Revere
Many EU customers	Indicator variable equal to one if the number of European customers is in top tercile of the number of European customers distribution. We calculate the bottom tercile separately for European and non-European countries.	FactSet Revere
Many non-EU customers	Indicator variable equal to one if the number of European customers is in top tercile of the number of European customers distribution. We calculate the bottom tercile separately for European and non-European countries.	FactSet Revere
Article 9 firm	Indicator variable equal to one if the firm has at least one investing fund classified as an "Article 9" fund under the EU SFDR. These funds invest in firms with a sustainability focus.	Refinitiv
Carbon intensity	Ratio of a firm's 2019 carbon emissions reported in Trucost to the firm's sales in 2019.	Trucost and Compustat
Low Margin	Indicator variable equal to one if the profit margin is in the bottom quartile of the profit margin distribution. We calculate the bottom quartile by industry and separately for European and non-European countries.	Compustat
High Free Emissions	Indicator variable equal to one if the ratio of free allowances to total emissions is above the in-sample median.	EU ETL
Low % ETS Coverage	Indicator variable equal to one for firms below the in-sample median ratio of Total ETS Emissions to Total Scope 1 and 2 Emissions in 2019 from Trucost.	EU ETL and Trucost
High HHI	Indicator variable that equals 1 if the HHI is above the top quartile in the respective country (or region for non-European countries) within three-digit GIC industry code.	Compustat

Appendix B: Background Information on the CBAM

In this Appendix, we provide a detailed background information on the CBAM.[27]

B.1 General Information

The Carbon Border Adjustment Mechanism (CBAM) was formally approved as Regulation EU 2023/956 of the European Parliament and of the Council on April 18, 2023. The CBAM aims to address the risk of carbon leakage, which occurs when firms transfer production or supply chains for carbon intensive goods to countries with less stringent climate policies. It will impact goods imported from outside the European Union into any of its 27 members countries as well as Switzerland and Norway (collectively referred to as the "EU" herein).[28] The CBAM is intended to level the playing field between EU and non-EU producers by ensuring that a specified list of carbon intensive goods imported to the EU are subject to similar carbon pricing as if they were produced within the EU. Importers of covered goods will be required to provide third party verified reports of imported embedded carbon emissions quarterly. They will also need to purchase CBAM certificates quarterly and surrender certificates annually to cover the balance of emissions imported during the year.

B.2 Ex-Ante State of Carbon Pricing and Carbon Leakage in the EU from the EU ETS

The EU has historically enforced carbon pricing through the EU Emission Trading System ("EU ETS"). The EU ETS launched in 2005 and today covers emission intensive industries such as power and heat generation, energy intensive manufacturing, aviation within the EU (since 2013) and marine transport (since 2024). These covered industries are responsible for around 40% of EU GHG emissions. The EU ETS is organized following a cap-and-trade principle. Firms with operations covered by the system are required to track green house gas ("GHG") emissions, submit verified emission reports and surrender emission allowances to offset their emissions. Within the EU ETS, one emission allowance (commonly referred to as an "EUA" or just "allowance") represents the right to emit one ton of carbon dioxide equivalent in GHG per period. Each year, the EU specifies a cap on the total number of allowances issued and permits trading of allowances via a primary auction market and various secondary markets (spot market, brokered transactions, derivatives market). This trading facilitates discovery of a price for such allowances and hence, a price for emissions. The annual cap on allowances is set to achieve targeted reductions in emissions within the system over time.

The CBAM is designed to complement and reinforce the EU ETS and even replace certain aspects of the EU ETS. Many features of the CBAM regulation are based on the structure and methodologies of the EU ETS to help ensure harmony and equal treatment for goods produced within the EU with those imported from outside the EU. Carbon leakage has been a significant challenge for the EU ETS (e.g., Naegele and Zaklan 2019, Borghesi et al., 2020, Dechezleprêtre et al. 2022a). To mitigate leakage, the EU ETS has provided a substantial portion of allowances for free to industries most at risk of relocating their production outside the EU. This helps reduce the cost burden on these industries of the EU ETS while still incentivizing emissions reductions. The CBAM is intended to replace this free allowance mechanism and will be phased in while the allocation of free allowances is phased out starting in 2026. The goal is to eliminate free allowances by 2034 and to ensure that EU ETS goods are not treated more favorably than CBAM imported goods.

B.3 CBAM as a Carbon Tax

In contrast to the cap-and-trade principle of the EU ETS, the CBAM functions more like a tax. It does not establish a

[27] For more information, see, also, https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en and https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en.

[28] While Switzerland and Norway are not member countries of the EU, they have agreements with the EU regarding the EU Emission Trading System and the CBAM, effectively treating Swiss and Norwegian firms as European Union firms in this context.

cap on emissions for imports, but rather imposes a price on the embedded emissions in imported goods whatever the volume of imports. To impose a price, the CBAM will require importers to purchase a CBAM certificate for each ton of embedded emissions imported (measured in CO2 equivalents). The CBAM will explicitly define the price for certificates instead of following the EU ETS methodology of using a market mechanism to discover a price for emissions. Specifically, CBAM certificate prices will be calculated and published on a weekly basis using the average closing auction price for EU ETS allowances per ton of CO2 in the preceding week. This will help ensure alignment in carbon pricing across the two systems.

Importers must hold at the end of each quarter CBAM certificates equal to at least 80% of the embedded emissions imported since the beginning of the calendar year. Additionally, after the end of the calendar year, an importing firm will have until May 31 of the following year to surrender CBAM certificates equivalent to the emissions embedded in CBAM goods imported during the year. Importers are allowed to claim a reduction in CBAM certificates that corresponds to the carbon price already paid for the embedded emissions in country of origin. However, rebates above the CBAM prices are not provided in the case that origin country carbon prices exceed those of the CBAM certificates.

The CBAM does not allow secondary market trading of CBAM certificates and any certificates purchased in the previous calendar year that remain on a firm's books at July 1 of the following year will be cancelled. This is in contrast to the treatment of allowances created for the EU ETS. EU ETS allowances typically do not expire and can be carried over into future periods or sold in the secondary market. The limitations for CBAM certificates help ensure that the price of emissions for imported goods remains directly tied to the EU ETS pricing, preventing speculative trading in CBAM certificates that could lead to price volatility and distortions across the EU ETS and CBAM. The CBAM does, however, include a limited repurchase mechanism for firms with excess certificates. Firms with an excess following the May 31 surrender date may request to sell excess CBAM certificates back to their national authority at the purchase price. Such repurchases are limited to one third of the volume of certificates purchased during the previous calendar year. Requests for repurchases must be submitted by June 30 of the following year.

B.4 Scope of the CBAM

Initially, the CBAM will apply to goods from six sectors: iron and steel, cement, aluminum, fertilizers, hydrogen and electricity generation. To determine whether a good is covered by CBAM, an importer needs to check whether the imported good is listed on the Combined Nomenclature (CN) list specified in Annex II of the EU CBAM implementing regulation (Commission Implementing Regulation (EU) 2023/1773). The initial sectors represent a subset of the sectors covered by the EU ETS to allow for a more manageable and targeted implementation during the initial phases of the CBAM. Sectors were selected focusing on industries most vulnerable to carbon leakage and those with the highest emissions intensity.[29]

There is a de minimis exemption from reporting when the total value of CBAM goods in a consignment is below 150 EUR in value. Additionally, CBAM goods are eligible to be placed under the inward processing regime of the EU. The inward processing regime is a customs procedure that allows businesses to import goods into the EU for processing without paying customs duties and other taxes. These goods can be processed, transformed and then either re-exported out of the EU or released for free circulation within the EU, with duties and taxes applicable only upon the release for free circulation. Importers of CBAM goods placed under the inward processing regime must still report embedded emissions and if the goods are released for free circulation within the EU, CBAM certificates must be purchased and surrendered for the goods.

[29] This targeted approach allows the EU to address the most pressing areas first, while gathering data and experience for potential future expansion. The CBAM is expected to eventually cover all goods and sectors covered by the EU ETS. Goods more exposed to carbon leakage will continue to be prioritized for earlier inclusion, but a tentative target of harmonizing the coverage of sectors and goods across the CBAM and EU ETS has been set for 2030.

B.5 Measurement and Reporting of Embedded Emissions

Firms importing CBAM covered goods are required to submit a report on a quarterly basis that includes information on the quantity of CBAM goods imported, total embedded emissions, total indirect emissions and details of any carbon prices already paid in the producing countries for the goods. Reports are required to be submitted within one month of the quarter end. Importers will be required to have their embedded emission reports verified by an EU-accredited agency following a similar set of verification methodologies and principles as used in the EU ETS verification process. As specified in Article 14 of the CBAM Regulation, the content of reports will remain confidential, except for the names, addresses, and contact details of operators and the locations of installations.

The calculation of emissions covered by the CBAM can vary dependent on the CBAM good being imported. However, generally covered emissions include direct emissions generated from the production of CBAM goods. Additionally, upstream Scope 2 emissions related to the electricity consumed in the production of CBAM goods are generally included. Upstream Scope 3 emissions associated with CBAM goods used as input materials for the imported good are also generally included. CBAM goods that use other CBAM goods as inputs are referred to as complex goods. Other upstream Scope 3 emissions, such as those related to raw materials, transportation and distribution, and waste, are generally not included. Furthermore, downstream Scope 3 emissions associated with the consumption, transportation, distribution, and end-of-life of a good are not covered by the CBAM.

Firms should measure emissions using either a calculation-based methodology or a measurement-based methodology. Broadly speaking, calculation-based methodologies consider the quantities of fuels and input materials consumed, using information on the carbon content, calorific value, and/or emission factors of each to calculate emissions. In contrast, a measurement-based methodology typically involves using a monitoring system that directly measures and tracks GHG emissions produced during the production process.

During 2024, a variety of other monitoring and reporting methodologies will be permitted. These include using reporting for carbon pricing or monitoring emissions from the producer's country, the use of default values, and the estimation of emissions for complex goods, for up to 20% of total embedded emissions. It is not expected that these alternative reporting methods are allowed after 2024.

B.6 Responsible Party for CBAM Covered Imports

The importer of the goods (also known as the reporting declarant) is the party responsible for reporting emissions and purchasing and surrendering CBAM certificates. In cases where a direct customs representative is appointed by a firm importing goods, the firm remains the responsible reporting declarant. Appointing a direct customs representative typically requires a formal legal relationship between the firm and the representative, allowing the representative to operate in the name and on behalf of the firm but allowing the firm to retain the rights and obligations related to customs procedures. In contrast, if an indirect customs representative is utilized, the representative becomes the importer of record and assumes the responsibility of the reporting declarant. In this scenario, the representative acts in their own name and holds the rights and obligations concerning customs procedures. This arrangement is typically employed when an importing firm does not have a physical presence within the EU and must instead rely on an indirect customs representative to operate where the foreign firm is not able to.

B.7 Implementation Phases

The CBAM will be implemented in two phases, the transitional phase and the definitive phase. On October 1, 2023, the CBAM started the transitional phase, which extends through the end of 2025. During this phase, importers need to report

the emissions embedded in imported CBAM goods but will not yet be required to purchase CBAM certificates or provide verified emission reports. This phase aims to gather data and allow learning by importers, foreign firms and regulators to help facilitate a smooth transition. Reports during the transitional period are to be filed quarterly with the first reporting for Q4 of 2023 due by January 31, 2024. During the transition period penalties can be enforced on firms for failing to submit a CBAM report or for submitting an incomplete or inaccurate CBAM report and not taking the appropriate action to resolve identified issues. These penalties can range between EUR 10 and EUR 50 per ton of unreported emissions.

During the definitive phase, which starts January 1, 2026, importers will also be required to submit copies of verification reports from accredited verifiers and to purchase and surrender CBAM certificates. CBAM certificate purchasing requirements will be gradually phased in linked to the phasing out of free allowances in the EU ETS so that imported and EU produced goods pay a similar carbon price across the definitive phase. During the definitive phase, penalties for noncompliance increase and CBAM declarants that fail to surrender the necessary number of CBAM certificates by May 31 of the following year will incur fines equal to those under the EU ETS, meaning €100 for each ton of CO2 with an adjustment for inflation. Also, similar to the EU ETS, paying a fine does not settle the obligation to surrender CBAM certificates and firms will be required to surrender certificates for any uncovered imported emission amounts in the following year. The importing of CBAM covered goods is only permitted by registered declarants. If unregistered declarants import CBAM covered goods they will face higher penalties than the ones listed above.

B.8 Monitoring, Verification and Administration

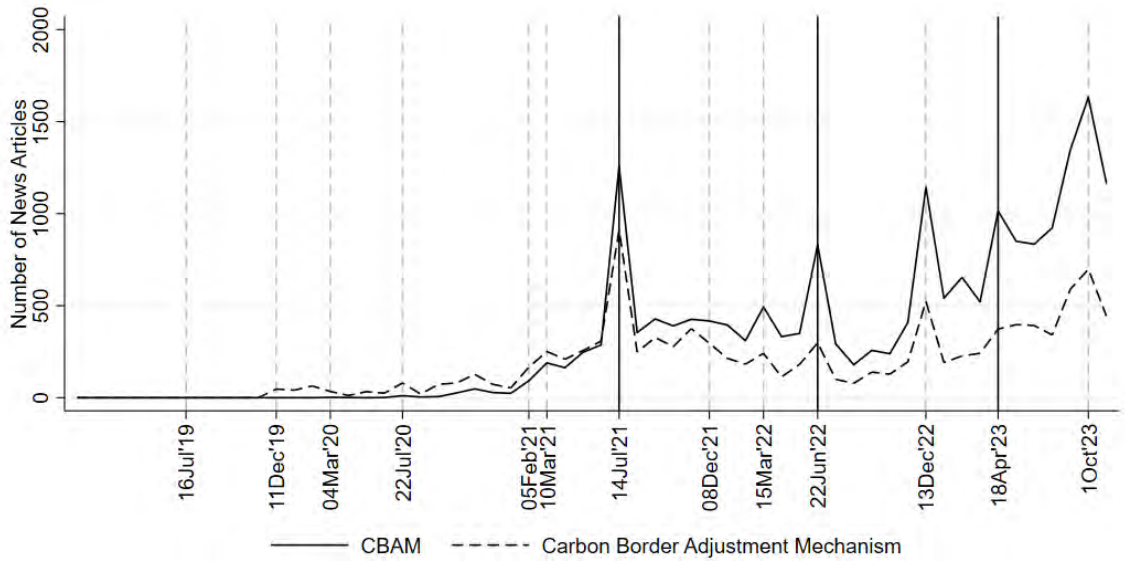
The European Commission will complete monitoring and conduct activities like cross-referencing firm reports with the information that is required to be reported by customs authorities for imports of covered goods. The European Commission refers any suspicious cases to the member states for additional investigation and potential enforcement action. The European Commission will also manage the CBAM Transitional Registry and establish the Common Central Platform, which will facilitate the sale and repurchase of certificates during the definitive period of the CBAM. It will also monitor the implementation of the CBAM more broadly to assess progress, identify risks of circumvention, and analyze the impact of the CBAM on exports, downstream products, trade flows, and least developed countries. Finally, the Commission will also prepare secondary legislation in the form of implementing and delegated acts to support the CBAM framework.

Each country in the EU designates a national competent authority that conducts monitoring and administration functions for the CBAM. National competent authorities have the responsibility for examining suspicious cases identified by the European Commission and can impose penalties. Other important duties include certifying qualified verification providers for embedded emission reports and reviewing verified emission reports submitted by importers in that country. The national competent authorities also verify quarterly that importers hold sufficient CBAM certificates to meet the 80% coverage requirement.

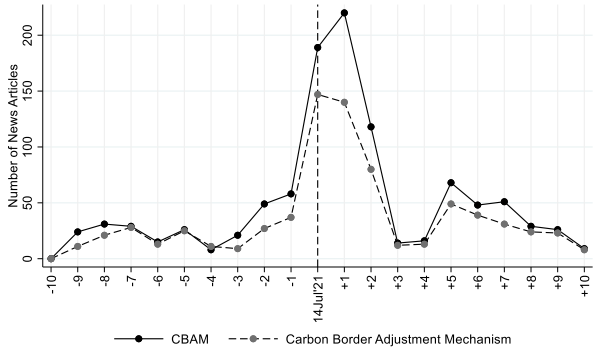
Figure 1: Timeline of News Articles on the CBAM

This figure presents the number of newspaper articles covering the CBAM using data from Factiva. In Panel A, we use monthly volume of articles over the period 2019 to 2023. The vertical lines mark the main CBAM regulatory event dates. In Panels B to D, we zoom into the daily number of newspaper articles from ten days prior to the respective event to ten days after the three main CBAM regulatory events: 7/14/2021, 6/22/2022, and 4/18/2023.

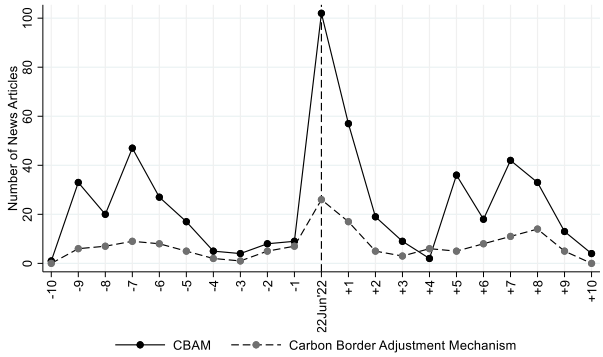
Panel A: Monthly News Articles on CBAM, 2019 to 2023



Panel B: News around July 14, 2021



Panel C: News around June 22, 2022



Panel D: News around April 18, 2023

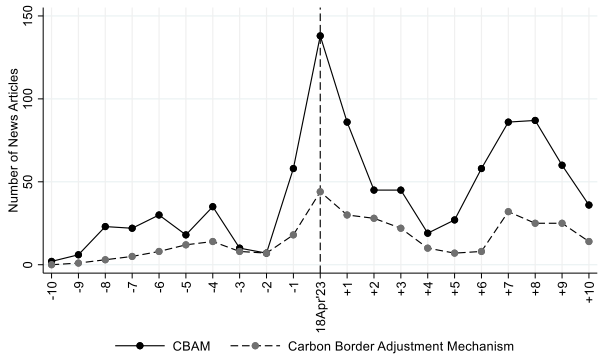


Figure 2: Importers of CBAM products

This figure illustrates the selection of the firms in the main analysis. We include the firms operating in the gray shaded sectors as *Importers of CBAM product*s.

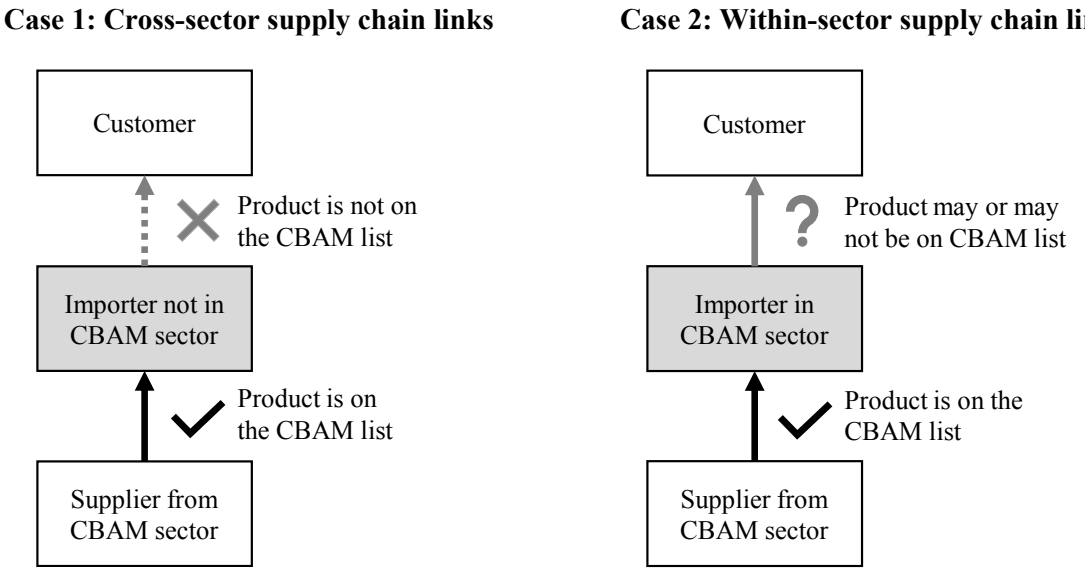
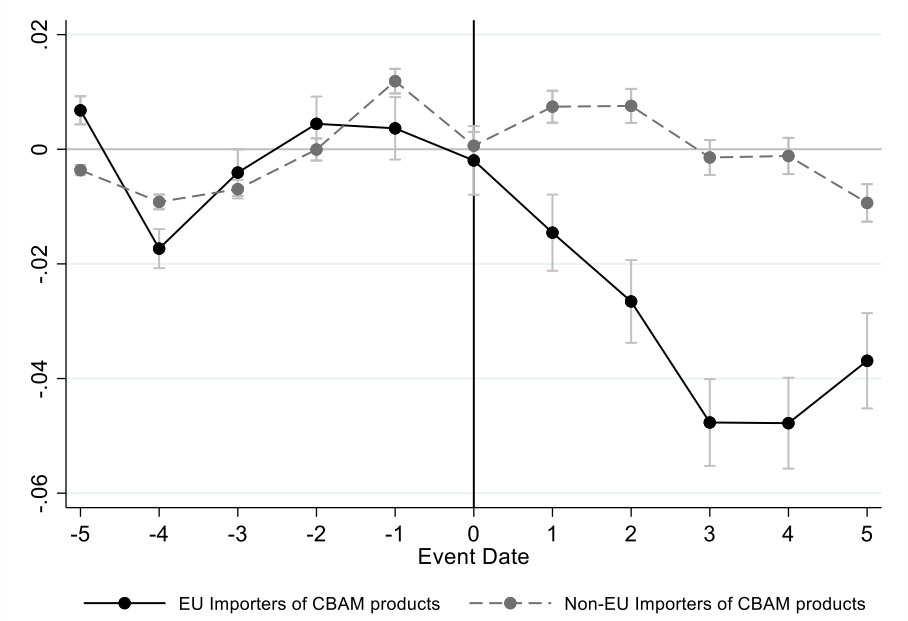


Figure 3: EU versus non-EU Importers

This figure plots the aggregate cumulative abnormal returns (CARs) of EU importers of CBAM products (black lines) and non-EU importers of CBAM products (gray lines) around the three selected event dates (i.e., July 14, 2021, June 22, 2022, and April 18, 2023). The horizontal axis indicates the number of trading days around the event dates. The vertical axis indicates average CARS and the corresponding 95% confidence intervals. Panel A shows cumulative returns over a window of (-5,+5) days around each event. Panel B shows cumulative returns over a window of (-1,+20) days around each event.

Panel A: CARs around the Event Date



Panel B: Longer-term development of CARs

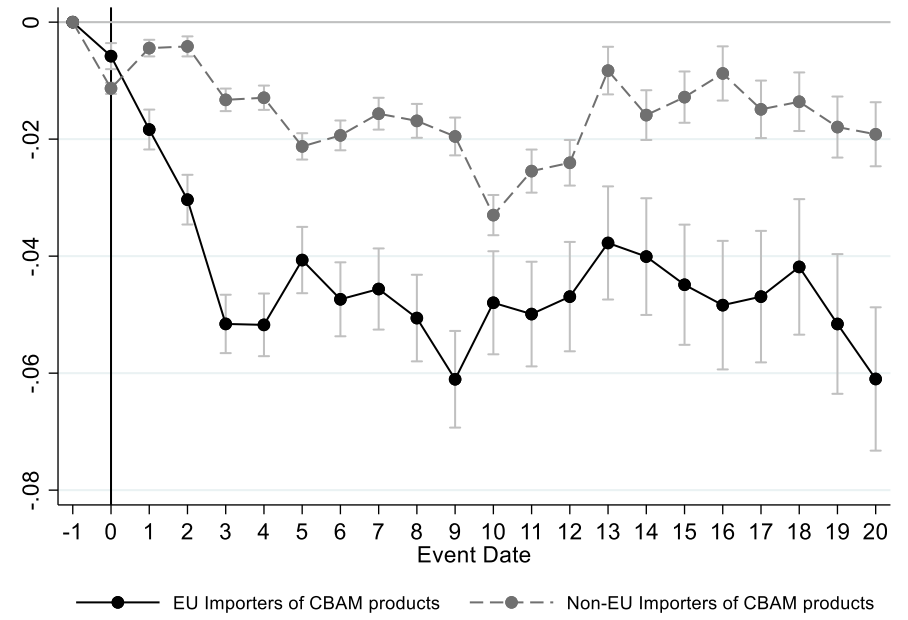
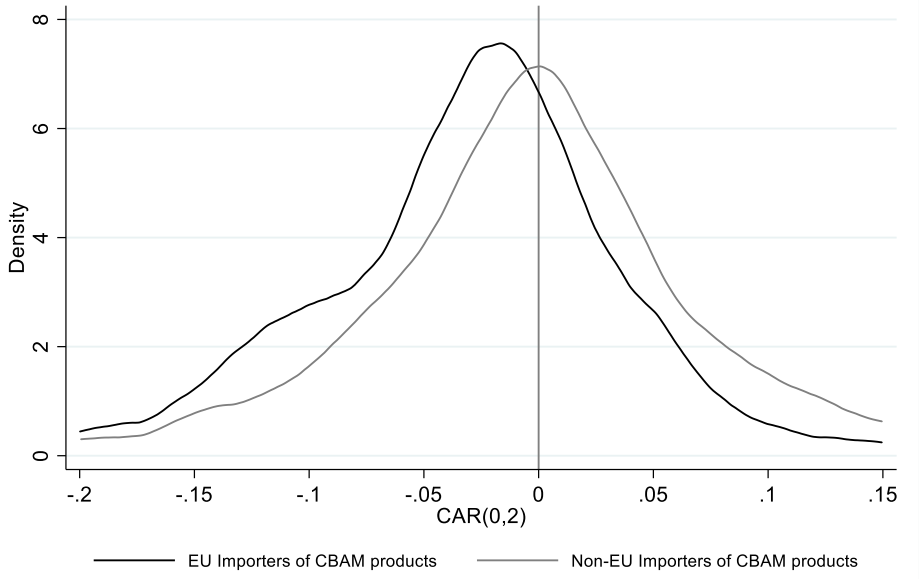


Figure 4: Histogram of CARs

This figure plots the distribution of aggregate cumulative abnormal returns (CAR(0,2)) of EU firms (black line) and non-EU firms (gray line) around the three selected event dates (i.e., July 14, 2021, June 22, 2022, and April 18, 2023). Panel A compares EU and non-EU firms that import CBAM products. Panel B compares EU and non-EU firms that do not import CBAM products. The y-axis reflects the kernel density function.

Panel A: Importers of CBAM products



Panel B: Not importers of CBAM products

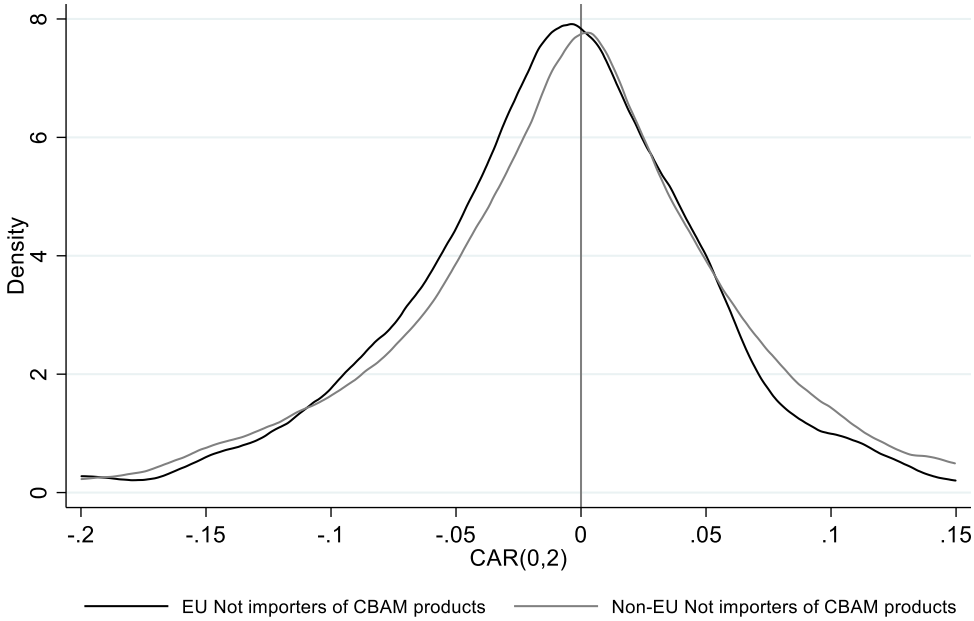
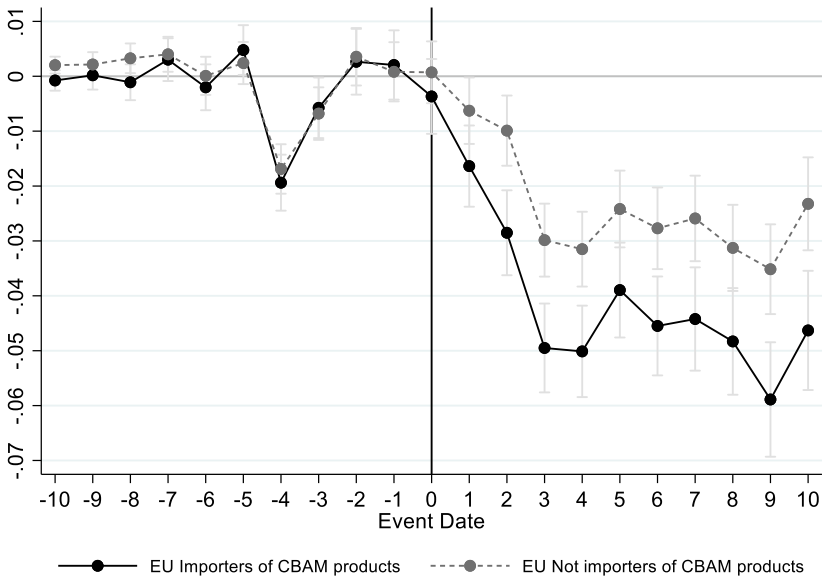


Figure 5: EU importers vs EU non-importers

This figure plots the aggregate cumulative abnormal returns of EU firms that import CBAM products (black lines) and EU firms that do not import CBAM products (gray lines) around the three selected event dates (i.e., July 14, 2021, June 22, 2022, and April 18, 2023). The horizontal axis indicates the number of trading days around the event dates. The vertical axis indicates average CARS and the corresponding 95% confidence intervals. Panel B includes all EU firms in the sample that import CBAM products. Panel B restricts the subsample of EU importers to those with suppliers from non-EU countries.

Panel A: All EU firms



Panel B: EU firms with suppliers from non-EU countries

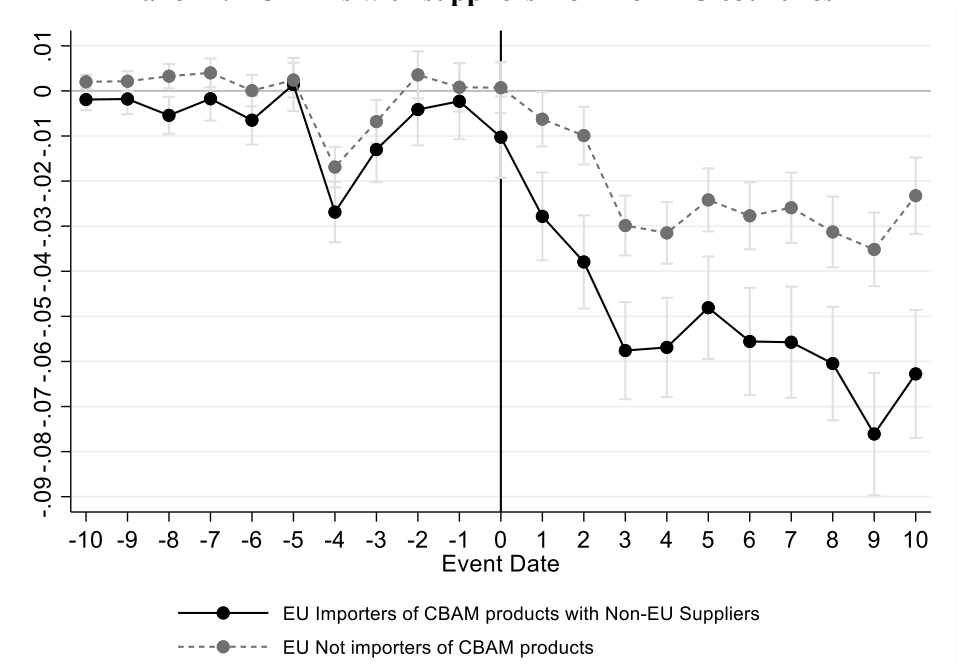


Figure 6: Importers with Foreign Supply Chain Links

This figure replicates the analysis of Figure 3 restricting the analysis to importers (of CBAM products) with foreign (i.e., EU/non-EU, correspondingly) supply chain links. The horizontal axis indicates the number of trading days around the event dates. The vertical axis indicates average CARS and the corresponding 95% confidence intervals. Panel B includes all EU firms in the sample that import CBAM products.

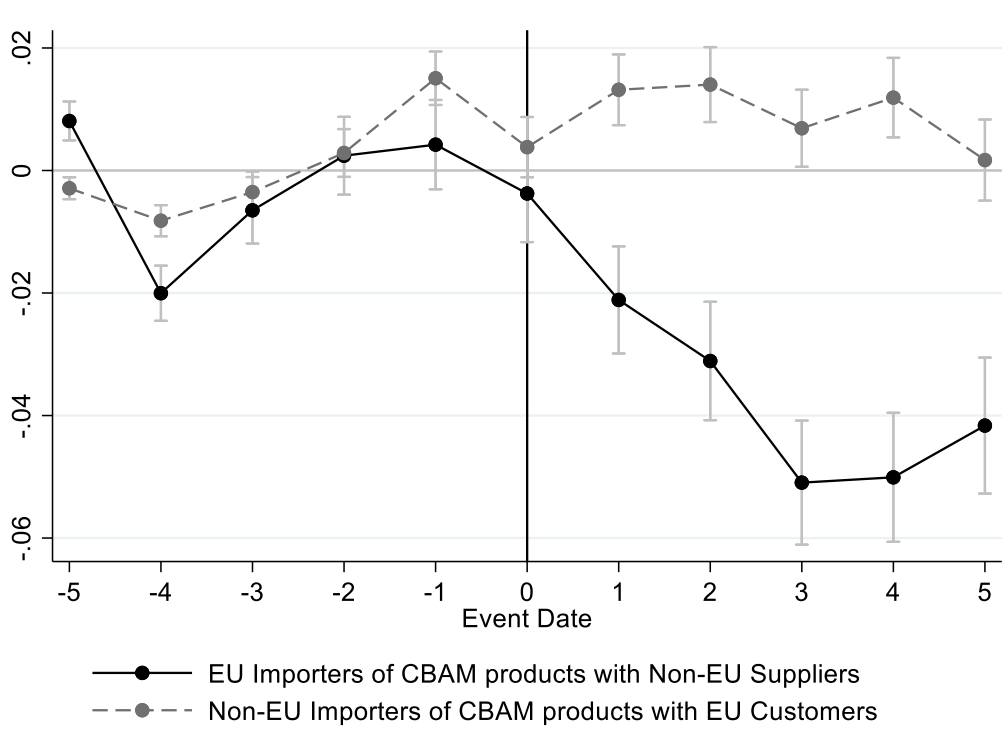


Table 1: Timeline of Events Related to the CBAM's Legislative and Implementation Process

This table presents a timeline of potentially relevant events associated with the development, ultimate adoption and implementation of the CBAM regulation. In Panel A we identify the events selected for our study and events that were not selected with rationales for their exclusion. In Panel B we include dates related to the implementation of the CBAM after it was approved. Exclusion rationales include (1) Insignificant Event: events assessed as not significant enough to have major implications for either the substance of a potential carbon border tax or the likelihood of such a tax being implemented, and (2) Confounded Event: events with significant contemporaneous and potentially confounding news unrelated to the CBAM. Additional discussion and robustness tests showing our results are robust to different research design treatments for Insignificant and Confounded Events is included in Table A.1 in the Appendix.

Panel A: Events

Date	Event description	Selected / Not (Rationale)
16 Jul 2019	Von der Leyen is elected EC President. In her acceptance speech she mentions, among a wide array of policy ideas, the introduction of a carbon border tax.	Not: Insignificant Event
11 Dec 2019	EC Communication: Proposal of the European Green Deal, including mention of developing a Carbon Border Adjustment Mechanism should differences in levels of carbon pricing worldwide persist.	Not: Confounded Event – Bundled Legislative News
4 Mar 2020	CBAM preparatory work by the EC: inception impact assessment notifying stakeholders of EC's intention to formally evaluate legislative policy for a CBAM to facilitate participation during consultation phases. Release states mechanisms under consideration include a carbon tax on selected products (imported and domestic), a new carbon customs duty, or the extension of the EU ETS to imports.	Not: Confounded Event – COVID Market Impacts
22 Jul 2020	CBAM Public consultation phase begins until 28 October 2020.	Not: Insignificant Event
5 Feb 2021	CBAM report adopted by the Environment, Public Health and Food Safety EU Parliament Committee.	Not: Insignificant Event
10 Mar 2021	EU Parliament adopted the resolution on a WTO-compatible CBAM.	Not: Insignificant Event
14 Jul 2021	**European Commission adopts its proposal for a CBAM**	**Selected**
8 Dec 2021	European Economic and Social Committee adopts its opinion on the CBAM	Not: Insignificant Event
15 Mar 2022	EU Council adopts its general approach on the CBAM	Not: Insignificant Event
22 Jun 2022	**EU Parliament adopts its position on the CBAM regulation**	**Selected**
13 Dec 2022	EU Parliament reaches a provisional agreement with the EU Council and the EC on the draft text of the CBAM	Not: Confounded Event – EU & US Monetary Policy
18 Apr 2023	**CBAM was voted in plenary: 487 votes in favor, 81 against and 75 abstentions**	**Selected**

Panel B: Implementation

1 Oct 2023	CBAM enters into application in its transitional phase
31 Jan 2024	End of the First reporting period. Firms have the ability to report using a variety of methods including default reference values.
1 Jan 2025	Only EU specified reporting methodology permitted going forward.
1 Jan 2026	Definitive regime enters into force and non-EU firms begin paying for carbon imported into the EU proportional to phasing out of EU ETS free allowances.
1 Jan 2035	EU ETS free allowances fully phased out and non-EU firms paying for 100% of carbon imported into the EU.

Table 2: Sample Composition

This table presents the composition of the final sample. Panel A presents the decomposition by the different subsamples in the analysis, while Panel B shows the breakdown by country. EU is defined as one of the 27 members of the European Union as well as Iceland, Switzerland and Norway. While Iceland, Switzerland and Norway are not member countries of the EU, they have agreements with the EU regarding the ETS and CBAM, effectively treating Icelandic, Swiss and Norwegian firms as EU firms.

Panel A. Subsamples

EU country (1,908 obs.)			**Non-EU country (15,580 obs.)**		
Importers of CBAM products (834 obs.)		**Not Importers of CBAM products (1,074 obs.)**	**Importers of CBAM products (8,067 obs.)**		**Not Importers of CBAM products (7,513 obs.)**
Importers in CBAM sector (160 obs.)	Importers not in CBAM sector (674 obs.)		Importers in CBAM sector (1,815 obs.)	Importers not in CBAM sector (6,252 obs.)	

Panel B. Breakdown by country

EU Country			**Non-EU Country**					
	All sample Firms	**Importers CBAM products**		**All sample Firms**	**Importers CBAM products**		**All sample Firms**	**Importers CBAM products**
Austria	37	19	Argentina	34	16	Mauritius	25	12
Belgium	73	26	Australia	320	147	Mexico	83	36
Bulgaria	16	9	Azerbajan	1	1	Monaco	1	0
Croatia	30	8	Burkina Faso	1	0	Mongolia	2	2
Cyprus	25	10	Bahrain	14	4	Morocco	31	18
Czeck Republic	3	2	Bangladesh	60	38	Namibia	3	1
Denmark	51	22	Barbados	1	0	Nigeria	30	13
Estonia	8	3	Bermuda	12	7	New Zealand	69	21
Finland	65	24	Bostwana	7	0	Oman	37	22
France	267	97	Brazil	168	88	Pakistan	108	66
Germany	303	155	Cambodia	1	0	Palestine	4	2
Greece	58	28	Canada	377	207	Panama	1	0
Hungary	11	7	Cayman Islands	33	13	Papua N.G.	1	1
Iceland	12	3	Chile	95	48	Peru	20	14
Italy	141	54	China	3,892	2,213	Philippines	164	87
Ireland	26	12	Colombia	25	12	Qatar	26	13
Latvia	2	0	Ecuador	2	1	Reunion	1	0
Lithuania	11	4	Egypt	64	37	Russia	43	33
Luxembourg	26	8	Gabon	1	1	Saudi Arabia	135	67
Malta	13	2	Guernsey	18	6	Senegal	2	1
Netherlands	56	22	Ghana	6	2	Serbia	7	5
Norway	78	32	Hong Kong	742	342	Singapore	246	111
Poland	101	60	Indonesia	290	144	South Africa	132	59
Portugal	32	11	Iman	2	0	Sri Lanka	50	26
Romania	23	16	India	854	536	Sudan	1	0
Spain	114	48	Israel	182	80	Taiwan	931	388
Slovenia	12	5	Ivory Coast	12	5	Tanzania	4	1
Sweden	179	68	Jamaica	8	1	Thailand	331	170
Switzerland	136	79	Japan	2,280	1,155	Trin.&Tobago	8	4
			Jersey	10	5	Tunisia	12	7
			Jordan	10	8	Turkey	156	81
			Kazahstan	13	7	Uganda	1	1
			Kenya	15	7	Ukraine	6	4
			Kyrgyzstan	1	1	U.A.E.	43	24
			Korea	1,103	613	U.S.A.	1,974	936
			Kuwait	68	20	Venezuela	2	2
			Lebanon	2	2	Viet Nam	136	86
			Macedonia	4	0	Virgin Islands	2	0
			Malaysia	9	2	Zambia	8	4
			Malawi	4	1	Zimbabwe	5	1

Table 3: Summary statistics

This table presents descriptive statistics for the variables employed in our primary analyses. All variables are defined in Appendix A.

Panel A: All Sample Firms (17,488 obs.)					
Variable	**Mean**	**Std. Dev**	**P25**	**Median**	**P75**
MV_{2019} (in million $)	2,888.09	8,079.65	148.67	471.13	1,540.76
MTB_{2019}	2.797	5.327	0.797	1.481	2.838
ROA_{2019}	0.021	0.096	0.006	0.030	0.060
$Cash_{2019}$	0.128	0.013	0.037	0.091	0.175
TA_{2019} (in million $)	4,260.64	21,346.47	234.54	565.26	1,879.24
Non-EU Suppliers	7.763	16.274	1	2	7
Non-EU Customers	7.661	12.855	1	3	9
EU Customers	1.378	3.301	0	0	1

Panel B: Importers of CBAM Products (8,901 obs.)				
Variable	**EU Firms (834 obs)**	**Non-EU Firms (8,067 obs)**	**Difference**	**[t-stat]**
MV_{2019} (in million $)	4,072.04	2,693.00	1,379.04***	[4.67]
MTB_{2019}	3.023	2.453	0.570***	[3.13]
ROA_{2019}	0.023	0.016	0.007*	[1.93]
$Cash_{2019}$	0.109	0.124	-0.015***	[3.42]
TA_{2019} (in million $)	7,430.42	4,836.59	2,593.82***	[2.77]
Non-EU Suppliers	8.053	7.732	0.321	[0.48]
Non-EU Customers	8.915	7.436	1.479***	[2.96]
EU Customers	4.836	0.959	3.877***	[33.17]

Panel C: Not Importers of CBAM Products (8,587 obs.)				
Variable	**EU Firms (1,074 obs)**	**Non-EU Firms (7,513 obs)**	**Difference**	**[t-stat]**
MV_{2019} (in million $)	3,155.41	2,927.88	227.53	[0.82]
MTB_{2019}	3.230	3.086	0.149	[0.82]
ROA_{2019}	0.032	0.025	0.007**	[2.42]
$Cash_{2019}$	0.098	0.139	-0.041***	[9.32]
TA_{2019} (in million $)	4,133.44	3,308.54	824.90	[1.63]
Non-EU Suppliers	6.626	7.922	-1.296**	[2.22]
Non-EU Customers	6.057	7.981	-1.923***	[3.96]
EU Customers	4.454	0.991	3.463***	[28.77]

Table 4: Average Cumulative Abnormal Returns

This table presents the average cumulative abnormal returns (CARs) across the three considered CBAM event dates pooling EU and non-EU observations. CAR(0,2) is the cumulative abnormal returns over the window of (0,+2) days around the event dates. The selected CBAM event dates are July 14, 2021, June 22, 2022, and April 18, 2023 (see Table 1). t-statistics are based on robust standard errors. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Pooled observations CAR(0,2) (1)	*Importers of CBAM products* CAR(0,2) (2)	*Not importers of CBAM products* CAR(0,2) (3)	**Difference (2) – (3)**
-0.047***	-0.0056***	-0.0037***	**-0.0020***
[8.14]	*[6.71]*	*[4.69]*	***[1.71]***
17,488	8,901 obs.	8,587 obs.	

Table 5: EU versus non-EU: Univariate Analysis

This table presents average cumulative abnormal returns (CARs) on CBAM event dates dividing the sample into firms that are (are not) in the EU. Panel A focuses on importers of CBAM products. Panel B compares *Importers* with *Not importers of CBAM products*. CAR(0,2) is the cumulative abnormal returns over the window of [0,2] days around the event dates. The selected CBAM event dates are July 14, 2021, June 22, 2022, and April 18, 2023. Firms are classified as "EU" if their headquarters are in one of the 27 countries of the European Union, Iceland, Switzerland, or Norway. t-statistics are based on robust standard errors. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Importers of CBAM products

Event(s)	# obs.	**CAR(0,2) Jul 14, 2021** **(1)**	**CAR(0,2) Jun 22, 2022** **(2)**	**CAR(0,2) Apr 18, 2023** **(3)**	**CAR(0,2) All events** **(4)**	**CAR(2,2) All events** **(5)**
EU	834	-0.0072***	-0.0157***	-0.0079***	-0.0309***	-0.0213***
[t-stat]		*[6.08]*	*[9.47]*	*[6.34]*	*[13.02]*	*[7.12]*
Non-EU	8,067	-0.0029***	0.0090***	-0.0091***	-0.0030***	0.0141***
[t-stat]		*[5.82]*	*[14.86]*	*[20.89]*	*[3.39]*	*[12.20]*
Difference		-0.0044***	-0.0247***	0.0012	-0.0279***	-0.0354***
[t-stat]		*[2.78]*	*[12.65]*	*[0.84]*	*[9.74]*	*[9.51]*

Panel B: Importers vs Not importers of CBAM products

	# obs.	*Importers* CAR(0,2) (1)	*Not importers* CAR(0,2) (2)	**Difference** **(3)**	*Importers* CAR(-2,2) (4)	*Not importers* CAR(-2,2) (5)	**Difference** **(6)**
EU	1,908	-0.0309***	-0.0096***	-0.0213***	-0.0213***	-0.0004	-0.0209***
[t-stat]		*[13.02]*	*[4.78]*	*[6.86]*	*[7.12]*	*[0.46]*	*[5.37]*
Non-EU	15,580	-0.0030***	-0.0028***	-0.0002	0.0141***	0.0045***	0.0084***
[t-stat]		*[3.39]*	*[3.39]*	*[0.16]*	*[12.20]*	*[5.16]*	*[5.23]*
Difference		-0.0279***	-0.0068***	**-0.0211*** **	-0.0354***	-0.0061**	**-0.0293*** **
		[9.74]	*[2.89]*	***[5.70]***	*[9.51]*	*[1.99]*	***[6.08]***

Table 6: EU versus non-EU: Multivariate Analysis

This table presents cross-sectional variation in the cumulative abnormal returns (CARs) on CBAM event dates based on whether the firm is (is not) in the EU. The analysis includes EU and non-EU importers of CBAM products. *EU importers of CBAM products* is an indicator variable equal to one if the firm is headquartered in one of the 27 countries of the European Union, Iceland, Switzerland, or Norway. *EU importers of CBAM products in (not in) CBAM sector* is an indicator variable equal to one if the firm is headquartered in EU and operates (does not operate) in one of the six CBAM sectors. Columns 1 to 6 show results separately for each of the three considered CBAM events. Columns 7 and 8 aggregate the CARs across all events. CAR(0,2) is the cumulative abnormal returns over the window of [0,2] days around the event dates. The considered CBAM event dates are July 14, 2021, June 22, 2022, and April 18, 2023. Robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

		14-Jul-21		*21-Jun-22*		*18-Apr-23*		*Full sample*	
Dep. Variable:		CAR (0,2)	CAR (0,2)	CAR (0,2)	CAR (0,2)	CAR (0,2)	CAR (0,2)	CAR (0,2)	CAR (0,2)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EU importers of CBAM products		**-0.004****		**-0.026*****		**0.001**		**-0.029*****	
		(0.001)		**(0.002)**		**(0.001)**		**(0.003)**	
EU importers of CBAM products	β_1		**-0.006****		**-0.026*****		**-0.003**		**-0.035*****
in CBAM sector			**(0.002)**		**(0.004)**		**(0.003)**		**(0.006)**
EU importers of CBAM products	β_2		**-0.004****		**-0.026*****		**0.002**		**-0.028*****
not in CBAM sector			**(0.002)**		**(0.002)**		**(0.002)**		**(0.003)**
ROA_{2019}		0.013*	0.012*	0.021***	0.021***	0.015**	0.015**	0.048***	0.048***
		(0.007)	(0.007)	(0.008)	(0.008)	(0.006)	(0.006)	(0.012)	(0.012)
$Cash_{2019}$		-0.002	-0.002	0.018***	0.018***	-0.007*	-0.007*	0.009	0.009
		(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.008)	(0.008)
TA_{2019}		0.000	0.000	-0.001*	-0.001*	0.000	0.000	-0.001	-0.001
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
MTB_{2019}		0.000	0.000	0.000	0.000	-0.000	-0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
H0: $\beta_1 = \beta_2$ *(p-value)*			(0.440)		(0.938)		(0.163)		(0.262)
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster Standard Errors		Firm Level	Firm Level	Firm Level	Firm Level	Firm Level	Firm Level	Firm Level	Firm Level
Observations		8,901	8,901	8,901	8,901	8,901	8,901	8,901	8,901
R-squared		0.030	0.030	0.085	0.085	0.031	0.031	0.068	0.068

Table 7: Supply-Chain Linkages

This table presents cross-sectional variation in the cumulative abnormal returns (CARs) on CBAM event dates based on supply chain linkages. The analysis includes EU and non-EU importers of CBAM products. Column 1 analyzes variation in non-EU suppliers among EU importers of CBAM products. Column 2 analyzes variation in EU customers among non-EU importers of CBAM products. Column 3 analyzes variation in non-EU customers among EU importers of CBAM products. *Many X* is an indicator variable for whether the firm is the top tercile cutoff of the sample distribution based on the variable *X*, where *X*={*number of non-EU Suppliers, number of EU Customers, number of non-EU Customers*}. Firms are classified as "EU" if their headquarters are in one of the 27 countries of the European Union, Iceland, Switzerland, or Norway. Robust standard errors are shown in parentheses. The considered CBAM event dates are July 14, 2021, June 22, 2022, and April 18, 2023. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Subsample:	**EU Importers of CBAM products**	**Non-EU Importers of CBAM products**	**EU Importers of CBAM products**
Dep. Variable:	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
	(1)	(2)	(3)
Many Non-EU Suppliers	-0.013**		
	(0.006)		
Many EU Customers		0.002	
		(0.003)	
Many Non-EU Customers			-0.004
			(0.006)
Controls	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Observations	697	6,825	697
R-squared	0.164	0.136	0.158

Table 8: Market Power

This table presents cross-sectional variation in the cumulative abnormal returns (CARs) on CBAM event dates based on market power. The analysis includes EU and non-EU importers of CBAM products. Columns 1-3 (4-6) include EU (non-EU) importers of CBAM products. *Low Margin* is an indicator variable for whether the firm's profit margin is in the lowest sample quartile of the sample distribution. Columns 2 and 5 (3 and 6) include firms without (with) non-EU suppliers (EU customers). Firms are classified as "EU" if their headquarters are in one of the 27 countries of the European Union, Iceland, Norway or Switzerland. The considered CBAM event dates are July 14, 2021, June 22, 2022, and April 18, 2023. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Subsample:	**EU importers of CBAM products**			**Non-EU importers of CBAM products**		
	Pooled	without non-EU suppliers	with non-EU suppliers	Pooled	without EU customers	with EU customers
Dep. Variable:	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
	(1)	(2)	(3)	(4)	(5)	(6)
Low Margin	-0.005	0.021	-0.027***	-0.007**	-0.003	-0.018***
	(0.008)	(0.014)	(0.009)	(0.003)	(0.003)	(0.005)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	827	371	456	7,956	6,110	1,846
R-squared	0.261	0.298	0.374	0.153	0.160	0.200

Table 9: Sensitivity Tests

This table presents the results of four variants of the analysis in Table 6. Column 1 uses a one-to-one matched sample of EU and non-EU importers of CBAM products with similar fundamentals. Column 2 uses value-weighted (rather than equally-weighted) returns (weights are based on market values in 2019). Column 3 restricts the sample of non-EU importers of CBAM products to firms with at least one customer from the EU. Column 4 restricts the sample to firms with Article 9 investors (*Art. 9 Firms*). The rest of the specification is as in Table 6. Robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Variant:	***Matched sample***	***Value weighted returns***	***Non-EU importers with EU customers***	***Art. 9 Firms***
Dep. variable	*CAR (0,2)* (1)	*CAR (0,2)* (2)	*CAR (0,2)* (3)	*CAR (0,2)* (4)
EU importers of CBAM products	**-0.030*** **	**-0.048*** **	**-0.029*** **	**-0.045*** **
	(0.004)	**(0.007)**	**(0.003)**	**(0.004)**
ROA_{2019}	0.027	0.103***	0.051***	0.044**
	(0.025)	(0.030)	(0.018)	(0.019)
$Cash_{2019}$	-0.017	0.019	0.005	-0.024
	(0.017)	(0.030)	(0.015)	(0.016)
TA_{2019}	-0.003**	-0.000	-0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
MTB_{2019}	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Industry FE	Yes	Yes	Yes	Yes
Observations	1,652	8,901	2,688	2,387
R-squared	0.119	0.297	0.081	0.181

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Table 10: Free Allowances

This table presents cross-sectional variation in the cumulative abnormal returns (CARs) on CBAM event dates based on the amount of free carbon allowances assigned to the firm. The analysis includes EU importers of CBAM products that participate in the EU ETS in 2019. *High free emissions* is an indicator variable for whether the firm is above the sample median of the ratio of free allowances to total ETS emissions in 2019. The rest of the variables are defined as in Table 7 and 8. Robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dep. Variable	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
	(1)	(2)	(3)	(4)
High Free Emissions	0.010	0.006	0.007	0.005
	(0.010)	(0.010)	(0.010)	(0.010)
Many Non-EU Suppliers		-0.028**		-0.028**
		(0.013)		(0.012)
Low Margin			-0.036**	-0.033**
			(0.015)	(0.015)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Observations	172	157	172	157
R-squared	0.327	0.343	0.358	0.369

Table 11: ETS Coverage

This table presents cross-sectional variation in the cumulative abnormal returns (CARs) on CBAM event dates based on the amount of free carbon allowances assigned to the firm. The analysis includes EU importers of CBAM products that participate in the EU ETS in 2019 with non-missing Trucost data. *Low % ETS Coverage* is an indicator variable for whether the firm is below the sample median of the ratio of total ETS emissions to total scope 1 and 2 emissions in 2019. The rest of the variables are defined as in Table 7 and 8. Robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dep. Variable	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
	(1)	(2)	(3)	(4)
Low % ETS Coverage	0.004	0.006	0.004	0.006
	(0.011)	(0.011)	(0.011)	(0.011)
Many Non-EU Suppliers		-0.030**		-0.030**
		(0.014)		(0.014)
Low Margin			-0.033**	-0.030*
			(0.015)	(0.016)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Observations	133	129	133	129
R-squared	0.395	0.409	0.419	0.430

Online Appendix

Figure A.1: Timeline of Google Search Trends

This figure presents the interest in the CBAM based on Google Search Trends over the period 2019 to 2023. Based on Google, "numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough. data for this term." The search terms are "EU CBAM" (solid line) and "carbon border adjustment mechanism" (dashed line) worldwide. Vertical lines show the main CBAM regulatory events.

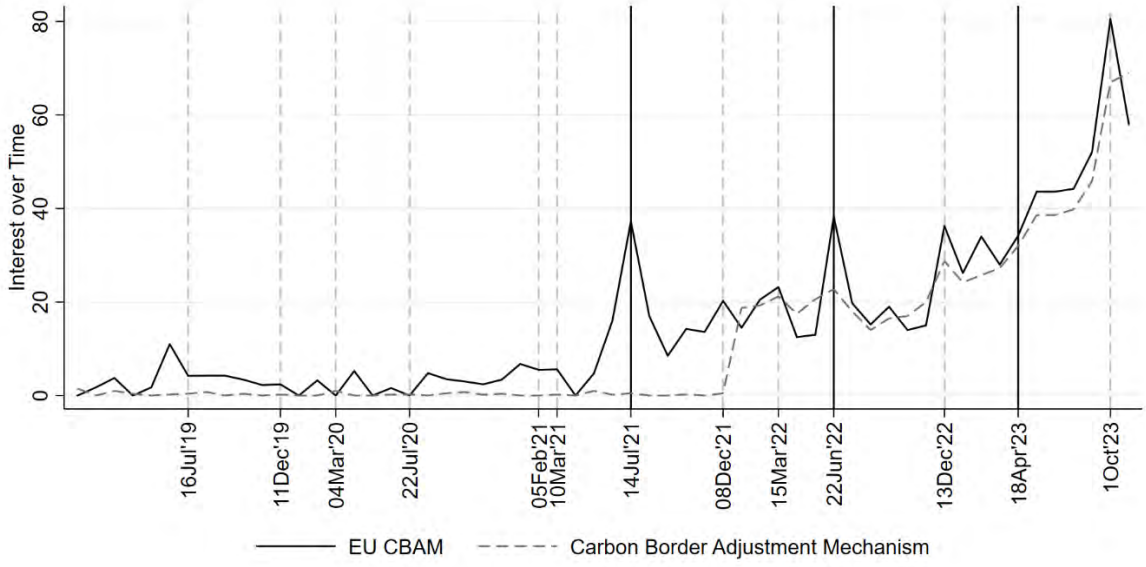


Figure A.2: CBAM Importers in CBAM Sectors' Customers, by Industries

These figures show the number of unique customers by sector of the firms in each of the six CBAM sectors. For example, Panel A indicates that the firms in the aluminum sector have 16 customers in the capital goods sector, 15 customers in the automobile sector, 13 in the aluminum sector, and so on.

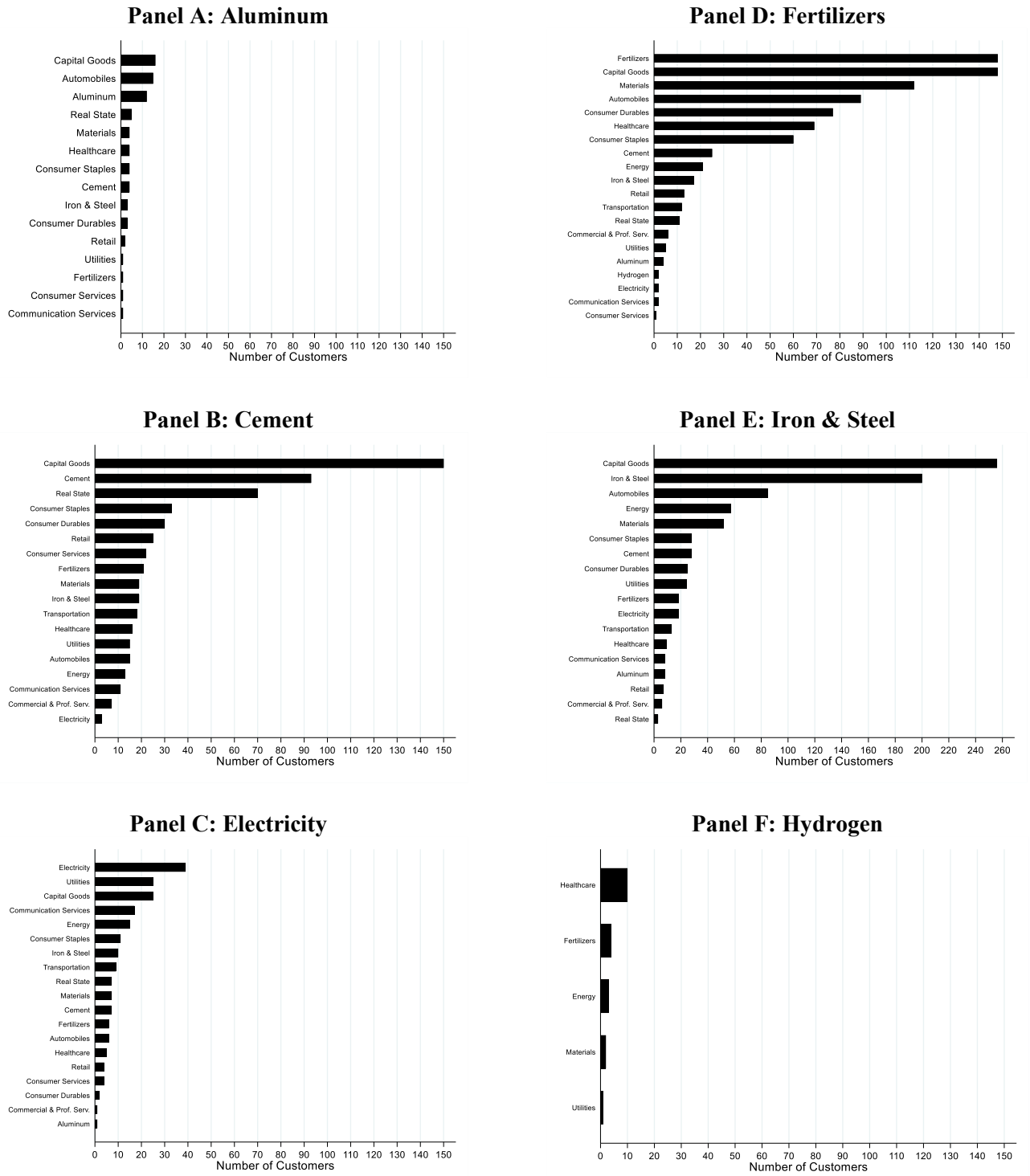
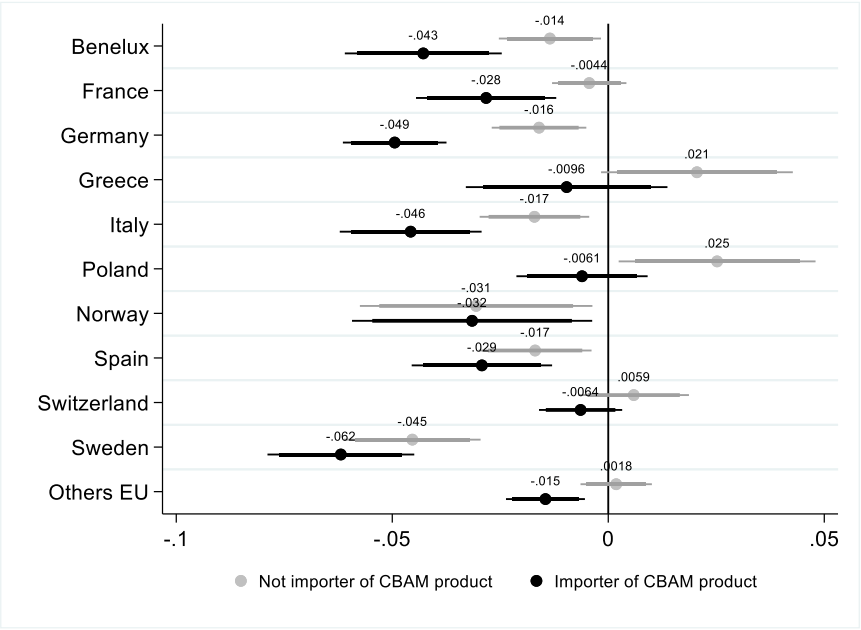


Figure A.3: CARs around CBAM Events by Country

These figures present the aggregated CAR(0,2) around CBAM events by country. The analysis distinguishes between EU/non-EU firms and importers/non-importers of CBAM products. In cases of relatively few observations by country, we group firms by geographic area. Panel A (B) includes EU (non-EU) firms. Dots represent the sample mean, while the thicker (thinner) line shows the 90% (95%) confidence intervals.

Panel A: EU Firms



Panel B: Non-EU Firms

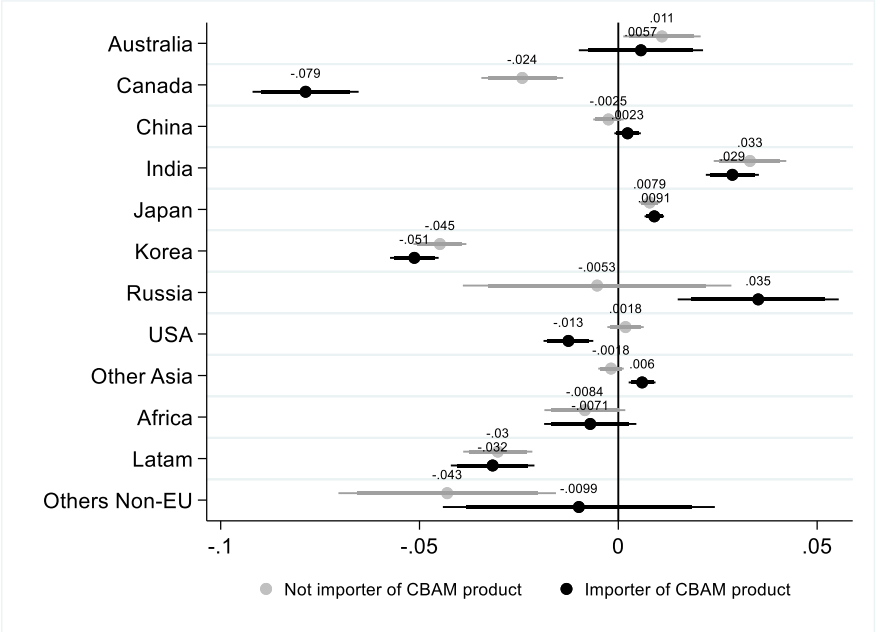


Figure A.4: CARs by Industries, CBAM firms

These figures present the aggregated CAR(0,2) around CBAM events by sector. The analysis distinguishes between EU/non-EU firms. We exclude the hydrogen sector as our sample included only three EU firms. Dots represent the sample mean, while the thicker (thinner) line shows the 90% (95%) confidence intervals.

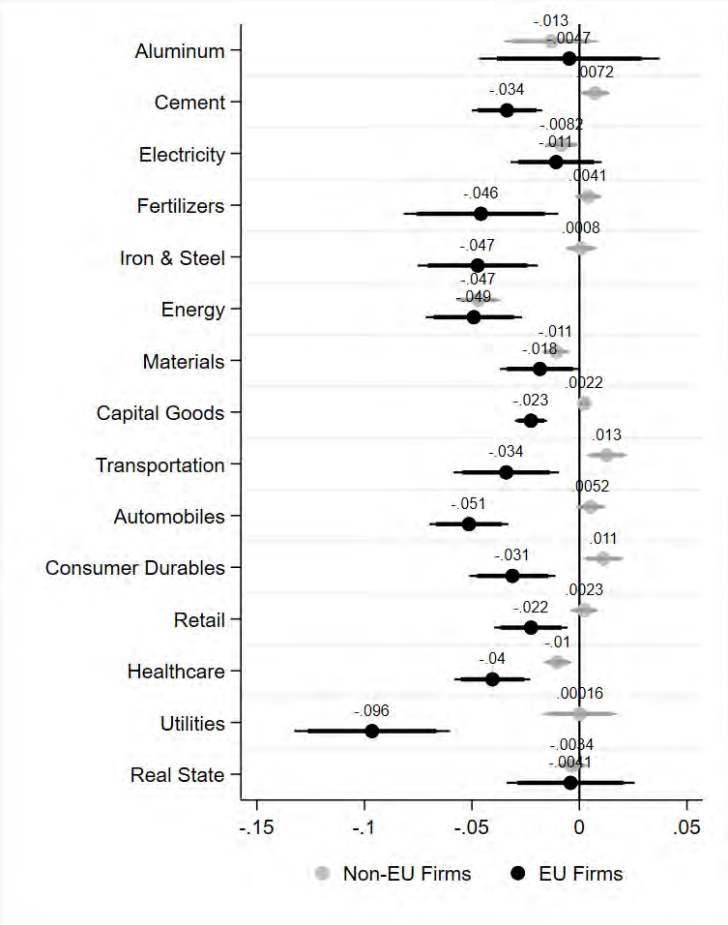
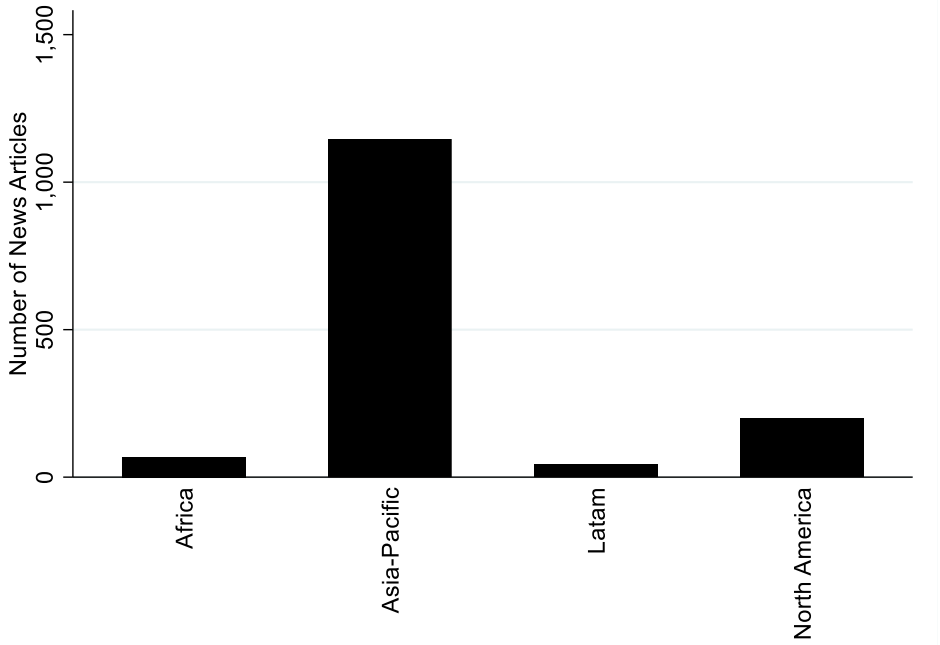


Figure A.5: News Paper Articles on the CBAM by Non-European region

This figure presents the number of news articles across regions around the three CBAM event dates: 07/14/2021, 06/22/2022, and 04/18/2023. Panel A shows the distribution of the amount of news by non-European region containing "CBAM" from ten days prior to the respective event to ten days after this event. Panel B shows the distribution of the amount of news on the respective event day and the two following days. Number of news are retrieved from Factiva.

Panel A: News Articles by Region from day -10 to day +10 around the CBAM three event dates



Panel B: News Articles by Region from day 0 to day +2 around the CBAM three event dates

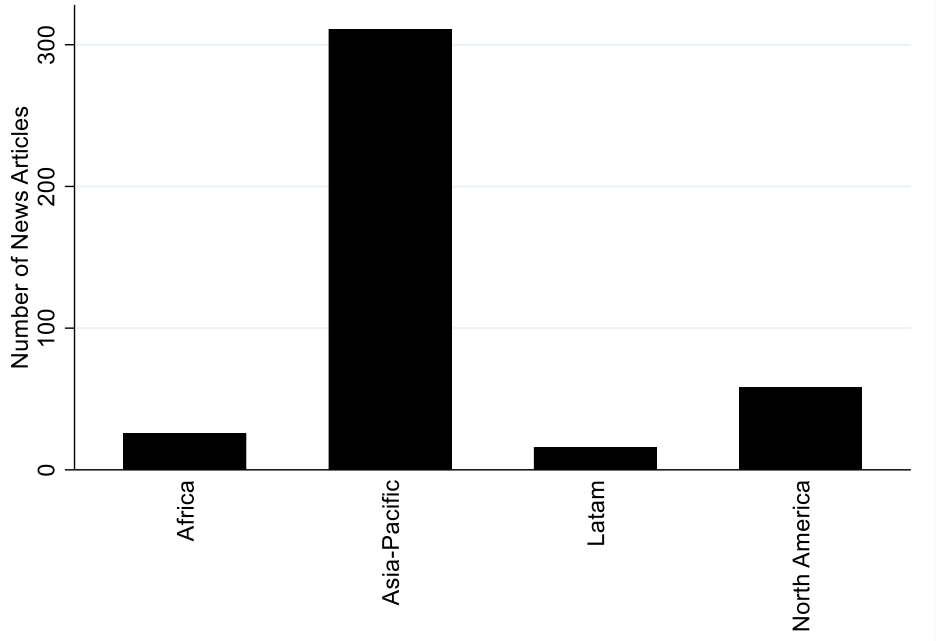


Table A.1: Robustness Analysis for Alternative Treatment of Potential Event Dates

This table presents results of repeating the analysis in Table 6 using the dates in Table 1 excluded in the analysis of Table 6 and others (see Table 1). Column 1 includes 11-Dec-19. Column 2 includes 4-Mar-20. Column 3 includes 13-Dec-22. Column 4 repeats the analysis including the three dates classified as "confounded" (see Table 1). Column 5 includes the three dates classified as "confounded" and the three dates classified as "selected" (see in Table 1). Column 6 includes the three dates classified as "insignificant" (see Table 1). Column 7 includes the three dates classified as "insignificant" and the three dates classified as "selected" (see in Table 1). Column 8 includes all the dates in Table 1. Column 9 includes all the dates in Table 1 except for 4-Mar-20. Robust standard errors are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	11-Dec-19 Green Deal	*4-Mar-20 COVID*	*13-Dec-22 Monetary shocks*	*All Confounded (3 Dates)*	*Selected & Confounded (6 Dates)*	*All Insignificant (6 Dates)*	*Selected & Insignificant (9 Dates)*	*All Dates (12 Dates)*	*All Dates except COVID (11 Dates)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
EU importers of CBAM products	0.004***	-0.043***	-0.007***	-0.045***	-0.075***	-0.012***	-0.041***	-0.086***	-0.044***
	(0.001)	(0.002)	(0.001)	(0.003)	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No	No	No	No	No
Observations	8,785	8,785	8,785	8,785	8,785	8,785	8,785	8,785	8,785
R-squared	0.031	0.091	0.021	0.058	0.084	0.041	0.061	0.075	0.053

Table A.2: Cumulative Abnormal Returns excluding 14 July 2021

This table repeats the analysis in Tables 6 and 9 excluding one of the three considered CBAM events, namely 14 July 2021. The empirical specification is as in Tables 6 and 9.

	Full sample	*Matched sample*	*Value weighted*	*Non-EU with EU customers*
	(1)	(2)	(3)	(4)
Variable	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
EU importers	-0.025***	-0.027***	-0.043***	-0.026***
of CBAM products	(0.002)	(0.003)	(0.006)	(0.003)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	8,901	1,662	8,901	2,688
R-squared	0.063	0.127	0.284	0.097

Table A.3: Cumulative Abnormal Returns, Different Sizes Samples

This table repeats the analysis in Tables 6 and 9 restricting the sample to firms above certain cutoffs of total assets. Panels A, B, and C show the main results for firms above 10, 50, and 1,000 million total assets respectively. The empirical specification is as in Tables 6 and 9.

Panel A: 10 million Total Assets				
	Full sample	*Matched sample*	*Value weighted*	*Non-EU with EU customers*
	(1)	(2)	(3)	(4)
Variable	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
EU importers	-0.023***	-0.024***	-0.048***	-0.025***
of CBAM products	(0.002)	(0.003)	(0.007)	(0.003)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	12,552	2,538	12,552	3,322
R-squared	0.047	0.069	0.294	0.062
Panel B: 50 million Total Assets				
	Full sample	*Matched sample*	*Value weighted*	*Non-EU with EU customers*
	(1)	(2)	(3)	(4)
Variable	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
EU	-0.026***	-0.026***	-0.048***	-0.028***
	(0.002)	(0.004)	(0.007)	(0.003)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	10,264	1,959	10,264	2,937
R-squared	0.055	0.111	0.295	0.072
Panel C: 1 billion Total Assets				
	Full sample	*Matched sample*	*Value weighted*	*Non-EU with EU customers*
	(1)	(2)	(3)	(4)
Variable	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
EU	-0.036***	-0.039***	-0.049***	-0.037***
	(0.004)	(0.005)	(0.007)	(0.004)
Controls	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	3,370	721	3,370	1,302
R-squared	0.166	0.327	0.322	0.172

Table A.4: Alternative Measures of Abnormal Returns

This table repeats the analysis in Table 5 using alternative measures of abnormal returns. In Panel A, CARs are computed using market-adjusted returns. In Panel B, CARs are computed based on the market model. In both cases, market returns are measured using the Russell 3000 daily market return. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Market-Adjusted Returns						
Event(s)	#obs.	**CAR(0,2) Jul 14, 2021**	**CAR(0,2) Jun 22, 2022**	**CAR(0,2) Apr 18, 2023**	**CAR(0,2) All events**	**CAR(-2,2) All events**
EU	834	0.0019*	-0.0535***	-0.0021*	-0.0537***	-0.0577***
[t-stat]		*[1.67]*	*[38.08]*	*[1.74]*	*[24.49]*	*[21.50]*
Non-EU	8,067	0.0065***	-0.0333***	-0.0040***	-0.0308***	-0.0317***
[t-stat]		*[13.52]*	*[57.89]*	*[9.64]*	*[36.56]*	*[28.88]*
Difference		-0.0046***	-0.0202***	0.0019	-0.0229***	-0.0260***
[t-stat]		*[3.00]*	*[10.93]*	*[1.44]*	*[8.43]*	*[7.39]*
Panel B: Market Model						
Event(s)	#obs.	**CAR(0,2) Jul 14, 2021**	**CAR(0,2) Jun 22, 2022**	**CAR(0,2) Apr 18, 2023**	**CAR(0,2) All events**	**CAR(-2,2) All events**
EU	834	-0.0112***	-0.0254***	-0.0081***	-0.0447***	-0.0379***
[t-stat]		*[9.61]*	*[15.88]*	*[6.56]*	*[18.93]*	*[12.71]*
Non-EU	8,067	-0.0057***	0.0009	-0.0090***	-0.0138***	0.0015
[t-stat]		*[11.76]*	*[1.49]*	*[21.37]*	*[15.53]*	*[1.27]*
Difference		-0.0055***	-0.0263***	0.0009	-0.0309***	-0.0394***
[t-stat]		*[3.55]*	*[13.45]*	*[0.67]*	*[10.76]*	*[10.36]*

Table A.5: Alternative Measure of Market Power

This table repeats the analysis in Table 8 using an alternative measure of market power. *High HHI* is defined as an indicator variable for firms in the top quartile of the sample distribution of the Herfindahl Index (HHI). HHI is computed based on three-digit GIC industry codes. Robust standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	All sectors	Not in CBAM sectors	Importers without non-EU suppliers	Not in CBAM sectors without non-EU suppliers	Importers with non-EU suppliers	Not in CBAM sectors with non-EU suppliers
Dep. Variable:	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*	*CAR (0,2)*
	(1)	(2)	(3)	(4)	(5)	(6)
High HHI	-0.036**	-0.042**	-0.002	-0.004	-0.057**	-0.065**
	(0.017)	(0.018)	(0.022)	(0.024)	(0.026)	(0.028)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.253	0.272	0.287	0.319	0.345	0.345
Observations	834	674	376	295	458	379