The Impact of Climate Policies on Financial Markets: Evidence from the EU Carbon Border Adjustment Mechanism

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Abstract

The introduction of the EU Carbon Border Adjustment Mechanism (CBAM) has triggered statistically significant negative stock market responses for firms within the EU. Comparing EU customers that have non-EU suppliers in CBAM-affected industries with their non-treated peers in the control group, we find an extra cumulative abnormal return of up to -1.3 percentage points over our main five-day event window around December 13, 2022. Both the suppliers' locations and their industries are key determinants of the treatment effects. We also document sizeable treatment effects for supplier firms and for other event dates.

Keywords: Carbon border adjustment mechanism, carbon pricing, supply chain, event study, cumulative abnormal returns, trade

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1 Introduction and Motivation

Climate policy has gained significant momentum in many countries in recent years. Among the various policy initiatives and instruments, the European Union Emissions Trading System (EU ETS), which was launched in 2005, arguably stands out as a worldwide flagship. Importantly, unlike many other policy instruments, the EU ETS is grounded on a solid economic foundation. In theory, putting a globally aligned price on carbon emissions, equated to the social cost of carbon, is the optimal approach to internalize climate externalities and to steer the green transition. In practice, though, the EU ETS comes with a big loophole widely known as carbon leakage. It covers only carbon emissions which originate from sources within EU countries. Firms can evade the need to buy emission permits by shifting their production to countries outside the EU which have no emissions pricing in place. Against this backdrop, in 2023 the EU decided to complement the EU ETS with a companion policy instrument: the EU Carbon Border Adjustment Mechanism (CBAM).

The CBAM is the world's first carbon border tax. In a nutshell, it requires the importers of certain goods to pay an import tax proportional to the carbon footprint of these goods. The tax rate is calibrated such that the tax roughly equals the hypothetical amount that would have to be paid for EU ETS certificates, had the goods been produced within the EU. Ideally, the CBAM thus levels the playing field for production inside and outside the EU in terms of carbon pricing.

This paper analyzes the stock price response of firms involved in international trade to the introduction of the CBAM. To this end, we conduct a causal event study around the main legislative event on December 13, 2022. On this day, at 1:00 a.m. in the morning, the EU published a press release announcing the breakthrough in the so-called Trilogue negotiations between the European Commission, the European Parliament and the Council of the European Union.[1] For our main analysis, we merge seven datasets, most importantly FactSet Revere data on customer-supplier relationships, Compustat and Worldscope data on returns and firm characteristics, and a linking table from CN goods classifiers to SIC industry codes.[2] Equipped with this dataset, we document a set of novel empirical findings.

First and foremost, the cumulative abnormal returns (CARs) of EU customer firms with

[1]In Section 2, we provide an in-depth discussion why this agreement constitutes the main exogenous event around which we conduct our event study. But we also run a series of robustness checks for other important dates related to the CBAM.

[2]We thank Peter Schott from Yale University for making this linking table publicly available.

CBAM-treated suppliers are on average 1.3 percentage points lower than the CARs of their peers in our control group, when measured over a five-day event window. This basic treatment effect is strongly significant and robust to a series of robustness checks. For instance, the results are consistent with baseline treatment effect when we slightly change the specification of treatment and control groups, allow the customer-supplier relationships ending before the event date, and use the Fama-French 3-factor (or 5-factor) model instead of the CAPM to compute abnormal returns.

Albeit small at first glance, this treatment effect is remarkable for several reasons. First of all, the total market capitalization of all firms in our treatment groups exceeds 6 trillion EUR, suggesting losses of several billion EUR over the event window. Second, the documented treatment effect applies to customer firms *within the EU*, suggesting a spillover of the effects of climate policies along the supply chain. Third, as will become clear below, the treatment effect measured here should rather be regarded as a lower bound for the (unknown) total effect of the CBAM. Fourth, in contrast to our findings, the empirical literature so far seems to suggest that carbon pricing has no measurable effect on the financial performance of treated firms. Among many others, Dechezlepretre, Nachtigall, and Venmans (2023) and Colmer, Martin, Muuls, and Wagner (2023) analyze granular firm-level data and find that the EU ETS has triggered substantial carbon emission reductions without notable negative side effects for regulated firms. They argue that the EU ETS may have induced productivity-increasing investments that offset the regulatory costs. In contrast, using a clean event study identification, our paper documents economically and statistically significant negative effects from the introduction of the CBAM, a companion policy tool to the EU ETS, when viewed through the lens of equity market investors. Our findings are thus more in line with the US-based evidence of Carattini and Sen (2019) or Bauer, Offner, and Rudebusch (2023), or with the aggregate time series analysis of Kaenzig (2023) who finds that a tightening of the carbon price regime lowers aggregate economic activity and increases consumption inequality.

Besides the overall effect, we also document significant partial treatment effects for EU customer firms. Specifically, a customer firm needs to have suppliers that satisfy two requirements in order to be counted as treated: (i) the supplier's production needs to be located outside the EU (henceforth labeled as "location treatment") and (ii) its products need to be subject to the CBAM (henceforth labeled as "industry treatment"). Separating these two requirements, we find that both the location treatment and the industry treatment trigger up to -1 percentage point average cumulative abnormal return.

The partial effects support several interpretations. First, even after the list of CBAM-affected goods has been finally approved, investors rightly expect many further products to be subject to the CBAM in the future. The official CBAM regulation states the intention that the CBAM shall apply to all goods covered by the EU ETS from 2030 onwards. Our findings indicate that this announcement is regarded as very credible. Second, the complexity of the CBAM regulation makes it hard for investors to assess whether an EU customer actually has relationships to treated suppliers, in particular because supply chain data is not fully publicly available. The resulting uncertainty can arguably lead to a negative abnormal stock return even for firms with suppliers within the EU or in non-treated industries.

A set of further analyses complements and supports our key takeaways. In our baseline case, we analyze the returns of EU customer firms because they are more relevant for policymakers within the EU. But of course it is straightforward to compute the cumulative abnormal returns of supplier firms located outside the EU around December 13, 2022. Because the data for suppliers is arguably much noisier, we find mostly insignificant treatment effects, but in magnitude the effects are comparable to those for customer firms within the EU. This suggests that the financial burden arising from the CBAM is shared among customers and suppliers, at least when viewed through the lens of equity investors. Given the limitations of our current dataset, there is however scope for further research on this question.

We also conduct similar event studies around other important legislative dates related to the CBAM. This is complicated by the fact that the CBAM is part of a larger set of EU climate policies subsumed under the so-called "Fit for 55 package", so that there are often news about several climate policies released on the same day. Still, our partial treatments (location treatment and industry treatment) are informative on these dates because none of the other, perhaps conflicting policies are targeting cross-border trade. We find cumulative abnormal returns of up to -2 percentage points around some of these dates.

We close the paper with a series of robustness checks concerning the exact composition of our treatment and control group, the length of the event window, customer-supplier relationships ending prior to the event date, or the asset pricing models used to compute abnormal returns. Our key results turn out to be very robust to such choices.

Related Literature Given the lack of empirical examples, the research on the financial impact of *global* carbon pricing schemes is still in its infancy. Since the CBAM legislation has been adopted only recently, our paper is – to the best of our knowledge – the first to study the financial market response to carbon border taxes. There is also – to the best of our knowledge – no study that analyzes the effects of carbon pricing along the supply chain empirically. Quantitatively, our paper documents that the potential losses of suppliers and customers caused by the CBAM regulation can be substantial. This stands in contrast to parts of the literature cited above which document only negligible negative effects of the EU ETS or other carbon pricing schemes on the performance of regulated firms.[3]

Still, our paper can be connected to a few strands of literature more generally. Firstly, our paper contributes to the broader discussion about the effectiveness and the design of climate policies. As previously noted by Blanchard, Gollier, and Tirole (2023), various existing climate policy instruments, including carbon markets, carbon taxes, and green subsidies, often appear incoherent and should be considered jointly in specific contexts.[4] Among them, carbon pricing is a pivotal solution to restore economic and environmental efficiency and should be part of the optimal mix of climate policies. Nevertheless, international climate agreements come with coordination failure due to free-riding problems, creating obstacles to forging effective global climate policies. Nordhaus (2015) therefore suggested the idea of a climate club, which is an agreement among countries to undertake harmonized climate actions. If the participation in such a club is incentivized properly, this coordination device may solve free-rider problems. Our paper studies the potential consequences of the most recent climate policy innovation, the EU CBAM. First and foremost, the CBAM is designed to address carbon leakage directly, but it can also be regarded as such an incentive for third countries to form a climate club with the EU, as emphasized by Beaufils, Wanner, and Wenz (2024).[5] Specifically, we examine the financial market reaction to the announcement of such a policy.

In contrast, there is a substantial body of literature, mainly in macroeconomics, that studies the optimal design of climate policies in open economy models. An example is the paper of Ernst, Hinterlang, Mahle, and Stähler (2023), which studies a carbon border tax in an E-DSGE model. Other papers examine border carbon adjustments (BCAs) in macroeconomic models (Böhringer, Fischer, Rosendahl, and Rutherford (2022), Fischer and Fox (2012)) and microeconomic models

[3]Besides the papers cited above, see, e.g., Jaraite-Kaukauske and Maria (2016), Marin, Marino, and Pellegrin (2018), Loeschel, Lutz, and Managi (2019), Klemetsen, Rosendahl, and Jakobsen (2020), Trinks and Hille (2024).

[4]There is an extant literature on each of these instruments. See, e.g., Calel and Dechezleprêtre (2016), Cui, Wang, Zhang, and Zheng (2021), Van den Bremer and Van der Ploeg (2021) for carbon markets; Elliott, Foster, Kortum, Munson, Cervantes, and Weisbach (2010), Marron and Toder (2014) for carbox taxes; Allcott, Knittel, and Taubinsky (2015), De Groote and Verboven (2019)) for subsidies.

[5]In fact, the preamble of the official CBAM regulation contains a paragraph that explicitly calls for the development of further cooperation with third countries to establish a climate club "in order to promote the implementation of ambitious climate policies in all countries and pave the way for a global carbon pricing framework".

(Al Khourdajie and Finus (2020), Böhringer, Carbone, and Rutherford (2016), Salib (2024)). However, to the best of our knowledge, no prior studies have analyzed the economic impact of such a policy in empirical real-world settings.

Furthermore, our paper also contributes to the literature on environmental policy and international trade. Early works have explored the impact of trade on a country's environment. For example, Antweiler, Copeland, and Taylor (2001) argue that this impact can be categorized into three components: scale, technique, and composition, and finds that international trade can induce technological change, therefore creating net benefits for the environment.[6] Other papers focus on how environmental regulation can affect trade flows. Separating industrialized and developing countries, Ederington, Levinson, and Minier (2005) finds the pollution abatement cost on imports from developing countries to be high. Notably, the concept of carbon leakage, wherein trade-exposed markets offset domestic emission reductions and circumvent market distortions from carbon regulation, has received attention (Fowlie, Reguant, and Ryan (2016), Shapiro and Walker (2018)).

Lastly, our paper sits within the context of literature analyzing the effects of public policies and regulations on asset prices. Cohen, Diether, and Malloy (2013) show that the historical voting record of legislators has explanatory power for (seemingly) abnormal post-legislation drifts in the prices of stocks that are affected by certain policies. Other papers delve into the implications of monetary policy (Nakamura and Steinsson (2018)) and fiscal policy (Gómez-Cram and Olbert (2023)) for equity prices using high-frequency data. The most relevant paper is by Meng (2017), who investigates the stock market reaction to climate policy and adopts Regression Continuity Design (RDD) to evaluate the marginal abatement cost. Extending this line of research, our paper focuses on the stock market's reaction to a new cross-border climate policy by incorporating supply chain information.

The rest of the paper is structured as follows. In Section 2, we elaborate on the legislative background of the CBAM. Data and methodology are presented in Section 3. Section 4 discusses our results, and Section 5 provides a set of robustness checks. Section 6 concludes and discusses policy implications.

[6]Similarly, Frankel and Rose (2005) find that trade tends to reduce three measures of air pollution using exogenous geographic determinants of trade as instrumental variable

2 Background information on the legislative process

In order to perform our event study, we need to single out the dates on which relevant news about the EU CBAM were publicly released. Table 1 summarizes the timeline of the CBAM legislation process. In the following, we will discuss these events briefly. As will become clear below, the most important and suitable date for our event study is December 13, 2022. We will therefore conduct our event studies mainly around this date.

Table 1: **Timeline of events**

Dec 11, 2019	Ursula v.d.Leyen announces EU Green Deal in a speech
Jul 14, 2021	European Commission adopts proposals for **"Fit for 55 package"** including proposal for the CBAM
Sep 13, 2021	Committee referral announced in European Parliament
Mar 15, 2022	European Council adopts its position on the CBAM
May 23, 2022	Draft report of the Committee on the Environment, Public Health and Food Safety of the European Parliament
June 22, 2022	European Parliament adopts its position on the CBAM
July 11, 2022	Beginning of Trilogue meetings (Commission, Parliament, Council)
Dec 13, 2022	**Informal provisional agreement about CBAM reached**
Feb 09, 2023	Parliamentary Committee approves official text of the Trilogue agreement concerning CBAM (and other parts of "Fit for 55")
Apr 18, 2023	CBAM (and other parts of "Fit for 55") formally adopted by the European Parliament
Apr 25, 2023	CBAM (and other parts of "Fit for 55") formally adopted by the European Council
May 10, 2023	Final act officially signed
May 16, 2023	Publication in the Official Journal of the EU
Oct 01, 2023	CBAM goes into effect (transitional period, reporting obligations only)
Jan 01, 2026	Importers have to surrender CBAM certificates for imports of listed goods (certificates can be purchased throughout the year, official declaration for a given year is due by May of the next year)
Jan 01, 2030	Intention that CBAM will apply to all goods covered by EU ETS (proposal still to be worked out by EU legislative bodies)

On December 11, 2019, a few months after the European Parliament election, the newly appointed president of the European Commission, Ursula von der Leyen, gave a widely recognized speech to the new parliament, in which she laid out her plans for the so-called EU Green Deal. The CBAM was one of many climate policy initiatives that she proposed in this speech.

From a legal perspective, the EU Carbon Border Adjustment Mechanism was implemented by means of an EU regulation, i.e. a "binding legislative act which must be applied in its entirety across the EU"[7]. As such, the CBAM regulation had to pass the EU's so-called "ordinary legislative procedure", which involves the European Commission, the European Parliament, and the Council of the European Union with different roles. The Commission usually initializes the legislative process, but it is the Parliament and the Council that have to adopt the act eventually (so-called Codecision Procedure). A proposal can go back and forth between Parliament and Council in several rounds, until both pass the act. In order to speed up the joint decision-making, the EU has established an informal meeting format between Commission, Parliament and Council, the so-called Trilogue, which was also applied to the CBAM.

This ordinary legislative procedure is visible in the timeline of events in Table 1. The legislative process was initiated through the adoption of a proposal by the Commission on July 14, 2021. This proposal was then passed on to the Parliament where the Committee on the Environment, Public Health and Food Safety was in charge of it. After both the Parliament and the Council had formulated their opinions on the CBAM proposal, the series of Trilogue meetings started on July 11, 2022, and resulted in an informal agreement on December 13, 2022. More precisely, the press release about the agreement was published at 1:00 am in the morning of December 13, 2022. After this breakthrough in the negotiations, it then took a few weeks to clarify further details. The final version of the CBAM regulation was approved by the responsible Parliamentary Committee on February 09, 2023. Both the European Parliament and the European Council adopted this final version of the CBAM regulation officially in April 2023.

We conduct our event study mainly around one date – December 13, 2022 – when the breakthrough in the Trilogue negotiations was reached. There are two major reasons for this choice. First of all, many of the candidate dates listed in Table 1 are confounded by multiple legislative events happening on the same day. The CBAM regulation is part of a broad legislative agenda that is publicly referred to as the "Fit for 55 package". This package concretizes the ideas laid out in the inaugural EU Green Deal speech from December 11, 2019. It includes, for instance, changes to the EU Emission Trading System (like an extension to further sectors and a stronger reduction of the emissions cap), a new emissions trading system for the road transport and building sector, or the phasing-out of fossil fuel cars by 2035. All these policies were negotiated very much in parallel with the CBAM. For instance, the first detailed proposal of the "Fit for 55 package" – including the first proposal for the CBAM – was adopted and publicly announced

[7] See https://european-union.europa.eu/institutions-law-budget/law/types-legislation_en

by the European Commission on July 14, 2021. Moreover, in its plenary meetings on April 18, 2023, the European Parliament voted on both the CBAM and the reform of the EU ETS. From the list of events in Table 1, December 13, 2022, is the only major event that is not contaminated with other EU climate policy decisions.

Second, the information that was released on December 13, 2022, can be considered as both novel and important for financial investors. To see this, one has to dig a little deeper into the details of the CBAM negotiations. The legislation proposal of the EU Commission on July 14, 2021, was already very advanced. For instance, it contained an initial list of goods (with CN codes) that the CBAM should cover. The proposal was also very detailed about how the carbon border tax should be implemented via trading of CBAM certificates, and also outlined penalties for misbehavior. Roughly speaking, for every import into the EU, importing firms located outside the EU need to surrender CBAM certificates, which can be purchased (and traded) at any time at a price equal to the average EU ETS price in the respective week. This general idea of the CBAM was not changed during the entire negotiation process. Clearly, a large part of the regulation is devoted to rules how to measure, declare and audit the amount of emissions for which CBAM certificates need to be surrendered. The initial proposal also contained the intention that the CBAM should be extended to all goods covered by the EU ETS until 2036. To sum up, the overall structure and outline was very clear already from this initial proposal.

Still, many details of the CBAM were changed or clarified during the following negotiations. Overall, the final CBAM regulation can be regarded as stricter than the initial proposal. The initial list of CBAM-affected goods was extended towards hydrogen, certain indirect emissions, certain precursors and downstream products like screws and bolts and similar products of iron and steel. The penalties for misbehavior were strengthened. Moreover, many details concerning the alignment of the CBAM with the EU ETS (for instance as regards the allocation of free allowances) had to be settled, also with an eye on the compatibility of the CBAM with WTO rules. Importantly, this alignment also implies that the CBAM should be extended towards a larger number of goods in the near future. The gradual phasing-in of the CBAM was decided to be much faster than initially proposed: the CBAM is supposed to be extended to all goods covered by the EU ETS until 2030. Finally, the institutional design was adjusted, with certain parts of the governance being centralized at the EU level. The tax will be collected by the national authorities of the EU member states, but the declarations of purchased allowances will have to be filed to an EU-wide CBAM registry administered by the EU Commission, presumably facilitating a proper enforcement of the CBAM.

Naturally, these adjustments represent a compromise between the positions of the Parliament and the Council that was reached during several rounds of negotiations. For instance, in its positioning on June 22, 2022, the Parliament pushed for the extension of the list of CBAM-affected goods and the stricter timeline. On the other hand, the semi-central governance structure rather reflects the position of the Council adopted on March 23, 2022. The compromise between these positions was published in a three-page press release on December 13, 2022, sketching the Trilogue agreement as outlined above.[8] We therefore view this date as the one containing the largest amount of news for financial markets that can be related specifically to the CBAM. The complete and final version of the legislative text was released alongside the final decision of the Parliamentary Committee on the Environment, Public Health and Food Safety on February 09, 2023. This version was then officially adopted by the European Parliament and the Council of the European Union in April 2023. But the key features of this final legislation were publicly known since December 13, 2022.

3 Data and Methodology

3.1 Data

We merge seven datasets for our analysis. The central datasource for our study is the FactSet Revere Supply Chain Relationships Database, which provides details on business relations between companies worldwide, for instance information on suppliers, customers, competitors or strategic partners. This information is systematically collected from primary public sources such as SEC 10-K annual filings, investor presentations, and press releases, and classified according to normalized relationship types. We start from the 729,223 global customer-supplier relationships that are active in the time period between January 01, 2021 and February 23, 2024. We then restrict the sample to relationships which are active around the event date (i.e. with start date before and end date after December 13,2022), which results in 321,268 active relationships.

Most data on firm characteristics such as firms' location, industry, stock price (including the adjustment factor accounting for dividend payments) is taken from Compustat North America and Global. As many small supplier firms are not publicly listed, we complement the data with location data from FactSet and suppliers' primary 4-digit SIC as well as 8 other non-primary SICs from Worldscope. For our study, it is paramount to consider all available SIC codes because a firm which produces diverse goods in different industries can be affected by the CBAM even

[8] See https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7719

if its core products are not subject to it. The firm-level data is matched via FactSet IDs as well as ISIN and SEDOL numbers. For the event date of December 13, 2022, we have location information for 46,447 global suppliers and industry information for 18,450 global suppliers.

The EU CBAM legislation specifies only goods categories to be subject to the border tax, not entire industries. To divide customers and suppliers into treatment and control group, we therefore need to link our industry information with goods categories. The list of affected goods is taken from the Official Journal of the European Union (L 130, published on May 16, 2023). The provisional agreement between the European Parliament, the European Commission and the European Council that was reached on December 13, 2022, states that the CBAM will initially apply to imports of cement, iron and steel, aluminium, fertilisers, electricity and hydrogen, whose production is very carbon intensive and presumably at the most significant risk of carbon leakage. The goods are listed with their official CN codes. We use the linking table provided by Pierce and Schott (2012)[9] in order to match the CBAM-affected goods (CN or HS codes) to industries (SIC codes). We use 6-digit CN or HS codes for the matching.

We calculate cumulative abnormal returns (CARs) of European customers using the daily European asset pricing factors provided by Ken French[10]. To compute the CARs of global suppliers, we proxy the market excess returns through the difference between returns of country-level MSCI equity indices and 1-month sovereign zero-coupon rates. This data is downloaded from Thomson Reuters Eikon.

Our analysis focuses on customers located within the EU and suppliers inside or outside the EU. Our final data sample consists of 1,142 EU customers.

3.2 Methodology

We study the stock market responses to the introduction of the CBAM via event studies. To do so, we first calculate the daily abnormal log return $AR_{i,t}$ relative to the CAPM.[11] Market betas are based on 180 days prior to the event window. The cumulative abnormal return, $CAR_{i,t-2,t+2}$, for each customer is defined as the sum over all $AR_{i,t}$ over the five-day event window. We first test whether the average CARs per group are significantly different from zero using two-sided t-tests and then compare the average CARs across various treatment and control groups using one-sided t-tests.

[9] The linking table is available on the webpage of Peter Schott: https://sompks4.github.io/sub_data.html.

[10] See https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[11] We consider the Fama French 3-factor and 5-factor models in robustness checks further below.

There are a lot of possible ways to split the sample into treatment and control groups. We will later present results from a series of robustness checks for the choices that we make in this regard. In our baseline analysis, we study only the CARs of European customer firms because they are more relevant for policymakers within the EU. We will later, in Section 4.3, also discuss results for supplier firms, but because of sampling issues these results need to be taken with a grain of salt.

Our baseline exercise for EU customer firms is specified as follows. A customer firm that is supposed to be treated by the CBAM must have at least one supplier which satisfies two requirements: (i) the supplier is located outside the EU and (ii) it supplies goods that fall under the CBAM-affected goods categories.

In order to operationalize requirement (i), we construct the variable *loc_treat_ratio*, defined as the number of non-EU suppliers divided by the total number of suppliers for each customer:

$$loc\_treat\_ratio_i = \frac{\#\ non\text{-}EU\ suppliers\ of\ firm\ i}{\#\ suppliers\ of\ firm\ i}.$$

For requirement (ii), we need to make additional assumptions on the link between industries and goods. We define an industry as CBAM-affected if at least one type of goods produced by this industry (according to the industry-goods linking table) falls under the CBAM. Furthermore, we define a supplier as CBAM-affected if it belongs to at least one affected industry (according to its primary and non-primary SIC codes). We then construct the variable *ind_treat_ratio*, defined as the number of suppliers in CBAM-affected industries divided by the total number of suppliers for each customer:

$$ind\_treat\_ratio_i = \frac{\#suppliers\ of\ firm\ i\ in\ CBAM\text{-}affected\ industries}{\#\ suppliers\ of\ firm\ i}.$$

We categorize firms into treatment and control groups based on these two treatment variables. The control group in the following consists of all customer firms for which both $loc\_treat\_ratio_i$ and $ind\_treat\_ratio_i$ are equal to zero, i.e., firms which have no suppliers outside the EU and no suppliers in treated industries. Because the number of firms in the control group is rather small, we will also show results for a broader control group comprising firms for which both $loc\_treat\_ratio_i$ and $ind\_treat\_ratio_i$ are below the cross-sectional median. We will label this group as "generalized control group". The treatment group contains all firms for which both $loc\_treat\_ratio_i$ and $ind\_treat\_ratio_i$ are above the cross-sectional median.

Besides the baseline specification, we also analyze a set of intermediate cases. The respective partial treatment groups are again constructed using the variables $loc\_treat\_ratio_i$ and

$ind\_treat\_ratio_i$, but we combine the cutoff thresholds in various other ways. We will introduce these groups as we go along. Finally, we will present a series of robustness checks where we vary the composition of treatment and control groups further.

4 Results

4.1 Total treatment effect for customers inside the EU

This section presents the results from our baseline exercise. Table 2 reports the average cumulative abnormal returns of the treatment group and the two control groups around the event date (December 13, 2022). The stars indicating statistical significance are derived from two-sided t-tests of the null hypothesis that the respective mean equals zero. Table 2 also reports the differences of the average CARs between the groups, together with the p-value from a one-sided t-test of the null hypothesis that these differences in mean are positive or zero. Complementing Table 2, Figure 1 depicts the evolution of the cumulative abnormal returns over the event window. The last datapoint that is plotted in Figure 1 is identical to the CAR of the respective group reported in Table 2.

The treatment group exhibits a strongly negative return, which is both statistically significant and economically large (-1 percentage point on average). The net treatment effect of -1.3 percentage points is also strongly significant. When we use the generalized control group as a comparison, the treatment effect becomes slightly smaller, but remains significant.

Supporting our causal interpretation, Figure 1 reveals that the bulk of this negative return is in fact realized during a narrow two-day window around the event date. To be precise, all returns in our analysis are obtained from closing prices. The press release about the breakthrough in the negotiations was published at 1:00 a.m. in the morning on Tuesday, December 13, 2022. The final round of negotiations itself took place over the course of Monday, December 12, 2022. Acknowledging the possibility of information leakage during such political bargaining, it seems natural that stock prices already started reacting at some point between market close on Friday, December 09, 2023, and market close on Monday, December 12, 2023.

Altogether, we view this as clear evidence that the introduction of the CBAM affects the market valuation of EU customers with treated suppliers negatively. Albeit quantitatively small at first glance, the size of the treatment effect is remarkable. Importantly, it can be considered a lower bound for the total effect of the CBAM on the stock prices of treated firms. This is because our event date is only one in a long sequence of dates where news about the CBAM

Table 2: **Total treatment effect**

	(1) **Control group**	(2) **Generalized control group**	(3) **Treatment group**	(4) **Difference (3) − (1)**	(5) **Difference (3) − (2)**
	$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median		
Mean CAR	0.0035	0.0000	-0.0097***	-0.0131***	-0.0096**
SE	(0.0036)	(0.0030)	(0.0030)		
p-value				(0.0036)	(0.0164)
# Obs	117	354	209		

Table 2 reports the average CARs for the treatment group and the two control groups of EU customer firms for the 5-day event window around December 13, 2022. The treatment group comprises customers with above median *loc_treat_ratio* and above median *ind_treat_ratio*. The control group comprises firms with *loc_treat_ratio* = 0 and *ind_treat_ratio* = 0. The generalized control group comprises firms where both ratios are below the median. The variable *loc_treat_ratio* is defined as the number of non-EU suppliers divided by the total number of suppliers for each customer. The variable *ind_treat_ratio* is defined as the number of suppliers in CBAM-affected industries divided by the total number of suppliers for each customer. Robust standard errors or p-values are reported in parentheses. CARs are calculated relative to CAPM expected returns. In the first three columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the last two columns, they refer to a one-sided t-test of the null hypothesis of the mean difference being positive or zero.

Figure 1: **Total treatment effect**

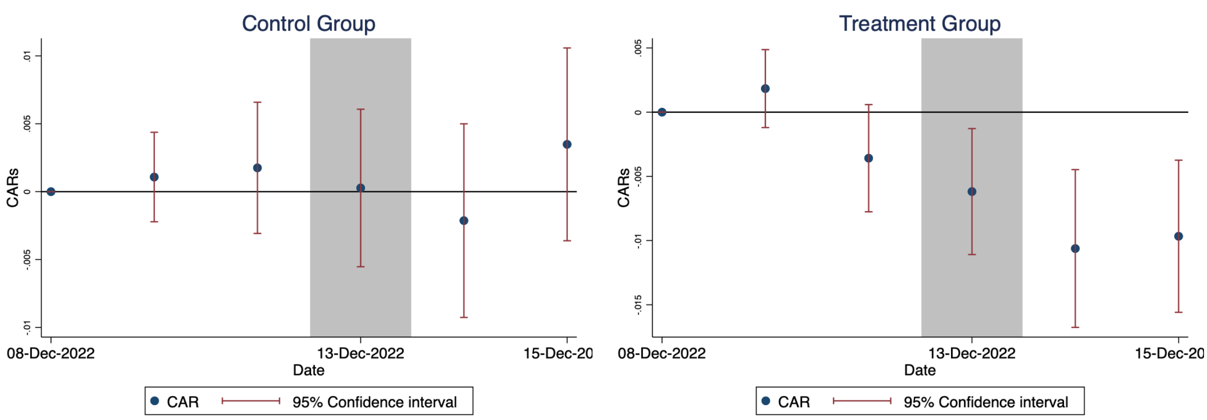

Figure 1 depicts the average CARs for the same groups as in Table 2 over the 5-day event window around December 13, 2022. The last datapoint in each plot is identical to the CAR of the respective group reported in Table 2. CARs are calculated relative to CAPM expected returns. The vertical lines on each day indicate 95% confidence intervals based on robust standard errors.

was released, and most of these news indicated that the CBAM could become stricter than previously expected. As outlined in Section 2, a lot of these news releases unfortunately fall together with news about other parts of the "Fit for 55 package", so that they are not suitable for clean identification in an event study. Presumably, the total effect of the CBAM on stock prices is thus much larger than documented in the table.

4.2 Partial treatment effects

To dig a bit deeper, we study a set of partial treatment groups that can be seen as intermediate cases between the treatment and control groups analyzed above. Remember that a customer firm that is supposed to be treated by the CBAM must have at least one supplier which satisfies two requirements: (i) the supplier is located outside the EU and (ii) it supplies goods that fall under the CBAM-affected goods categories. In the following, we construct groups of firms that satisfy only one of the two requirements. Tables 3 and 4 report the CARs for these groups and some more differences across groups. Figures 2 and 3 present the respective returns of these groups over the full event window.[12]

4.2.1 Location treatment

Specifically, Table 3 presents results from partial treatments based on suppliers' location inside versus outside the EU. For Panel A, we simply perform a median split based on the variable *loc_treat_ratio*. I.e., we compare EU customer firms with many suppliers outside the EU with EU customers which have only few suppliers outside the EU, irrespective of the industry of these suppliers. Interestingly, we observe a negative and significant treatment effect of about -0.5 percentage points, i.e. about half as large as the total treatment effect shown in the previous subsection.

There are several possible interpretations for this. For example, the official CBAM regulation contains the commitment that, by 2030, all goods that are subject to the EU ETS should also be subject to the CBAM. Even though the official CBAM regulation concentrates on a few selected goods initially, investors may thus rightly expect many more goods (or industries, respectively) to be subject to the CBAM in the future, as long as the suppliers are located outside the EU. Moreover, as the definition of the goods categories being subject to the CBAM is arguably very complex, there could be uncertainty as to whether certain suppliers outside the EU are actually

[12]For the sake of readability, we do not report the CAR differences between all possible combinations of groups in the tables and figures here. The complete set of results is reported in Table A.1 in Appendix A.

Table 3: **Partial treatment effect – location**

Panel A: Only location information

	(1)	(2)	(3)
	Location control group	**Location treatment group**	**Difference**
	$loc\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median	
Mean CAR	-0.0027	-0.0081***	-0.0054*
SE	(0.0021)	(0.0031)	
p-value			(0.0724)
# Obs	571	571	

Panel B: Location and industry information

	(1)	(2)	(3)
	Control group	**Location treatment, industry control group**	**Difference**
	$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i <$ median	
Mean CAR	0.0035	-0.0072	-0.0106*
SE	(0.0036)	(0.0045)	
p-value			(0.0982)
# Obs	117	362	

Table 3 reports the average CARs for further groups of EU customer firms for the five-day event window around December 13, 2022. The location treatment group and location control group in Panel A result from a median split of our entire sample for the variable *loc_treat_ratio*. The treatment group in Panel B comprises customers with below median *ind_treat_ratio* and above median *loc_treat_ratio*. It is a subgroup of the location treatment group in Panel A. The CAR of the control group in Panel B has been reported in Table 2. Robust standard errors or p-values are reported in parentheses. CARs are calculated relative to CAPM expected returns. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. For the differences in the last column, the stars refer to a one-sided t-test of the null hypothesis of the mean difference being positive or zero.

treated or not, and investors may shy away from their customers' stocks irrespectively. Finally, while investors may have a hard time to draw a complete picture of the industrial composition of a firms' supplier relationships, it seems a much easier task to assess whether a firm has suppliers inside or outside the EU. Because of such informational frictions, investors may thus simply choose to decide based on the location information, irrespective of the industries.

In Panel B, we view the partial location treatment effect from another angle, supporting these explanations. Specifically, we compare the control group, which was already presented in Table 2, with another dedicated group. This group comprises firms with above median *loc_treat_ratio*, but below median *ind_treat_ratio*.[13] Stated differently, the EU customer firms in this group have many suppliers outside the EU, but mostly in industries that are not subject to the CBAM. This group is a subgroup of the location treatment group in Panel A. The treatment effect is again negative, significant, and economically large, exceeding -1 percentage point. Figure 2 also indicates that the bulk of this treatment effect is indeed realized in a very narrow time window around the event. Altogether, we view these results as evidence that the information on suppliers' location alone already has a substantial negative impact on EU customer returns, irrespective of the industry of these suppliers and whether they are actually subject to the CBAM.

4.2.2 Industry treatment

Table 4 presents results from partial treatments based on suppliers' industries. For Panel A, we perform a median split based on the variable *ind_treat_ratio*. I.e., we compare EU customer firms with many suppliers in CBAM-affected industries with EU customers which have only few suppliers in CBAM-treated industries, irrespective of the location of these suppliers. Again, we observe a negative treatment effect of about -0.5 percentage points. Albeit insignificant, we find a p-value of 11% for the t-test, which is very close to the usual 10% threshold. Moreover, the CAR of the industry treatment group (second column in Panel A) is negative and strongly significant and exceeds -0.8 percentage points.

In Panel B, we compare the control group from Table 2 with another specific group. This group comprises firms with above median *ind_treat_ratio*, but below median *loc_treat_ratio*. Stated differently, the EU customer firms in this group have many suppliers in CBAM-treated industries, but mostly from within the EU. This group is a subgroup of the industry treatment

[13] In contrast to the control group, we do not impose the stricter condition $loc\_treat\_ratio_i = 0$ here because this would reduce the number of firms in the treatment group considerably. The same holds true for Table 4 below.

Figure 2: **Location treatment effects**

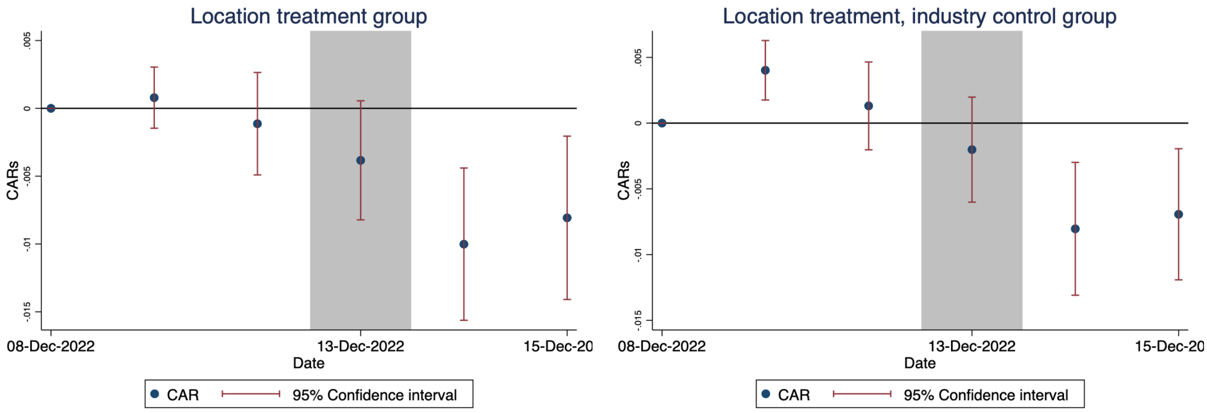

Figure 2 depicts the average CARs for different location treatment groups over the 5-day event window around December 13, 2022. The treatment groups are the same as those in Table 3. CARs are calculated relative to CAPM expected returns. The vertical lines on each day indicate 95% confidence intervals based on robust standard errors.

group in Panel A. The treatment effect is again negative, significant, and economically large, exceeding -1 percentage point. Moreover, from Figure 3, we again take away that the bulk of this treatment effect is realized in a very narrow time window around the event.

Altogether, we view these results as evidence that the information on suppliers' industries also has a substantial negative impact on EU customer returns, irrespective of the location of these suppliers and whether they are actually subject to the CBAM. Again, complexity of customer-supplier relationships is a likely explanation for this partial treatment effect. Presumably, there may be a lot of uncertainties as to how many suppliers outside the EU a customer firm really has. If so, having suppliers in CBAM-treated industries (inside or outside the EU) may serve as a signal for investors that the respective EU customer is going to be hit by the CBAM regulation at least partially. Investors may then shy away from their stocks, leading to a negative cumulative abnormal return.

Finally, one has to keep in mind that, albeit below the median, the variable *loc_treat_ratio* is different from zero for most firms in the treatment group in Panel B of Table 4. I.e., most of these firms actually do have a small number of suppliers in treated industries outside the EU, so that they can indeed be regarded as partially treated. The same is true for the treatment group in Panel B of Table 3.

Table 4: **Partial treatment effect - industry**

Panel A: Only industry information

	(1) **Industry control group** $ind\_treat\_ratio_i <$ median	(2) **Industry treatment group** $ind\_treat\_ratio_i >$ median	(3) **Difference**
Mean	-0.0036	-0.0083***	-0.0046
SE	(0.0027)	(0.0020)	
p-value			(0.1133)
# Obs	716	426	

Panel B: Industry and location information

	(1) **Control group** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Industry treatment, location control group** $loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i >$ median	(3) **Difference**
Mean	0.0035	-0.0069***	-0.0104*
SE	(0.0036)	(0.0025)	
p-value			(0.0088)
# Obs	117	217	

Table 4 reports the average CARs for further groups of EU customer firms for the five-day event window around December 13, 2022. The industry treatment group and industry control group in Panel A result from a median split of our entire sample for the variable *ind_treat_ratio*. The treatment group in Panel B comprises customers with below median *loc_treat_ratio* and above median *ind_treat_ratio*. It is a subgroup of the industry treatment group in Panel A. The CAR of the control group in Panel B has been reported in Table 2. Robust standard errors or p-values are reported in parentheses. CARs are calculated relative to CAPM expected returns. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. For the differences in the last column, the stars refer to a one-sided t-test of the null hypothesis of the mean difference being positive or zero.

Figure 3: **Industry treatment effects**

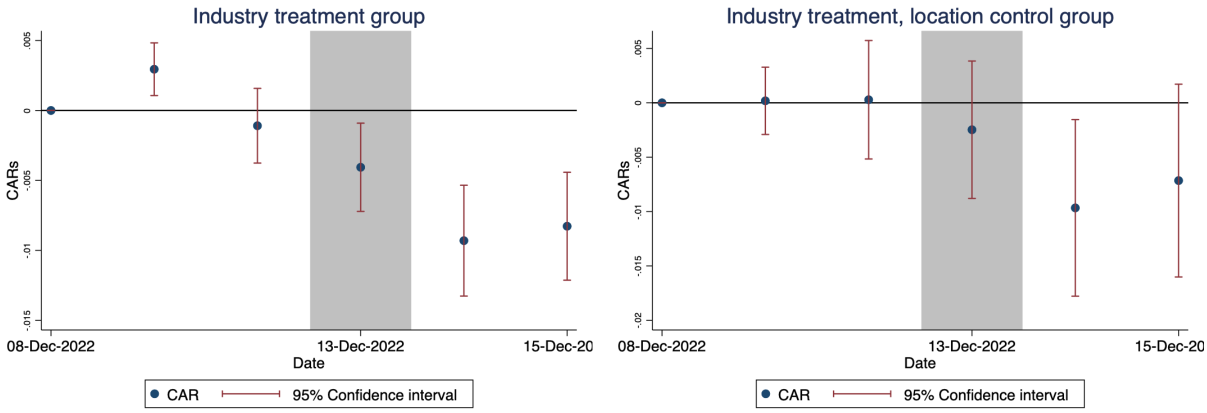

Figure 3 depicts the average CARs for different industry treatment groups over the 5-day event window around December 13, 2022. The treatment groups are the same as those in Table 4. CARs are calculated relative to CAPM expected returns. The vertical lines on each day indicate 95% confidence intervals based on robust standard errors.

Taken together, the fact that we find significant partial treatment effects emphasizes that both the industry and the location information play an essential role. The two pillars of the CBAM treatment are both economically important, also on a standalone basis.

4.3 Cumulative abnormal returns of suppliers

In our baseline specification above, we analyze the stock returns of customer firms inside the EU only. Obviously, supplier firms both inside and outside the EU are affected by the CBAM regulation as well. Unfortunately, we have only limited data available to derive robust results for the cumulative abnormal returns of suppliers. There are several reasons for this. First, many supplier firms in our customer-supplier relationship data are small and not publicly listed. Second, we are dealing with a very heterogeneous international sample of firms, which complicates the computation of cumulative abnormal returns relative to the CAPM. We use MSCI country-level equity indices as proxies for the market factor, acknowledging that there remains a lot of noises in the abnormal returns. Third, the international sample of firms which have customer-supplier relationships reported in our data is rather small and cannot be regarded as representative for the worldwide set of publicly listed firms. In particular the cumulative abnormal returns of what we label as control group have to be taken with a grain of salt.

Despite the caveats concerning data quality indicated above, we essentially follow the

Table 5: **Cumulative abnormal returns of non EU suppliers**

	(1) **Control group**	(2) **Industry treatment, location control group**	(3) **Location treatment, industry control group**	(4) **Treatment group**	(5) **Difference (2) − (1)**	(6) **Difference (3) − (1)**	(7) **Difference (4) − (1)**
	$EU\_customer\_ratio_j = 0$ $ind\_cbam_j = 0$	$EU\_customer\_ratio_j = 0$ $ind\_cbam_j > 0$	$EU\_customer\_ratio_j > 0$ $ind\_cbam_j = 0$	$EU\_customer\_ratio_j > 0$ $ind\_cbam_j > 0$			
Mean CAR	-0.0602***	-0.0553***	-0.0567***	-0.0802***	0.0049	0.0035	-0.0200
SE	(0.0204)	(0.0160)	(0.0117)	(0.0150)			
p-value					(0.4773)	(0.4451)	(0.4027)
# Obs	836	47	662	53			

Table 5 reports the average CARs for each group of supplier firms outside the EU for the five-day event window around December 13, 2022, as well as differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is explained in Section 4.3. Robust standard errors or p-values are reported in parentheses. For the CAR of each group, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. For the CAR differences, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

same event study procedure as in the previous section. In the final dataset, we have identified 1,598 publicly listed suppliers which are located outside the EU. We construct the variable *EU_customer_ratio*, defined as the number of EU customers divided by the total number of customers for each supplier:

$$EU\_customer\_ratio_j = \frac{\#\ EU\ customers\ of\ supplier\ j}{\#\ customers\ of\ supplier\ j}.$$

As in the baseline specification, we define an industry as CBAM-affected if at least one type of goods produced by this industry (according to the industry-goods linking table) falls under the CBAM. The dummy variable ind_cbam_j equals 1 if supplier j belongs to at least one affected industry (according to its primary and non-primary SIC codes) and 0 otherwise.

We again categorize firms into several groups. The group labeled as "control group" in the following consists of all supplier firms that operate in industries that are not subject to the CBAM ($ind\_cbam = 0$) and have no customers in the EU ($EU\_customer\_ratio = 0$). Furthermore, we have three different treatment groups. "Location treatment, industry control" refers to firms which have nonzero *EU_customer_ratio*, but do not operate in CBAM-affected industries ($ind\_cbam = 0$). The group "Industry treatment, location control" refers to firms without EU customers, but belong to CBAM-affected industries ($ind\_cbam = 1$). Finally, the "treatment group" comprises all firms which have EU customers and belong to CBAM-affected industries ($ind\_cbam = 1$).[14]

The results for the cumulative abnormal returns of supplier firms outside the EU are presented in Table 5.[15] In line with the results for customer firms, the treatment group has the most negative cumulative abnormal return. The difference between the treatment and the control group amounts to -2 percentage points and is thus even larger than the treatment effect that we have measured for customer firms in Section 4.1. Unfortunately, because of the large noise in the data, the difference is statistically insignificant. But, as we show in robustness checks in Section 5.5 later on, playing around with the exact definition of treatment and control groups, one can also get significant negative treatment effects for suppliers. Moreover, because of the data limitations outlined above, the control group has a large negative and significant CAR as well, reflecting the fact that our control group is not representative for the worldwide universe of publicly listed firms. Still, altogether, we view these results as roughly confirming the results

[14]The median of *EU_customer_ratio* equals zero, rendering a median split like in the previous section infeasible. In a robustness check also reported below, we split the sample into control and treatment groups along the 70% of the cross-sectional distribution of the *EU_customer_ratio*, i.e. we compare firms below the 70% quantile and firms above the 70% quantile.

[15]The complete results of non EU suppliers are documented in Table A.2 in Appendix A.

for customers presented in the previous section, but take them with a grain of salt.

4.4 Further event dates

For completeness, we report cumulative abnormal returns for EU customer firms for a set of further events outlined in Section 2. These events are unfortunately characterized by news about several different EU climate policies being announced jointly on one day, making causal identification impossible at first glance. But we can still gain some insights from the following results. Specifically, none of the other policy measures of the "Fit for 55 package" that were negotiated in parallel with the CBAM, like a reform of the EU ETS, are directly related to international trade. We can thus still meaningfully compare different treatment groups with each other. It is rather the firms in the control group that are affected by several policy measures at the same time. For this reason, we try not to overinterpret any numbers for the control group in the following.

The event study is designed exactly as in the baseline specification. We study three additional dates. On July 14, 2021, the EU Commission presented the initial proposal for the CBAM, along with proposals for several other climate policy measures subsumed under the "Fit for 55 package". Around this date, we have 278,145 active customer-supplier relations, and we end up with 1,140 EU customers after merging with the various other databases. On February 09, 2023, the Parliamentary Committee of the Environment, Health, and Food Safety adopted the final Trilogue agreement. There we have 332,037 active customer-supplier relations and end up with 1,130 EU customers. On April 18, 2023, the EU Parliament finally adopted the CBAM regulation. For this event, we have 568,926 active customer-supplier relations and 1,120 EU customers.[16]

Table 6 presents the results for all three dates. For the sake of readability, we report only the numbers for the total treatment, the complete set of results can be found in Table A.3 in Appendix A. Several observations can be made. First of all, there is no treatment effect at all on February 09, 2023. We view this as evidence that all relevant news related to the Trilogue agreement have been priced in since the press release on December 13, 2022. The publication of the full text of the regulation two months later does not trigger any stock price reaction.

Second, both the release of the first proposal by the EU Commission on July 14, 2021,

[16]As discussed in Section 2, the list of goods that are subject to the CBAM varies across the event dates. For instance, the initial list that comes with the proposal on July 14, 2021, comprises fewer goods than the final CBAM regulation on April 18, 2023. We therefore use different lists of goods, exactly as published on the respective event dates, throughout this section.

Table 6: **Average CARs on other event dates**

Event date		(1) **Control group** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Treatment group** $loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	(3) **Difference (2) − (1)**
July 14, 2021	Mean	0.0024	-0.0116	-0.0140
	SE	(0.0050)	(0.0091)	
	p-value			(0.1047)
	# Obs	151	191	
Feb 9, 2023	Mean	0.0011	-0.0035	-0.0046
	SE	(0.0040)	(0.0043)	
	p-value			(0.2429)
	# Obs	112	216	
April 18, 2023	Mean	0.0007	-0.0175	-0.0182
	SE	(0.0049)	(0.0186)	
	p-value			(0.2620)
	# Obs	118	247	

Table 6 reports the average CARs for each group of EU customer firms for five-day event windows around a few other event dates. CARs are calculated relative to CAPM expected returns. The control and treatment groups are defined in the same way as in Tables 2. Robust standard errors or p-values are reported in parentheses. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the third column, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

and the final decision by the EU Parliament on April 18, 2023, trigger large (but insignificant) stock price reactions. We avoid to interpret the numbers for the control group because of the simultaneity of several policy announcements. But this concern does not apply to the location treatment in isolation. In fact, the complete set of results in the appendix suggests that the partial treatments (both location and industry) also give rise to large negative (but insignificant) stock returns of up to -0.8 percentage points around July 14, 2021. For April 18, 2023, the respective treatment effects are even larger (up to -2.4 percentage points).

Taken together, these numbers give a very rough indication of the economic significance of the CBAM for financial markets. Of course, adding up the treatment effects around all the different dates is statistically infeasible. For one, they are derived from very different samples. For another, we cannot control for other, potentially positive or zero news reaching the market in between the events. Still, from our reading of the sequence of legislative documents published by the EU decision-making bodies over the course of two years, there was not much contrarian positive or zero news along the negotiation process of the CBAM which could have reversed the negative treatment effects that we find. Specifically, the opinions of both the European Parliament and the Council of the European Union can be regarded as stricter than the initial proposal by the EU Commission, and so was the final outcome of the Trilogue. The (hypothetical, back-of-the-envelope) combined treatment effect for EU customers across the three major event dates (July 14, 2023, December 13, 2022, and April 18, 2023) amounts to more than 4 percentage points. On top, the analysis of supplier firms in Section 4.3 suggests that the treatment effects for suppliers outside the EU could be (at least) about equally large. Against the background of economic debates about "stranded assets" resulting from the tightening of climate policies, these numbers are remarkable.

5 Robustness

We close the paper with a series of robustness checks concerning choices that we made for our baseline specification. For the sake of readability, we only report a small selection of the cumulative abnormal returns in the main text. The complete set of results can be found in Tables A.4 to A.7 in Appendix A.

5.1 Longer event window

Table 7 reports cumulative abnormal returns around December 13, 2022, when we extend the event window to 10 days, ranging from December 08 to December 20. Over this longer event window, the cumulative abnormal return of the treatment group is much more negative than in the baseline exercise, exceeding -2.7 percentage points. However, the control group also exhibits a strongly negative (but insignificant) return. As a result, the treatment effect is insignificant and smaller than in the baseline setting. Notably, when we compare the treatment group to the generalized control group as defined in Table 2 (results not shown here for brevity), the treatment effect turns out to be significant again and exceeds -1 percentage point.

Table 7: **10 day event window**

	(1) **Control group** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Treatment group** $loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	(3) **Difference (2) − (1)**
Mean	-0.0215	-0.0271***	-0.0056
SE	(0.0118)	(0.0054)	
p-value			(0.3119)
# Obs	117	209	

Table 7 reports the average CARs for each group of EU customer firms for the 10-day event window around December 13, 2022. The composition of the different treatment groups is the same as in Tables2. Robust standard errors or p-values are reported in parentheses. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the third column, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

Taken together, we view this as evidence that our findings are, by and large, robust to extending the event window. But, as expected, the returns become noisier because it is more likely that some other important news is released during this longer event window, making it harder to identify a clear treatment effect. A notable example for such news is the Trilogue agreement about a reform of the EU ETS (another part of the "Fit for 55" package) that was reached on December 18, 2022. Constraining the event window to five days guarantees that our results are not biased by such conflicting policy events.

5.2 Alternative specifications of treatment and control groups

Table 8 reports cumulative abnormal returns around December 13, 2022, when we slightly change the specification of treatment and control groups. Instead of median splits for the two treatment variables $loc\_treat\_ratio_i$ and $ind\_treat\_ratio_i$, we now split the sample at the 70% quantile or at the 30% quantile of the respective cross-sectional distributions.

Table 8: **Alternative specifications of treatment and control groups**

		(1) **Control group** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Treatment group** $loc\_treat\_ratio_i >$ x% quantile $ind\_treat\_ratio_i >$ x% quantile	(3) **Difference (2) − (1)**
70% quantile	Mean	0.0035	-0.0055	-0.0090*
split	SE	(0.0036)	(0.0061)	
	p-value			(0.0899)
	# Obs	117	80	
30% quantile	Mean	0.0035	-0.0084**	-0.0119***
split	SE	(0.0036)	(0.0023)	
	p-value			(0.0035)
	# Obs	117	306	

Table 8 reports the average CARs for each group of EU customer firms for the five-day event window around December 13, 2022. The composition of groups is similar as in Tables 2, but the different treatment groups are based on 70% or 30% quantile splits, respectively. Robust standard errors or p-values are reported in parentheses. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the third column, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

The average cumulative abnormal returns of the different groups are hardly affected by these choices. We mainly see changes in the p-values for the CAR differences for some of the partial treatments (not reported here for brevity). Qualitatively, our results are very robust.

5.3 Customer-supplier relationships ending prior to the event date

One may be concerned that the information about the start and end date of a customer-supplier relationship which firms disclose in official declarations and which is then incorporated into the FactSet database is not equal to the true beginning or end of the relation between these firms. Relations may, e.g., be paused and resumed later on, or it may take some time to negotiate contracts and build up a new relationship.

Table 9: **Relationships ending prior to event date**

		(1) **Control group** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Treatment group** $loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	(3) **Difference (2) − (1)**
1 month	Mean	0.0034	-0.0099***	-0.0133***
	SE	(0.0036)	(0.0030)	
	p-value			(0.0031)
	# Obs	118	213	
2 months	Mean	0.0039	-0.0097***	-0.0135***
	SE	(0.0035)	(0.0021)	
	p-value			(0.0025)
	# Obs	117	220	
3 months	Mean	0.0053	-0.0091***	-0.0144***
	SE	(0.0035)	(0.0029)	
	p-value			(0.0012)
	# Obs	119	221	

Table 9 reports the average CARs for each group of EU customer firms for the five-day event window around December 13, 2022. The composition of groups is similar as in Tables 2, but we allow the customer-supplier relationships to end 1, 2, 3 months before the event date. Robust standard errors or p-values are reported in parentheses. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the third column, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

We therefore run robustness checks where we also include customer-supplier relationships that have officially been terminated 1, 2, or 3 months prior to our main event date. This increases our sample size only very slightly to 1,148, 1,157, or 1,167 EU customer firms, respectively. Table 9 reports the cumulative abnormal returns. They are practically identical to those in the baseline specification.

5.4 Fama-French three-factor and five-factor model

The one-factor Capital Asset Pricing Model is arguably a very rough model when it comes to computing abnormal returns for a cross-section of stocks. For robustness, we estimate our baseline specification using the Fama-French three-factor or five-factor model instead. For our sample of EU customer firms, we use the European Fama-French factors that are available on Kenneth French's webpage, although these factors also contain information from stocks traded in some non-EU countries like the UK.

Table 10: **Average CARs with respect to FF3 and FF5 factors**

		(1) **Control group** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Treatment group** $loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	(3) **Difference** **(2) − (1)**
FF3	Mean	-0.0002	-0.0109***	-0.0108**
	SE	(0.0035)	(0.0037)	
	p-value			(0.0277)
	# Obs	117	209	
FF5	Mean	-0.0006	-0.0119***	-0.0113**
	SE	(0.0036)	(0.0033)	
	p-value			(0.0151)
	# Obs	117	209	

Table 10 reports the average CARs with respect to the Fama-French three-factor and five-factor models for each group of EU customer firms for the five-day event window around December 13, 2022. The composition of the different treatment groups is the same as in Tables2. Robust standard errors or p-values are reported in parentheses. In the first two columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the third column, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

The results are presented in Table 10. Qualitatively, our results remain unchanged. In fact, the average cumulative abnormal return of the treatment group is now slightly more negative, the CAR of the control group is now virtually zero, and the total net treatment effect is about the same size as in baseline specification.

5.5 70% split for supplier firms

Finally, we present results from a robustness check regarding the analysis of the returns of supplier firms in Section 4.3. There, we sorted firms with $EU\_customer\_ratio_j = 0$ into the control or industry treatment group and firms with $EU\_customer\_ratio_j > 0$ into the treatment or location treatment group.

In fact, more than 50% of our sample have $EU\_customer\_ratio_j = 0$. For robustness, Table 11 presents results when we split the sample along the 70% quantile of $EU\_customer\_ratio_j$.[17] Compared to Table 5, we find that the treatment effects are much larger in size. Interestingly, the difference between treatment group (fourth column) and the "industry treatment, location control" group (second column) is now strongly significant. This difference proxies for the incremental effect of the location treatment: we compare supplier firms in treated industries that have many versus only few customers within the EU. Overall, the results thus support the key takeaways from Section 4.3 that the financial performance of supplier firms is affected by the CBAM regulation as well and that the magnitude of the effect is comparable, if not larger than for EU customer firms.

6 Conclusion

In order to address the carbon leakage problem, the EU decided to complement the EU Emissions Trading System with a companion policy instrument – the EU Carbon Border Adjustment Mechanism (CBAM) – in 2023. The CBAM is the world's first carbon border tax and, ideally, levels the playing field for production inside and outside the EU in terms of carbon pricing.

This paper analyzes the stock price response of firms involved in international trade to the introduction of the CBAM in a causal event study around important legislative events. Quantitatively, our paper documents that the stock price responses of both suppliers and customers caused by the CBAM regulation are substantial, at the minimum -1 percent on average per event, depending on the exact specification of treatment and control group. Both the suppliers' locations and their industries are key determinants of the various treatment effects. Importantly,

[17] The full set of results is documented in Table A.2 in Appendix A

Table 11: **Cumulative abnormal returns of non EU suppliers (70% split)**

	(1) **Control group**	(2) **Industry treatment, location control group**	(3) **Location treatment, industry control group**	(4) **Treatment group**	(5) **Difference (4) − (1)**	(6) **Difference (4) − (2)**
	$EU\_customer\_ratio_j < 70\%$ quantile $ind\_cbam_j = 0$	$EU\_customer\_ratio_j < 70\%$ quantile $ind\_cbam_j > 0$	$EU\_customer\_ratio_j > 70\%$ quantile $ind\_cbam_j = 0$	$EU\_customer\_ratio_j > 70\%$ quantile $ind\_cbam_j > 0$		
Mean	-0.0597***	-0.0518***	-0.0559***	-0.0968***	-0.0371	-0.0450**
SE	(0.0162)	(0.0133)	(0.0171)	(0.0183)		
p-value					(0.3348)	(0.0234)
# Obs	1,059	63	439	37		

Table 11 reports the average CARs for each group of supplier firms outside the EU for the five-day event window around December 13, 2022. CARs are calculated relative to CAPM expected returns. The different treatment groups are composed as explained in Section 4.3, with the exception that the split between treatment and control groups is done at the 70% quantile of the *EU_customer_ratio*. Robust standard errors or p-values are reported in parentheses. In the first four columns, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In the last two columns, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

given the peculiarities of the empirical setup, the estimates presented in this paper should rather be regarded as a lower bound for the (unknown) total effect.

Our paper has several implications for policymakers. For instance, on a broader level, we provide evidence that EU climate policy which targets supplier firms outside the EU has spillover effects for customer firms located inside the EU. These spillover effects are also economically significant on aggregate, given that the EU accounts for 14% of the world's trade in goods. Moreover, our findings for the CBAM stand in contrast to recent literature which documents that the EU ETS has had no measurable negative impact on the economic performance of regulated firms inside the EU.

Substitution elasticities within industries and product market competition might play an important role for these spillover effects. How the costs from the CBAM are shared ultimately depends on the relative market power of customers and suppliers. This market power, in turn, is determined by many factors, including the scarcity of the respective goods, the opportunity costs for replacing an existing customer-supplier relationship, as well as further regulations and policies, like changes in the EU ETS that are implemented in parallel with the CBAM. Given the limitations of our current dataset, we leave these issues open for future research.

Our paper also informs the broader debate about "stranded assets" resulting from the tightening of climate policies. Our empirical design does not allow us to disentangle whether the negative abnormal stock returns arise from a change in firms' expected cash flows or a change in their discount rates. One can make a case for both hypotheses. On the one hand, the financial burden from the CBAM will reduce the earnings of treated firms and thus affects expected cash flows. On the other hand, it can also increase the default probability of certain suppliers or customers whose business prospects rely heavily on the possibility of carbon leakage. If equity investors anticipate this default risk correctly, the cost of capital (a.k.a. discount rates) will increase, triggering negative announcement returns, just as we document them in our data.

Looking ahead, it seems plausible that other countries will follow the EU example – as it was also the case with the EU ETS back in 2005 – and also introduce carbon border taxes. Alternatively, but partly also as a response to the CBAM, a number of countries have joined the new climate club, which was founded by the G7 in 2022. In one or the other way, the EU CBAM has helped pave the way towards a globally harmonized carbon pricing system. In this regard, our results inform the respective political debates with quantitative evidence about the impact of climate policies on financial market expectations.

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A Complete results

Table A.1: **CARs and CAR differences for the baseline exercise**

Panel A: Average CARs for each group

	(1) **Control**	(2) **Generalized Control**	(3) **Industry Treatment Location Control**	(4) **Location Treatment Industry Control**	(5) **Treatment**	(6) **Industry Control**	(7) **Industry Treatment**	(8) **Location Control**	(9) **Location Treatment**
	$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	$ind\_treat\_ratio_i <$ median	$ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median
Mean	0.0035	0.0000	-0.0069***	-0.0072	-0.0097***	-0.0036	-0.0083***	-0.0027	-0.0081***
SE	(0.0036)	(0.0030)	(0.0025)	(0.0045)	(0.0030)	(0.0027)	(0.0020)	(0.0021)	(0.0031)
# Obs	117	354	217	362	209	716	426	571	571

Panel B: Differences between groups

	(5)-(3)	(3)-(1)	(5)-(4)	(4)-(1)	(5)-(1)	(5)-(2)	(7)-(6)	(9)-(8)
Mean	-0.0027	-0.0104***	-0.0025	-0.0106*	-0.0131***	-0.0096**	-0.0046	-0.0054*
p-value	(0.2444)	(0.0088)	(0.3469)	(0.0982)	(0.0036)	(0.0164)	(0.1133)	(0.0724)

Panel A in Table A.1 reports the average CARs for each group of EU customer firms for the five-day event window around December 13, 2022. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 2, 3 and 4. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** $p<0.01$, ** $p<0.05$, * $p<0.1$) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero, respectively.

Table A.2: **CARs and CAR differences for non EU suppliers**

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Average CARs for each group									
		Control	**Industry Treatment Location Control**	**Location Treatment Industry Control**	**Treatment**	**Industry Control**	**Industry Treatment**	**Location Control**	**Location Treatment**
		$EU\_customer\_ratio_j = 0$ $ind\_cbam_j = 0$	$EU\_customer\_ratio_j = 0$ $ind\_cbam_j = 1$	$EU\_customer\_ratio_j = 1$ $ind\_cbam_j = 0$	$EU\_customer\_ratio_j = 1$ $ind\_cbam_j = 1$	$ind\_cbam_j = 0$	$ind\_cbam_j = 0$	$EU\_customer\_ratio_j = 0$	$EU\_customer\_ratio_j = 1$
Zero split	Mean	-0.0602***	-0.0553***	-0.0567***	-0.0802***	-0.0586***	-0.0685***	-0.0599***	-0.0584***
	SE	(0.0204)	(0.0160)	(0.0117)	(0.0150)	(0.0125)	(0.0110)	(0.0194)	(0.0109)
	# Obs	836	47	662	53	1498	100	883	715
		Control	**Industry Treatment Location Control**	**Location Treatment Industry Control**	**Treatment**	**Industry Control**	**Industry Treatment**	**Location Control**	**Location Treatment**
		$EU\_customer\_ratio_j < 70\%$ quantile $ind\_cbam_j = 0$	$EU\_customer\_ratio_j < 70\%$ quantile $ind\_cbam_j = 1$	$EU\_customer\_ratio_j > 70\%$ quantile $ind\_cbam_j = 0$	$EU\_customer\_ratio_j > 70\%$ quantile $ind\_cbam_j = 1$	$ind\_cbam_j = 0$	$ind\_cbam_j = 0$	$EU\_customer\_ratio_j < 70\%$ quantile	$EU\_customer\_ratio_j > 70\%$ quantile
70 % quantile split	Mean	-0.0597***	-0.0518***	-0.0559***	-0.0968***	-0.0586***	-0.0685***	-0.0593***	-0.0591***
	SE	(0.0162)	(0.0133)	(0.0171)	(0.0183)	(0.0125)	(0.0110)	(0.0153)	(0.0159)
	# Obs	1059	63	439	37	1498	100	1122	476

Panel B: Differences between groups

		(2)-(1)	(4)-(3)	(3)-(1)	(4)-(2)	(4)-(1)	(6)-(5)	(8)-(7)
Zero split	Mean	0.0049	-0.0235	0.0035	-0.0249	-0.0200	-0.0098	0.0015
	p-value	(0.4773)	(0.2859)	(0.4451)	(0.1291)	(0.4027)	(0.4196)	(0.4751)
70% quantile split	Mean	0.0079	-0.0409	0.0038	-0.0450**	-0.0371	-0.0098	0.0002
	p-value	(0.4527)	(0.2455)	(0.4447)	(0.0234)	(0.3348)	(0.4196)	(0.4968)

Panel A in Table A.2 reports the average CARs for each group of non EU supplier firms for the five-day event window around December 13, 2022. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 5 and 11. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

Table A.3: **CARs and CAR differences on the other event dates**

Panel A: Average CARs for each group

Event Dates		(1) **Control** $loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	(2) **Generalized Control** $loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i <$ median	(3) **Industry Treatment Location Control** $loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i >$ median	(4) **Location Treatment Industry Control** $loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i <$ median	(5) **Treatment** $loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	(6) **Industry Control** $ind\_treat\_ratio_i <$ median	(7) **Industry Treatment** $ind\_treat\_ratio_i >$ median	(8) **Location Control** $loc\_treat\_ratio_i <$ median	(9) **Location Treatment** $loc\_treat\_ratio_i >$ median
July 14, 2021	Mean	0.0024	-0.0042	-0.0035	-0.0036	-0.0116	-0.0039	-0.0078	-0.0040	-0.0063*
	SE	(0.0050)	(0.0050)	(0.0030)	(0.0028)	(0.0091)	(0.0029)	(0.0050)	(0.0036)	(0.0036)
	# Obs	151	401	169	379	191	780	360	570	570
Feb 9, 2023	Mean	0.0011	0.0006	0.0008	-0.0019	-0.0035	-0.0006	-0.0014	0.0007	-0.0025
	SE	(0.0040)	(0.0032)	(0.0035)	(0.0041)	(0.0043)	(0.0026)	(0.0028)	(0.0024)	(0.0030)
	# Obs	112	343	212	359	216	702	428	555	575
April 18, 2023	Mean	0.0007	0.0018	0.0065	-0.0144	-0.0175	-0.0061	-0.0065	0.0034	-0.0156
	SE	(0.0049)	(0.0044)	(0.0042)	(0.0133)	(0.0186)	(0.0068)	(0.0103)	(0.0032)	(0.0109)
	# Obs	118	395	208	370	247	765	455	603	617

Panel B: Differences between groups

		(5)-(3)	(3)-(1)	(5)-(4)	(4)-(1)	(5)-(1)	(5)-(2)	(7)-(6)	(9)-(8)
July 14, 2021	Mean	-0.0082	-0.0061	-0.0080	-0.0059	-0.0140	-0.0074	-0.0039	-0.0023
	p-value	(0.2099)	(0.1315)	(0.1457)	(0.1510)	(0.1047)	(0.2207)	(0.2410)	0.3243
Feb 9, 2023	Mean	-0.0043	-0.0003	-0.0016	-0.0029	-0.0046	-0.0042	-0.0007	-0.0032
	p-value	(0.2177)	(0.4823)	(0.3961)	(0.3503)	(0.2429)	(0.2148)	(0.4274)	(0.2036)
April 18, 2023	Mean	-0.0240	0.0058	-0.0031	-0.0151	-0.0182	-0.0193	-0.0005	-0.0190**
	p-value	(0.1223)	(0.1941)	(0.4439)	(0.2620)	(0.2509)	(0.1098)	(0.4834)	(0.0484)

Panel A in Table A.1 reports the average CARs for each group of EU customer firms for the five-day event window around the other event dates. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 6. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

Table A.4: **CARs and CAR differences for ten-day event window**

Panel A: Average CARs for each group

	(1) **Control**	(2) **Generalized Control**	(3) **Industry Treatment Location Control**	(4) **Location Treatment Industry Control**	(5) **Treatment**	(6) **Industry Control**	(7) **Industry Treatment**	(8) **Location Control**	(9) **Location Treatment**
	$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	$ind\_treat\_ratio_i <$ median	$ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median
Mean	-0.0215*	-0.0145***	-0.0091*	-0.0242***	-0.0271***	-0.0194***	-0.0179***	-0.0124***	-0.0252***
SE	(0.0118)	(0.0052)	(0.0048)	(0.0061)	(0.0054)	(0.0040)	(0.0036)	(0.0037)	(0.0043)
# Obs	117	354	217	362	209	716	426	571	571

Panel B: Differences between groups

	(5)-(3)	(3)-(1)	(5)-(4)	(4)-(1)	(5)-(1)	(5)-(2)	(7)-(6)	(9)-(8)
Mean	-0.0180***	0.0125	-0.0029	-0.0027	-0.0056	-0.0125*	0.0015	-0.0128**
p-value	(0.0065)	(0.1263)	(0.3725)	(0.4168)	(0.3119)	(0.0577)	(0.5989)	(0.0127)

Panel A in Table A.4 reports the average CARs for each group of EU customer firms for the ten-day event window around December 13, 2022. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 7. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or negative, repectively.

Table A.5: **CARs and CAR differences using alternative specification of treatment and control**

		Panel A: Average CARs for each group								
		(1) **Control**	(2) **Generalized Control**	(3) **Industry Treatment Location Control**	(4) **Location Treatment Industry Control**	(5) **Treatment**	(6) **Industry Control**	(7) **Industry Treatment**	(8) **Location Control**	(9) **Location Treatment**
		$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i <$ x% quantile $ind\_treat\_ratio_i <$ x% quantile	$loc\_treat\_ratio_i <$ x% quantile $ind\_treat\_ratio_i >$ x% quantile	$loc\_treat\_ratio_i >$ x% quantile $ind\_treat\_ratio_i <$ x% quantile	$loc\_treat\_ratio_i >$ x% quantile $ind\_treat\_ratio_i >$ x% quantile	$ind\_treat\_ratio_i <$ x% quantile	$ind\_treat\_ratio_i >$ x% quantile	$loc\_treat\_ratio_i <$ x% quantile	$loc\_treat\_ratio_i >$ x% quantile
70% quantile	Mean	0.0035	-0.0039	-0.0077***	-0.0062	-0.0055	-0.0046*	-0.0072***	-0.0051***	-0.0060
split	SE	(0.0036)	(0.0027)	(0.0022)	(0.0050)	(0.0061)	(0.0025)	(0.0022)	(0.0020)	(0.0041)
	# Obs	117	546	254	262	80	808	334	800	342
30% quantile	Mean	0.0035	0.0027	-0.0080**	-0.0066***	-0.0084***	-0.0036	-0.0083***	-0.0010	-0.0073***
split	SE	(0.0036)	(0.0039)	(0.0037)	(0.0036)	(0.0023)	(0.0027)	(0.0020)	(0.0028)	(0.0024)
	# Obs	117	228	120	488	306	716	426	348	794

		Panel B: Differences between groups							
		(5)-(3)	(3)-(1)	(5)-(4)	(4)-(1)	(5)-(1)	(5)-(2)	(7)-(6)	(9)-(8)
70% quantile	Mean	0.0023	-0.0112***	0.0007	-0.0097	-0.0090*	-0.0016	-0.0026	-0.0009
split	p-value	(0.3325)	(0.0032)	(0.4713)	(0.1097)	(0.0899)	(0.4148)	(0.2630)	(0.4101)
30% quantile	Mean	-0.0004	-0.0115**	-0.0018	-0.0101*	-0.0119***	-0.0111***	-0.0046	-0.0063*
split	p-value	(0.4619)	(0.0141)	(0.3539)	(0.0892)	(0.0035)	(0.0050)	(0.1133)	(0.0599)

Panel A in Table A.5 reports the average CARs for each group of EU customer firms for the five-day event window around the other event dates. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 8. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

Table A.6: **CARs and CAR differences allowing for customer-supplier relationships ending before event dates**

Panel A: Average CARs for each group

		(1) **Control**	(2) **Generalized Control**	(3) **Industry Treatment Location Control**	(4) **Location Treatment Industry Control**	(5) **Treatment**	(6) **Industry Control**	(7) **Industry Treatment**	(8) **Location Control**	(9) **Location Treatment**
		$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	$ind\_treat\_ratio_i <$ median	$ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median
1 month	Mean	0.0034	-0.0002	-0.0069***	-0.0085*	-0.0099***	-0.0044	-0.0084***	-0.0027	-0.0091***
	SE	(0.0036)	(0.0029)	(0.0025)	(0.0047)	(0.0030)	(0.0028)	(0.0020)	0.0021	0.0031
	# Obs	118	358	216	361	213	719	429	574	574
2 month	Mean	0.0039	-0.0009	-0.0070***	-0.0075	-0.0097***	-0.0043	-0.0083***	-0.0032	-0.0083***
	SE	(0.0035)	(0.0029)	(0.0026)	(0.0046)	(0.0021)	0.0028	0.0019	0.0020	0.0031
	# Obs	117	348	214	375	220	723	434	562	595
3 month	Mean	0.0053	-0.0005	-0.0059	-0.0047	-0.0091***	-0.0027	-0.0076***	-0.0026	-0.0063*
	SE	(0.0035)	(0.0029)	(0.0029)	(0.0053)	(0.0029)	(0.0031)	(0.0021)	(0.0021)	(0.0035)
	# Obs	119	351	218	377	221	728	439	569	598

Panel B: Differences between groups

		(5)-(3)	(3)-(1)	(5)-(4)	(4)-(1)	(5)-(1)	(5)-(2)	(7)-(6)	(9)-(8)
1 month	Mean	-0.0030	-0.0103***	-0.0014	-0.0119*	-0.0133***	-0.0097**	-0.0041	-0.0063**
	p-value	(0.2233)	(0.0090)	(0.4144)	(0.0789)	(0.0031)	(0.0145)	(0.1487)	(0.0465)
2 month	Mean	-0.0027	-0.0108***	-0.0021	-0.0114*	-0.0135***	-0.0088*	-0.0040	-0.0051*
	p-value	(0.2458)	(0.0066)	(0.3699)	(0.0881)	(0.0025)	(0.0217)	(0.1503)	(0.0854)
3 month	Mean	-0.0032	-0.0112***	-0.0044	-0.0100	-0.0144***	-0.0087**	-0.0049	-0.0038
	p-value	(0.2192)	(0.0095)	(0.2715)	(0.1515)	(0.0012)	(0.0223)	(0.1271)	(0.1822)

Panel A in Table A.6 reports the average CARs for each group of EU customer firms for the five-day event window around the other event dates. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 9. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** p<0.01, ** p<0.05, * p<0.1) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.

Table A.7: **CARs and CAR differences relative to Fama French 3 and 5 factors**

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Average CARs for each group										
		Control	**Generalized Control**	**Industry Treatment Location Control**	**Location Treatment Industry Control**	**Treatment**	**Industry Control**	**Industry Treatment**	**Location Control**	**Location Treatment**
		$loc\_treat\_ratio_i = 0$ $ind\_treat\_ratio_i = 0$	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i <$ median $ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median $ind\_treat\_ratio_i >$ median	$ind\_treat\_ratio_i <$ median	$ind\_treat\_ratio_i >$ median	$loc\_treat\_ratio_i <$ median	$loc\_treat\_ratio_i >$ median
FF3	Mean	-0.0002	-0.0033	-0.0092***	-0.0114***	-0.0109***	-0.0074***	-0.0101***	-0.0056***	-0.0112***
	SE	(0.0035)	(0.0029)	(0.0025)	(0.0045)	(0.0037)	(0.0027)	(0.0022)	(0.0020)	(0.0031)
	# Obs	117	354	217	362	209	716	426	571	571
FF5	Mean	-0.0006	-0.0041	-0.0094***	-0.0122***	-0.0119***	-0.0082***	-0.0106***	-0.0061***	-0.0121***
	SE	(0.0036)	(0.0028)	(0.0025)	(0.0045)	(0.0033)	(0.0027)	(0.0021)	(0.0020)	(0.0031)
Panel B: Differences between groups										
		(5)-(3)	(3)-(1)	(5)-(4)	(4)-(1)	(5)-(1)	(5)-(2)	(7)-(6)	(9)-(8)	
FF3	Mean	-0.0017	-0.0090**	0.0005	-0.0113*	-0.0108**	-0.0076*	-0.0026	-0.0057*	
	p-value	(0.3467)	(0.0179)	(0.4711)	(0.0824)	(0.0277)	(0.0531)	(0.2477)	(0.0639)	
FF5	Mean	-0.0025	-0.0088**	0.0003	-0.0116*	-0.0113**	-0.0078**	-0.0025	-0.0060*	
	p-value	(0.2762)	(0.0212)	(0.4823)	(0.0773)	(0.0151)	(0.0403)	(0.2574)	(0.0518)	

Panel A in Table A.7 reports the average CARs for each group of EU customer firms for the five-day event window around the other event dates. Panel B reports differences between them. CARs are calculated relative to CAPM expected returns. The composition of the different treatment groups is the same as in Table 10. Robust standard errors or p-values are reported in parentheses. In Panel A, stars indicating statistical significance (*** $p<0.01$, ** $p<0.05$, * $p<0.1$) refer to two-sided t-tests of the null hypothesis of the mean being equal to zero. In Panel B, they refer to one-sided t-tests of the null hypothesis of the mean difference being positive or zero.