Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

European power and the structure of regulatory upgrading

Scott Michael Hamilton

scott.hamilton@uantwerpen.be

University of Antwerp

Dirk De Bièvre

University of Antwerp

Article

Keywords:

Posted Date: November 17th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11564453/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

In light of the immense difficulty in achieving voluntary intergovernmental cooperation of all states, Nobel laureate William Nordhaus proposed to form a 'Climate Club' as a new architecture for international climate cooperation to counter free-riding behaviour of individual participating countries. To some extent, the European Union (EU) Carbon Border Adjustment Mechanism (CBAM) is an embodiment of such a club, as it is designed to maintain market access for cooperative partners while imposing punitive measures on detractors. In this paper, we investigate how CBAM affects support for climate policies in EU trade partners, balancing Nordhaus' focus on adaptation costs with a political economy approach that foregrounds political costs and bargaining power. We show that adaptation costs and 'loyalty' created by a lack of export alternatives have a strong influence on firm support. Bargaining power, meanwhile, affects the strength of the positions eventually taken by policymakers. When the EU relies upon trade partners for imports, they are more likely to try to leverage their position and gain concessions through negotiations or threats of retaliation. We test our argument by analyzing public debates through an automated text analysis of media in trade partner countries using large language models to identify affected actors and analyze their positions. Our study analyzes all newspaper articles in the Nexis Uni database mentioning CBAM since the European Commission released its official proposal in the 'fit for 55' package in July 2021. Our findings align with our expectations for both firm and policymakers, suggesting that success of CBAM and other policies which rely upon a club goods logic will depend on political factors as well as the cost-benefit factors identified by Nordhaus. While abatement costs are an important determinant of stakeholder positions, the political response from EU trade partners ultimately depend upon how costs are distributed, and the capacity of trade partners to bite back.

Introduction

States have been trying unsuccessfully to stop climate change through multilateral cooperation for several decades, unable to agree on how they would solve the problem, and for the most part failing to meet even their own individual targets. Nobel prize winner William Nordhaus advocates for a different institutional architecture to tackle such free-riding behavior, which he sees as inherent to the multilateral approach to climate policy (W. Nordhaus, 2015; W. D. Nordhaus, 2006, 2019). He argues that in order to ensure compliance, participating states need to be rewarded while non-cooperative states are subjected to enforceable sanctions. Rejecting the notion that all states need to be in agreement from the outset, he demonstrates how an 'effective small coalition' might be able to encourage climate change mitigation by turning access to their markets into a club good accessible only to states which incorporate carbon pricing into their national economies. As long as the members of this club would be sufficiently attractive to trade with, and as long as punishment for non-members would be sufficiently strong, the 'climate club' would achieve a centripetal effect and other states would rationally choose to pay the necessary abatement costs of joining the club.

The European Union's Carbon Border Adjustment Mechanism has been likened to a 'de facto climate club' because it attempts to use the incentive of market access combined with punitive tariffs to prevent carbon leakage, i.e. to stop high-polluting industry from shifting production abroad to avoid internal EU

environmental regulations, and promote decarbonisation in third countries. Since CBAM is different from the hypothetical models which Nordhaus analyzed, and since those were in any case computer models rather than experimental policies, we consider it an empirical question whether it induces a club good effect. To this end, we analyze the responses of political actors in EU trade partners to determine whether it forces trade partners to align, encourages them to negotiate a new agreement on market access, attracts diplomatic complaints, or triggers retaliatory action. Our analysis thus considers which constituencies in trade partners are most likely to react to the imposition of this carbon levy, and how their preferences are likely to impact upon the positions of policymakers.

The paper proceeds as follows. First, we outline the details of the free-rider problem which Nordhaus' model was intended to fix and explain the logic of club membership in relation to abatement costs, benefits of cooperation and penalties imposed on non-participants. We then present the EU's CBAM and explain how it addresses these central features. In section 2, we derive our expectations using the framework of Exit, Voice and Loyalty (Hirschman, 1970), balancing the economic expectations from the literature on regulatory upgrading, also called the California or Brussels effect (Bradford, 2020; Vogel, 1995), with political expectations based on the influence of trade dependence on bargaining power (Hirschman, 1945/1980). As the cost of either implementing or not implementing carbon border adjustment measures increases, and as these costs are concentrated within sectors, economic actors from CBAM industries are expected to put increasing pressure on policymakers to align with CBAM, seek out other markets, complain about it, or outright retaliate against it with trade sanctions of their own. As the bargaining power of trade partners increases, policymakers in trade partners are expected to advance the preferences of their constituents more assertively, either by negotiating or by threatening retaliation.

In section 3, we test our expectations using an automated claims analysis of news media in trade partners that vary in terms of the carbon content of their exports to the EU and in terms of their bargaining power. Using Gemma 4 26B-A4B, we analyzed 4256 positions given by 1383 unique actors from 37 countries, identified in 8558 articles from newspapers and trade press. Our findings corroborate our hypotheses to a surprisingly high degree, demonstrating that the firms affected by CBAM are likely to voice objections, and that policymakers' resonate with their concerns when, and only when, high costs are combined with the relative bargaining power of their national jurisdictions. We conclude by highlighting how our findings emphasize the importance of the material dimension of political cleavages, drawing attention to the economic micro-foundations of political discontent.

1 A club to prevent free riding

According to William Nordhaus(W. Nordhaus, 2015; W. D. Nordhaus, 2006), the principle problem hindering environmental cooperation, from Kyoto to present, has been free-riding. He claims that since climate measures benefit everyone regardless of whether they contribute, states avoid contributing, either by refusing to set binding targets, or withdrawing without penalty when the distributional effects of emissions mitigation provokes unwanted political pressures. He shows how a system of exclusion could be adapted to the problem of climate change by decentralizing the enforcement problem to a 'club' which other states are compelled to join. He defines a club as, "a group that derives common benefits from voluntarily sharing the

production costs of an activity with public good characteristics." Rather than seeking agreement from all states on how to produce a public good, a small group of states could agree to exclude states which do not contribute to the production of that public good from accessing a common 'club good' which participating states have the capacity to manage together. In this case, the public good is greenhouse gas reduction, and the club good which participating states manage access to through an effective system of exclusion is privileged access to their own markets. The advantage of this club good approach is that participating states have the authority to enforce decisions regarding the management of the club good without requiring the assent of non-participating states. In other words, 'clubs' are effective because members retain their capacity to coerce others into joining. According to Nordhaus, past climate agreements have failed to reach their goals because there was no hierarchical authority to prevent free-riding. The club good approach avoids this problem by relying on an agreement between decentralized members to enforce compliance in their own jurisdictions, through existing institutions.

1.1 The climate club: costs, benefits and penalties

The models which Nordhaus uses to anticipate the effects of a climate club are based on variation along three principal dimensions: abatement costs, the benefits of cooperation, and penalties for non-compliance. First, **abatement costs** are the costs associated with reducing emissions to meet the club's carbon pricing requirements. They include investments in renewable energy, subsidies for transition to clean technologies, and higher production costs for industries. These are first placed upon industries that emit greenhouse gases because the climate club's membership requirements are met by imposing either flat taxes on carbon emissions or a system for auctioning and trading the right to pollute, such as Europe's Emissions Trading Scheme. In either case, industries effectively pay a fee for emitting the CO2 equivalent of various greenhouse gases. To a lesser extent, industries which do not emit greenhouse gases also bear costs because they nonetheless need to conduct emissions audits. To the extent that costs can be passed along to consumers, they also pay the cost of abatement. To avoid punishing industry and consumers, governments which collect these taxes on emissions can find ways to give them back to consumers by subsidizing green consumption, and to industries through incentives which help them to adapt their production or access cleaner energy. The actual cost to each state varies depending on the carbon intensity of its exports, the availability of low-cost mitigation technology, and the decisions which governments make about how to re-invest the proceeds from their carbon tax.

Second, the **benefits** of compliance work counter to abatement costs – they are the exclusive privileges which are extended to members to encourage states to incur the abatement costs. These are envisioned as tariff-free access to all other club member's national markets. While Nordhaus does not actually introduce variance along this dimension, there is some natural variation in the distribution of 'benefits' based on the degree of trade dependence between target states and club members. If countries export a lot to the rest of the club and are currently subject to high tariff levels, then the benefits of membership are quite high. Yet, in a real-world scenario, the attractiveness of such an additional incentive for cooperation may be relatively low due to existing trade agreements. WTO bound tariff levels on trade in goods are already relatively low; numerous countries have bilaterally concluded preferential trade agreements with tariffs nearing 0%; and

many developing countries benefit from preferential access to major markets through unilateral initiatives of their primary consumers.

Finally, the **penalties** of non-compliance are the price which non-members must pay for failing to implement a carbon pricing scheme. Since carbon duties are difficult to enforce because they require detailed (and verifiable) accounting on the carbon content of imports, Nordhaus proposes uniform tariffs on all imports from non-members and runs his model at different tariff levels. He proposes that a 5% blanket tariff would be sufficient to encourage membership without undermining trade relationships or introducing new economic inefficiencies. Given that the 'carrot' of market access is widely available through WTO membership, it is this 'stick' which does most of the heavy lifting, coercing third parties into joining the club by punishing all exporters from non-compliant trade partners so that they share a vested interest in regulatory upgrading.

1.2 The European Union (EU) Carbon Border Adjustment Mechanism (CBAM)

On July 14, 2021, the European Commission proposed the European Carbon Border Adjustment Mechanism (CBAM) as part of its "Fit for 55" program. It entered into force on January 1, 2026, requiring importers to purchase CBAM certificates equivalent to the embedded carbon emissions in their imported goods unless they are imported from trade partners with approved carbon pricing schemes. CBAM applies to aluminum, cement, electricity, fertilizers, hydrogen, and iron and steel. This covers more than 50% of the emissions from sectors subject to the EU-Emissions Trading Scheme, which in turn covers approximately 45% of GHG emissions in the EU. A recent modification to the implementing legislation has limited the application to the major importers in each sector, and so its impact will be limited slightly, but still targets 90% of the original estimates. The stated aim of the mechanism is to avoid 'carbon leakage,' a process through which costs or climate policies incentivize firms to shift production to trade partners with lower environmental regulations (COM/2021/550). It does so by ensuring equivalent carbon pricing for imports of carbon-intensive goods and their domestic equivalents. It also claims to support the Paris Agreement by motivating trade partners to reduce their emissions (Regulation (EU) 2023/956, Preamble, § 9–14). In short, CBAM is presented as a way to protect EU companies within the internal market against import competition from less environmentally ambitious jurisdictions, while promoting positive environmental spillovers in more polluting countries and incentivizing imports from trade partners which contribute to greenhouse gas reduction with effective climate policies.

On the surface, CBAM is presented in line with Nordhaus' 'club' model and could be considered as an experimental application of Nordhaus' club goods approach – indeed, some scholars and policymakers have already drawn the comparison (Clausing & Wolfram, 2023; Erbach & Scalamandrè, 2023; Overland & Sadaqat Huda, 2022; Szulecki, Overland, & Smith, 2022). Like in the climate club, CBAM could disincentivize greenhouse gas emissions through the imposition of penalties on producers from non-compliant trade partners. Also, like in the climate club, a select group of trade partners could benefit from improved market access if they implement domestic carbon pricing schemes. Just like in the climate club, trade partners can weigh the costs of abatement against benefitting from the club's purchasing power, as well as the threat of enforcement penalties, and determine whether to adopt a carbon pricing scheme. But costs, benefits, and

penalties associated with CBAM are each different in relation to what is included in Nordhaus' model, and it is important to take this into consideration in order to specify how different constituencies in trade partners will be affected by CBAM, and what we can expect to learn about club goods theory by assessing their reactions.

On one hand, abatement costs under CBAM are higher than Nordhaus' estimated carbon price of $50 per ton. CBAM requires that carbon certificates be purchased on the European market, where prices fluctuate and are currently trading at €88 per ton ($98 USD). Regulation (EU) 2023/956 states that the carbon pricing mechanism must be applied "without any rebates beyond those also applied in accordance with the EU Emissions Trade Scheme (ETS)" (Art. 2, para 6b). This effectively ensures against carbon leakage by setting the ETS as the standard bearer. If a non-EU country has implemented a carbon pricing system similar in scope and stringency, the carbon price already paid can be deducted from the CBAM obligation. It is also possible for countries to negotiate blanket exemptions by demonstrating that their domestic carbon pricing schemes are equivalent to the ETS. At present, only non-EU members of the European Economic Area do not need to pay for CBAM, since these countries either participate directly in the ETS or have systems which are fully integrated with it. Because the EU is not alone in having already introduced carbon-pricing, the costs of joining the club vary across trade partners. Although some states would need to pay a high price to join the club, in states where investments in clean energy and carbon mitigation technology have already been made, there could even be a significant cost for *not* joining the club.

On the other hand, there are no additional (formal) 'membership benefits' under the EU's CBAM. If trade partners upgrade their carbon pricing schemes and either integrate them with the ETS or negotiate equivalence, they only maintain access to the EU market at present tariff levels. Whereas the Nordhaus model had envisioned tariff free access to all goods from all club members, CBAM does not envision new benefits beyond simply maintaining the status quo. Moreover, the 'club' does not grow in the same way as the Nordhaus climate club. Whereas Nordhaus conceived of a growing mass of market access, driven by the increasing purchasing power of states who joined the club, CBAM's centripetal force builds solely upon the EU's internal market. Still, an existing literature places a great deal of emphasis on the 'market power' of the EU and posits a related "Brussels effect" whereby its immense buying power allows it to export regulations in a manner similar to the California effect in the United States (Bradford, 2020; Damro, 2012; Vogel, 1995). Because of the EU's relative global importance as an export market, it is possible that a network effect of increasing membership benefits with each additional member is not necessary in order for exporters to encourage their governments to adopt carbon-pricing schemes. Moreover, if trade partners implement effective carbon pricing regimes, they have a strong incentive to implement their own carbon border measures as well, in which case the de facto market access benefits also increase for countries who join later.

Finally, and perhaps most importantly, there are no additional penalties for not complying with CBAM beyond having to purchase the certificates necessary to comply with the regulation. This is again distinct from the 'club' approach in that it does not put pressure on non-carbon-intensive exporters to lobby for regulatory upgrading. Moreover, because the tax only applies to raw materials, sectors importing goods containing these inputs are not subject to CBAM, which further decreases the pressure which policymakers

in trade partners may face (Böning, Di Nino, & Folger, 2023). For example, an EU producer of motors will face an increased cost of inputs, since the Indian steel they use in their production process becomes more expensive. But a Turkish competitor, even if Turkey has not implemented a carbon tax, can import Indian steel to produce a motor and export it to the EU without having to buy CBAM certificates. Whereas Nordhaus considered penalties necessary to create vested interests in regulatory upgrading across the board in trade partners, the EU CBAM has been initiated much more cautiously, even to the point of allowing a temporary misalignment of incentives which could undermine the instrument's stated purpose.

In short, even though the EU has adopted some central elements of the 'club' approach (a carbon price) and has put a framework in place to allow trade partners to 'join' by adopting a carbon pricing scheme equivalent to the ETS, CBAM is quite different from the Nobel prize-winning model. While the climate club was based on costs, benefits and penalties for non-compliance, the CBAM approach simply involves a variable cost which turns into a penalty if EU trade partners have not already paid it, and which preserves benefits which their trade partners already have. For now, whether or not the EU's trade partners will 'join the club' is an open and empirical question which depends very crucially on two important elements which flow from this discussion: the extent to which costs have already been paid by firms seeking to maintain EU market access, and the extent to which the 'benefits' of market access are put in jeopardy. Going forward, we consider how and to what extent these two crucial factors determine responses to CBAM.

2 Exit, Voice, and the structure of foreign trade

In order to formulate expectations about how the demand for regulatory upgrading affects the positions of policymakers in EU trade partners, we consider adaptation costs and trade dependence in light of Hirschman's Exit, Voice and Loyalty framework (Hirschman, 1970). We use this theoretical framework because it captures how social, political, and economic bonds influence both the likelihood and the capacity of actors to pursue different courses of action in light of rising costs, adding an explicitly political dimension to the cost-benefit analysis of exporters. *Exit* means to let the market run its course, including leaving in search of alternatives. *Voice* means to seek a political solution. *Loyalty*, refers to all the reasons different actors have to seek a political solution instead of letting the market run its course. Hirschman says that rational actors exit as costs increase, unless they have loyalty, in which case they use voice. The strength of their voices is then determined by the credibility of their threat of exit. In the context of CBAM, there are a number of reasons why actors would not want to let the market run its course, and especially exporters of CBAM goods in EU trade partners are likely to revert to political solutions in which they exercise 'voice' in an attempt to improve their situation.

First and foremost, firms may seek to prevent a market solution because the market would impose too many costs upon them. Such costs can work both against and in favour of carbon pricing. On one hand, and perhaps most obviously, firms which are relatively carbon intensive producers of CBAM goods, such as steel producers who rely on coal for energy, may use voice because they will be forced to pay for import certificates. They will oppose letting the market run its course because CBAM ensures that they would be priced out of it. On the other hand, firms may use voice because failing to implement an equivalent carbon pricing scheme would be costly. For example, because CBAM will likely divert carbon-intensive CBAM goods

away from the EU, producers of CBAM goods which are relatively 'green' have every interest in quickly lobbying for domestic equivalents to protect against competition from goods diverted away from the EU. In other words, adaptation costs affect how actors use their voice – either to support or oppose carbon pricing. The more actors are harmed by CBAM, the more likely they are to use their voice to contest it. The more actors are harmed by not having an equivalent system of carbon pricing, the more likely they are to use voice to support equivalent measures in their home countries. This leads to our first two hypotheses.

H1a: When adaptation costs are high, firms pressure policymakers to oppose CBAM.

H1b: When adaptation costs are low, firms pressure policymakers to support an equivalent domestic carbon pricing scheme.

Another important detail which should affect the positions of firms is the availability of alternative markets. If 'loyalty' is what makes actors use their voices rather than exit, and it consists of all possible bonds that prevent the possibility of exit, we consider it important to take into consideration how foreign exporters of CBAM goods perceive their market opportunities outside of Europe. For many firms, Europe is just one of many active export destinations, and the introduction of CBAM will simply divert their products elsewhere. For others, either alternative export markets are not yet developed, or they may even be closed due to tariff and non-tariff barriers. In this case, CBAM poses a more significant problem, and they are effectively forced to be 'loyal' to the EU market. This leads to two further hypotheses:

H1c: When firms have alternative markets, firms oppose CBAM less.

H1d: When alternative markets are closed by trade barriers, firms oppose CBAM more.

There are, of course, mitigating factors like public opinion, institutions, opportunity structure, and so on, as well as actors like citizens, civil society groups or political parties. We do not consider them irrelevant, but we also do not consider CBAM to exist in a vacuum, and in fact many trade partners know about carbon pricing, have debated it domestically, and even experimented with different levels of implementation. We consider these additional factors to be very relevant to the debate, but also likely to already be reflected in adaptation costs which also reflect past lines of political conflict. We therefore take a somewhat radically 'society-centered' view of political economy which expects that policymakers' positions vary primarily in light of the preferences of their key economic constituents (Oatley, 2023). This does not efface the cultural preferences of citizens, party competition, or non-material concerns - it merely leverages the loss aversion hypothesis central to a great deal of political economic thinking. We therefore foreground the concerns of actors who are threatened by some form of non-action because immediate loss is more likely to provoke reactions than potential future gains (Kahneman & Tversky, 1979). This leads to a second hypothesis:

H2: Policymakers' positions on CBAM follow their domestic constituencies, firms in particular.

Crucially, the capacity to use voice is conditioned by the threat of exit, allowing us to draw inferences about the intensity with which policymakers defend the interests of their constituencies. While policymakers' stances on carbon pricing can be expected to be informed by how domestic constituencies are affected by carbon pricing, it is their bargaining power which conditions the strength of the position they can actually

take. While the conditional effect of societal demands upon voice was formalized in Exit, Voice and Loyalty, it was actually foreshadowed in Hirschman (Hirschman, 1945/1980), which demonstrates how bargaining power is a function of trade dependence. He shows that asymmetrical trade relationships create situations of dependence which can be leveraged by the larger partner. The causal mechanism which he highlights is the vested interests in smaller trade partners which lobby their governments to acquiesce to the demands of stronger partners. In practice, this would imply vested interests within trade partners lobbying for the adoption of EU standards in order to protect their export markets. Yet, the same mechanism must also work in the opposite direction, with vested interests within the EU lobbying on behalf of their suppliers in cases where the EU is dependent upon imports from abroad. In other words, bargaining power is a balance of two dependences: The EU on its partners, and trade partners on the EU. The more trade partners enjoy bargaining power over the EU, the more they can be expected to push back against the imposition of CBAM, regardless of whether or not they support it. This leads to a final hypothesis:

H3: Policymakers from trade partners with greater bargaining power take a stronger position against CBAM.

Our hypotheses are additive: H3 builds on top of the H2, which in turn builds on top of the first set. As adaptation costs and 'loyalty' increase, policymakers are more likely to be pressured by affected firms – either to support carbon pricing when adaptation costs are low, or to contest it when adaptation costs are high. Policymakers then resonate with firm positions, especially when they involve defending the status quo against imposed changes. As bargaining power increases – because policymakers can leverage trade dependence to pursue the preferences of domestic actors – their threat of exit becomes more credible and they are likely to use voice more aggressively. In the analysis which follows, our core interest is to understand the positions which are eventually taken by policymakers in trade partners and therefore the extent to which the club good logic of Nordhaus is capable of explaining real-world responses to the EU CBAM.

Data and Methods

To test our hypotheses, we analyzed public debates in EU trade partners that vary in bargaining power and adaptation costs. The independent variables bargaining power and adaptation costs were built from trade data on the goods the CBAM covers (iron and steel, aluminium, cement, fertilisers, electricity and hydrogen), identified by the product codes in the CBAM annex: EU imports from Eurostat (Eurostat, 2024) and partner exports from Comtrade (United Nations Statistics Division, 2026). The dependent variable actor positions was built by automated coding of newspaper and trade press articles from Nexis Uni. We selected the 37 trade partners with the largest CBAM-goods exports to the EU, except Russia, Norway and the United Arab Emirates, which are not represented in Nexis Uni.

3.1 Bargaining power and adaptation costs

We operationalize bargaining power as the ratio of the EU's dependence on a trade partner to that partner's dependence on the EU. EU dependence is the country's share of all EU imports of CBAM goods: the larger it is, the harder it would be for the EU to replace the partner. Partner dependence is the share of the partner's total exports that consists of CBAM goods sold to the EU. A partner has high bargaining power when the EU

relies heavily on its supplies but only a small part of its output goes to the EU. We take the base-10 logarithm of the ratio, centre it, and calculate it for all CBAM goods together (country level) and for each CBAM sector (sector level). Firms receive the value for their own sector; policymakers, experts and general business associations receive the country value. In the analysis we sort countries into three equal groups (low, mid and high) to avoid relying entirely on a ratio of two noisy measures. Because bargaining power is rooted in the notion of a credible threat or offer, we expect that it works more like a threshold than a dial: a middling difference in dependence buys very little, while a large one changes how officials talk.

Adaptation cost is the CBAM charge a partner's exporters would face once the mechanism is fully in force, as a percentage of their CBAM exports to the EU. We take the emissions embedded in the goods the partner exports to the EU (the default values in the EU's implementing legislation), multiply by the gap between the EU carbon price (€88 per tonne of CO_2) and the price producers already pay at home, floored at zero, weight by the tonnes the EU actually imported, and divide by the value of those imports. The home price is the sector's emissions-weighted effective carbon price in 2024 (Dolphin & Merkle, 2024), averaged over states and provinces for the United States and Canada. Iceland, Liechtenstein and Switzerland are exempt and have zero cost. Firms in CBAM sectors receive the cost for their own sector and country; hydrogen and electricity firms, policymakers, experts and general business associations receive a country value pooling all the country's CBAM exports; firms in other industries and in finance receive zero, because the CBAM does not directly apply to them. Cost is capped at 100% and expressed in units of 10 percentage points.

We also measure whether exporters have alternative markets and the extent to which these alternative markets are open. To do so, the base-10 logarithm of a country's CBAM exports to its largest non-EU buyer divided by its exports to the EU (zero means another buyer is as large as the EU), assigned in the same way as cost. Because other markets can be closed, we add two Global Trade Alert measures (Evenett & Fritz, 2026). These are the share of non-EU exports going to destinations that restrict the product, and the size of the largest unrestricted destination relative to the EU.

3.2 LLM Coding of actor positions

To identify actor positions, we collected news coverage of the CBAM from Nexis Uni, searching all newspaper and trade press articles that mention CBAM (or Carbon Border Adjustment Mechanism, Carbon Border Adjustment, or Carbon Border Tax) and the EU or the European Union in the top 40 exporters of CBAM goods to the EU. After removing 1,732 articles from one outlet that publishes automated stock-market blurbs, the corpus comprises 13,299 articles from 2,150 outlets in 37 countries, about half in English and the rest in 25 other languages. Because the CBAM became a concrete policy only with the Commission's proposal of 14 July 2021 (COM/2021/550), we analyze the 8,858 articles published from that date to June 2025 (date of data collection), mostly from 2023 on.

A large language model run locally (Gemma 4, 26 billion parameters; temperature zero) read each article in its original language, listed every statement by a non-EU actor about the CBAM and, in a second pass, about carbon pricing more broadly, with the verbatim quote, the speaker and the speaker's country. It skipped the article author's own commentary and statements made by actors within the EU. A second call coded the speaker's role (firm, government, expert) and position: opposes (criticism, or a request to exempt, delay,

soften or retaliate), supports (welcoming or defending the policy, or urging a matching domestic measure), mixed, or neutral (no evaluation), scored − 1, + 1, -0.5 and 0. Mixed statements (8%) score − 0.5 because, under our codebook, they accept the policy in principle but ask the EU for relief; scoring them 0 has little effect on the estimates.

Of 17,899 statements extracted, 6,626 are about the CBAM and by non-EU actors. We removed statements attributed only to a country ("India said"), duplicate quotes, statements before 14 July 2021, one consultancy's press-release boilerplate, international organisations and unclassifiable speakers, which leaves 4,256 statements by 1,383 actors (Table A1). Because some actors speak very often (India's trade minister Piyush Goyal accounts for 311 statements), we average each actor's scores into one observation per actor. The actors are 383 policymakers (ministers, officials, ministries and legislators), 504 business actors (firms, producers' associations and chambers, each assigned a sector) and 496 experts (think tanks, academics, NGOs and unions, that is, organised voices that are neither governmental nor commercial). Of these, 1,329 in 31 countries have a cost and a bargaining power value (Table A2). We run every analysis on CBAM statements, on carbon pricing statements, and on both pooled.

3.3 Statistical models

Our analysis is exploratory: we adapted measures, coding and tests as we validated the results. All models are ordinary least squares regressions, reported with standard errors (SE) and p-values. Because observations from the same country or sector share a media environment and institutions, standard errors allow for correlation within groups (cluster-robust) and p-values use the t distribution, which is more cautious with few groups. Where the explanatory variable varies only by country, we also repeat the test with one observation per country (country means), since individual actors in the same country are not independent evidence.

Three sets of models follow our hypotheses. First, we regress each firm's share of opposing positions, and its mean position, on its adaptation cost (H1a; 504 firms, 138 country-sector clusters), with and without country fixed effects, which compare firms only within the same country. We read H1b as the low-cost end of the same relationship, and repeat the test on the 155 firms in the CBAM sectors, all of which face some cost. To test H1c and H1d we add the alternative-market and trade-restriction measures to this model, and also let the cost slope depend on them, to see whether exporters with alternative export markets respond less to cost. Second, for H2 we regress each policymaker's position on the share of that country's firm actors who oppose (or support) the CBAM, requiring three firm and three policymaker actors per country (343 policymakers, 20 countries), controlling for the country's cost and bargaining power. Because policymakers may respond to the wider domestic debate rather than to firms in particular, we repeat the test with the share of opposing (or supporting) experts and enter both together: if firms lobby, firms should matter more than experts; if policymakers track the general tone of debate, the two should matter about equally. Three timing checks compare policymakers with firms in the same article, country-week and country-month.

Third, for H3 we compare policymakers in the three bargaining-power groups (23 countries, 355 policymakers): their positions, their reaction to cost, and how closely they follow their firms. Because we

expect bargaining power to work more as a threshold than as a steady dial, we also cut countries into two and four groups and enter bargaining power as a continuous rank and index (Table A10). The Appendix tests rival explanations (Tables A8–A10) by adding the firm's industry, the income and size of its country, its trade agreement with the EU, BASIC membership and the carbon price paid at home (and, for the policymaker tests, the alternative-market and trade-restriction measures), and repeats each test with other scoring, carbon prices and emission values, and leaving out one country at a time.

3.4 Validation

One author coded random English-language articles blind to the model's output, and we compared the two with Cohen's kappa, which corrects agreement for chance (0 is chance, 1 is perfect). On 54 articles, the model's speaker type (κ = 0.88), country (κ = 0.94) and firm sector (κ = 1.00, 13 firms) agreed with the human coding. Of 41 statements the model found, 90% were real non-EU statements on the target, and it found 71% of those the coder identified. For position alone, on 111 statements from 50 further articles, agreement was 69% (κ = 0.54, 95% CI 0.38–0.69), and 91% where both chose 'opposes' or 'supports' (κ = 0.82, 77 cases). Disagreement between the human and LLM coder lies in the middle categories: the model sometimes labels exploratory statements ("we will monitor the policy") as supportive, and cost warnings as opposition. The checks rest on one coder and on English-language articles only (Table A3).

Results

Each finding is shown in one figure with its regression table in the Appendix (Tables A4–A7); Tables A8–A10 hold the robustness checks. Positions run from − 1 (opposes) to + 1 (supports), and cost is the expected CBAM charge as a share of export value. Unless we say otherwise, results use statements explicitly about the CBAM.

First, we tested H1a to see if firms facing higher costs take more negative positions. Figure 1a shows each of the 504 firms as a dot: the vertical axis is the firm's mean position and the horizontal axis is the CBAM charge it would face. The dots fall in columns because firms in the same country and sector share one cost; the column at zero holds firms the CBAM does not touch, over a third of the sample. The orange dots average firms of similar cost, and the line is the fitted relationship. Figure 1b collapses the firms into the 138 country-sector groups behind the columns.

Firms facing higher charges are more opposed to the CBAM. For every extra 10 percentage points of cost, the share of a firm's statements that oppose the CBAM rises by 5.1 percentage points (SE = 0.017, p = 0.004; Table A4, column 1) and its mean position becomes more negative (p = 0.001; column 3). The relationship holds within countries (p ≤ 0.002), so it does not simply reflect differences between countries. For statements about carbon pricing alone, the relationship is not significant across countries (share opposing p = 0.28, mean position p = 0.12; Table A4) but appears within countries (p = 0.034 and p = 0.016), so firms with a higher charge are also more negative about carbon pricing itself than firms in the same country. The weaker result across countries is expected, since the CBAM charge is not the cost of a country's own carbon price. These results support H1a: the more a firm stands to pay, the more opposed to the CBAM it is.

The same slope gives a partial test of H1b at its low end. Among firms in the CBAM sectors, all of which pay something, those facing a charge of 10% of their export value or less (45 firms in 13 countries) are net supportive (mean position + 0.33; 60% take a supportive average position), those between 10% and 20% are close to that (+ 0.19), and those above 20% (78 firms) are net opposed (− 0.12). Across these firms, a higher charge goes with a more negative position ($p = 0.030$), and firms at up to 10% differ from those above 20% in mean position (+ 0.45, $p = 0.047$) and in the share of opposing statements (− 21.6 percentage points, $p = 0.046$; Table A8); the 10–20% band is not significantly different from the highest band ($p = 0.20$). The limits are that firms outside the CBAM sectors, which pay nothing, are almost all of the firms at zero cost and so cannot stand in for green producers; that these are positions on the CBAM, not on a domestic carbon price; and that the cost slope in statements about carbon pricing alone is not significant across countries ($p = 0.28$ and $p = 0.12$). In plain terms, firms that would pay little are, on balance, on the CBAM's side, which fits H1b as the other end of H1a but does not show them lobbying for an equivalent scheme.

These results survive controls for industry, income, size, trade agreement with the EU, BASIC membership, the home carbon price and bargaining power (Table A8; $p \leq 0.056$ throughout), and it holds under other scoring, other carbon prices and when any country is dropped. It weakens, though the direction is the same, in two checks. Holding country and industry fixed together leaves almost nothing to compare, because firms in the same country and industry share one cost ($p = 0.26$). Collapsing the firms to the 138 country-sector dots of Fig. 1b and giving each dot equal weight, whether it holds one firm or twenty, lets small and noisy dots count as much as large ones ($p = 0.32$).

We also found that alternative markets matter in the way Hirschman's ‘loyalty’ argument predicts (H1c and H1d; Table A8). Firms that can sell to a large buyer outside the EU oppose the CBAM less: for each tenfold increase in the largest non-EU buyer relative to the EU, the share of a firm's statements that oppose it falls by 6.8 percentage points ($p = 0.064$) and its mean position becomes more favourable ($p = 0.056$). The Global Trade Alert measure of the largest unrestricted buyer, which is almost the same variable ($r = 0.98$), gives 8.2 points ($p = 0.019$) and $p = 0.008$. Closed doors work the other way: for each extra 10 percentage points of a country's exports facing restrictions elsewhere, the share of statements opposing the CBAM is 11.2 points higher ($p < 0.001$) and the mean position more negative ($p < 0.001$), and both measures matter when entered together. Alternatives also change how firms respond to cost: the cost slope for share opposing falls by 3.4 points per tenfold increase in the largest non-EU buyer ($p = 0.001$), so where another buyer is ten times the EU's, the effect of cost has almost gone. Restrictions elsewhere raise opposition at every level of cost without changing the slope ($p = 0.55$). The cost response does not differ with bargaining power, the size of the economy, income per head, trade agreement or BASIC membership ($p \geq 0.25$ for each interaction). In plain terms, firms with somewhere else to sell complain less about the cost the CBAM imposes, firms shut out of other markets complain more, and firms that bear a higher cost complain whether their country is large or small, rich or poor, powerful or weak.

Next, we tested whether policymakers align with the firms of their own country. Figures 2a and 2b compare the 20 countries with at least three firm and three policymaker actors. Each dot is a country, plotting the share of its firm actors that oppose the CBAM (2a) or support it (2b) against the share of its policymakers that are negative or positive. Both lines slope upward and are statistically significant.

For every extra 10% of a country's firms that oppose the CBAM, the chance that a policymaker is negative rises by 7.6 percentage points (SE = 3.5, p = 0.046; Table A5), or 7.2 with controls for the country's cost and bargaining power (p = 0.009); for support, the chance of a positive policymaker rises by 6.8 (p = 0.029). The timing checks (Table A6) test whether the link also holds at shorter horizons. In the 80 articles quoting both a policymaker and a firm from the same country, the policymaker is more negative when the firm opposes ($p < 0.001$; Fig. 2c). The link also holds when we pair each country's firms and policymakers in the same week (163 country-weeks; $p < 0.001$; Fig. 2d) or the same month (177 country-months; p = 0.015). Country fixed effects set a much harder test, since they remove everything stable about a country and ask only whether its policymakers move when its own firms move. The weekly link passes it (p = 0.028); the monthly link does not (p = 0.47), though there are few observations per country.

While H2 expected policymakers to follow firms because firms face immediate losses, experts in the dataset give us a way to test this claim against a rival explanation. Think tanks, academics, NGOs and unions pay no CBAM bill, so if constituencies with immediate losses matter more, policymakers' positions should track firm positions more closely than the expert positions. We find that they do not. Policymakers track expert opposition as closely as firm opposition (+ 1.02, $p < 0.001$, vs. +0.88, p = 0.11), and when both enter the same model the firm coefficient falls to + 0.20 (p = 0.73) while the expert coefficient stays at + 0.94 (p = 0.002). With 17 countries and the two mean positions correlated at r = 0.50, we cannot rule out a role for firms. What the data support is the broader claim that policymakers move with the domestic debate. Where firms and experts are more opposed to the CBAM, so are policymakers, whether we compare articles, weeks or months. Our design shows that they move together, not which moves first, and the pattern fits a shared information environment more than firms leading and policymakers and experts following.

Table A9 tests rival explanations. The estimates stay positive and mostly significant with controls for income, size, trade agreement, carbon pricing at home and alternative markets. BASIC membership is the exception. Brazil, South Africa, India and China are critical in both firm debate and government, and with BASIC as a control the estimate for opposition roughly halves (p = 0.010) and for support is no longer significant (p = 0.21). BASIC is a coalition in the climate negotiations, where the CBAM is a live issue, so part of the finding may be a shared stance of those countries.

Finally, we tested whether bargaining power affects policymaker positions. Figures 3a and 3b show the 23 countries with policymaker statements, sorted into low, mid and high bargaining power (seven, eight and eight countries); each dot is a country and the bar is the group mean. Policymakers in the eight high-bargaining power countries (Australia, China, India, Japan, South Korea, the UK, the US and Vietnam) are more negative than those in the seven low-bargaining power countries (Argentina, Egypt, Kazakhstan, Morocco, Pakistan, Serbia and Ukraine), both on the position scale (p = 0.016) and in the share who are negative, which is 29 percentage points larger (p = 0.020; Table A7). Figure 3c plots each country's mean policymaker position against its expected CBAM cost. The lines are flat in low and mid countries but fall in high countries: the higher the cost, the more negative the policymakers (p = 0.006), a slope that differs significantly from the low group's (p = 0.042) and the mid group's (p = 0.020). Figure 3d shows that policymakers follow their firms about equally closely in all groups, or at least without signficiant cross-group differences.

In plain terms, policymakers in the countries with the most bargaining power are the most negative, and only there do they become more negative as the national CBAM bill grows. Importantly, however, it is not a story about firms, because the stronger cost response does not come from officials following their firms more closely. Instead, it fits the idea that policymakers in states with greater bargaining power respond to their own country's CBAM cost, but our data do not show how.

Table A10 tests rival explanations, and most leave the result standing: it does not come from countries with few policymakers, nor from income, the home carbon price, alternative markets or trade restrictions elsewhere (level difference $p \leq 0.023$). A trade agreement with the EU weakens it ($p = 0.074$), and across these checks the slope difference keeps its size but its p-value rises to between 0.07 and 0.21, so the slope difference is the less stable result. The most consistent finding is the high-power group's own slope: policymakers there become more opposed as the CBAM bill grows in 17 of the 20 checks, significantly so in 12 ($p = 0.002$ with two groups, 0.006 with three, 0.075 with four). Controlling for economy size absorbs the level difference ($p = 0.37$), but size is itself a source of leverage, and groups cut by economy size reproduce the pattern ($p = 0.002$). Controlling for BASIC countries is slightly different. It is an informal coalition in the climate talks, not a trade bloc, and only two of its members, China and India, are members in the high bargaining power group, so the drop ($p = 0.36$) suggests the difference is concentrated in them. The result is carried by the largest high-bargaining power cases, as the argument expects. Leaving out each country in turn, with the groups held fixed, the level difference stays at $p \leq 0.077$ whichever country is left out ($p = 0.077$ without India, 0.052 without China, below 0.05 in the other 21), and the slope difference falls to $p = 0.53$ without India. A theory about bargaining power should show its effect in the countries that have the most of it, and India and China are the two of the largest, so we read this as the effect concentrating where the theory expects it. A continuous test points the same way but is weaker ($p = 0.05$ on bargaining-power rank, 0.16 on the index), which fits an effect that switches on at high levels rather than rising steadily.

Discussion and Conclusion

We began by asking whether the EU CBAM is creating a carbon club. By Nordhaus's standards it is a weak one. It offers no new membership benefit and no penalty that falls on every exporter in a non-participating country. We therefore looked at how it is actually shaping the demand for regulatory upgrading in trade partners, using a political economy account of who raises their voice and when policymakers echo them.

The cost of the CBAM is the clearest driver. Firms that face a higher charge oppose it more, and this holds in large and small countries, rich and poor, powerful and weak. Firms that would pay little are, on balance, on the CBAM's side. The Hirschman logic helps explain who complains. Exporters with another large buyer complain less when costs rise, and exporters shut out of other markets complain more. Where firms can leave, they do not need voice; where they cannot, they use it. This is the CBAM's stick working in the way Nordhaus intended, but since the agreement has just come into force and trade partners have yet to actually upgrade, so far we can only show that it produces complaint, not alignment.

We also found that policymakers tend to move with firms, rather than follow them. Rather than one leading the other, we found that they both follow the domestic debate instead. While policymaker positions track firm positions, they also track experts equally closely, and the firm effect disappears once both are

considered. This supports the society-centred premise of our theory but not its narrower mechanism, firm lobbying. It also qualifies the premise that wider voices are embedded in adaptation costs: experts' opposition does not rise with the national CBAM bill. Cost drives firms; something broader moves policymakers. Identifying that something is the next step, and it requires data on lobbying and on the sequence of statements, which news coverage cannot give.

Finally, bargaining power is where the politics comes in. Policymakers in the countries with the most leverage over the EU are the most negative, and only there do they become more negative as the national CBAM bill grows. This is not because their firms oppose more strongly: firms respond to their own costs to the same degree everywhere. It is because leverage changes what officials do with the same pressure. This is what Hirschman's account of dependence predicts, with one refinement. He located the effect in vested interests lobbying their governments, whereas here it shows up in the officials themselves. The pattern is also lumpy rather than smooth: the contrast between high- and lower-leverage groups holds across different cut-offs, but a continuous measure of bargaining power is weaker. Leverage seems to matter once the EU's dependence on a partner is large enough that it cannot be ignored. We coded positions, not intentions, so the link between leverage and strategy is inferred from theory rather than observed.

The costs that Nordhaus expected to drive club membership are the same costs that are currently generating opposition, and the partners with the greatest capacity to expand club benefits are the ones where policymakers are most willing to align firmly behind expressed societal contestation. The CBAM may be an effective instrument for coercing small, dependent exporters. But policymakers in larger trade partners appear to be willing to turn domestic costs into domestic politics. Nordhaus's penalty logic assumes that exporters have a shrinking list of viable alternative export markets – that is, he expected increasing loyalty to be driven by a sense of closure and a perceived threat of exclusion. On one end of a spectrum, we have found traces of this alignment. On the other, we have also identified the most vocal CBAM opponents as trade partners whose voices are amplified by viable threats to let the market run its course. If Europe refuses to let them in, it may well be priced out of its own club.

Declarations

Funding Declaration

This research has been generously funded by the Fonds Wetteschappelijk Onderzoek (FWO) Senior Research Project: “Towards a Theory of Resonance: Coalition-Forming and the Emergence of the So-Called Green Deal and 'Open Strategic Autonomy' as Policy Paradigms in the European Union.” Grand number G075226N.

Author Contribution

S.H. wrote the main text, conducted the empirical analysis and prepared figures and tables.D.D.B. reviewed and made significant edits to the manuscript over several working versions, including the final submitted version.

Data Availability

All data supporting the findings of this study are available within the paper and its Supplementary Information. A fully replicable dataset and code is available through Harvard Dataverse, via a link in the article's appendix.

References

1. Böning, J., Di Nino, V., & Folger, T. (2023). Benefits and costs of the ETS in the EU, a lesson learned for the CBAM design. *Working Paper Series*. Retrieved from https://ideas.repec.org//p/ecb/ecbwps/20232764.html
2. Bradford, A. (2020). *The Brussels effect: How the European Union rules the world*. New York, NY: Oxford University Press.
3. Clausing, K. A., & Wolfram, C. (2023). Carbon Border Adjustments, Climate Clubs, and Subsidy Races When Climate Policies Vary. *Journal of Economic Perspectives*, *37*(3), 137–162. https://doi.org/10.1257/jep.37.3.137
4. Damro, C. (2012). Market power Europe. *Journal of European Public Policy*, *19*(5), 682–699. https://doi.org/10.1080/13501763.2011.646779
5. Dolphin, G., & Merkle, M. (2024). Emissions-weighted carbon price: Sources and methods. *Scientific Data*, *11*(1), 1017. https://doi.org/10.1038/s41597-024-03121-6
6. Erbach, G., & Scalamandrè, C. (2023). *G7 climate club*. European Parliamentary Research Service. Members' Research Service. Retrieved from https://www.europarl.europa.eu/RegData/etudes/ATAG/2023/739385/EPRS_ATA(2023)739385_EN.pdf
7. Eurostat. (2024). *Eurostat Comtext: EU Trade Since 1988 by HS2-HS4-HS6 and CN8 (Data for 2022–2024)* [Data set]. Retrieved from https://ec.europa.eu/eurostat/comext/newxtweb/
8. Evenett, S. J., & Fritz, J. (2026). *Global Trade Alert database* [Data set]. St. Gallen Endownment for Prosperity Through Trade. Retrieved from globaltradealert.org
9. Hirschman, A. O. (1970). *Exit, voice, and loyalty: Responses to decline in firms, organizations, and states*. Harvard University Press.
10. Hirschman, A. O. (1980). *National power and the structure of foreign trade*. Berkeley (Calif.) Los Angeles (Calif.) London: University of California press. (Original work published 1945)
11. Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263. https://doi.org/10.2307/1914185
12. Nordhaus, W. (2015). Climate Clubs: Overcoming Free-riding in International Climate Policy. *American Economic Review*, *105*(4), 1339–1370. https://doi.org/10.1257/aer.15000001
13. Nordhaus, W. D. (2006). After Kyoto: Alternative Mechanisms to Control Global Warming. *American Economic Review*, *96*(2), 31–34. https://doi.org/10.1257/000282806777211964
14. Nordhaus, W. D. (2019). Can We Control Carbon Dioxide? (From 1975). *American Economic Review*, *109*(6), 2015–2035. https://doi.org/10.1257/aer.109.6.2015

15. Oatley, T. H. (2023). *International political economy* (Seventh Edition). New York London: Routledge, Taylor & Francis Group.
16. Overland, I., & Sadaqat Huda, M. (2022). Climate clubs and carbon border adjustments: A review. *Environmental Research Letters*, *17*(9), 093005. https://doi.org/10.1088/1748-9326/ac8da8
17. Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652., COM/2021/550 final (2021).
18. Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism., OJ L 130, 16.5.2023, p. 52–104 (2023).
19. Szulecki, K., Overland, I., & Smith, I. D. (2022). The European Union's CBAM as a de facto Climate Club: The Governance Challenges. *Frontiers in Climate*, *4*, 942583. https://doi.org/10.3389/fclim.2022.942583
20. United Nations Statistics Division. (2026). *UN Comtrade Database* [Data set]. Retrieved from https://comtradeplus.un.org/
21. Vogel, D. (1995). *Trading up: Consumer and environmental regulation in a global economy* (2. printing). Cambridge, Mass.: Harvard Univ. Press.

Figures

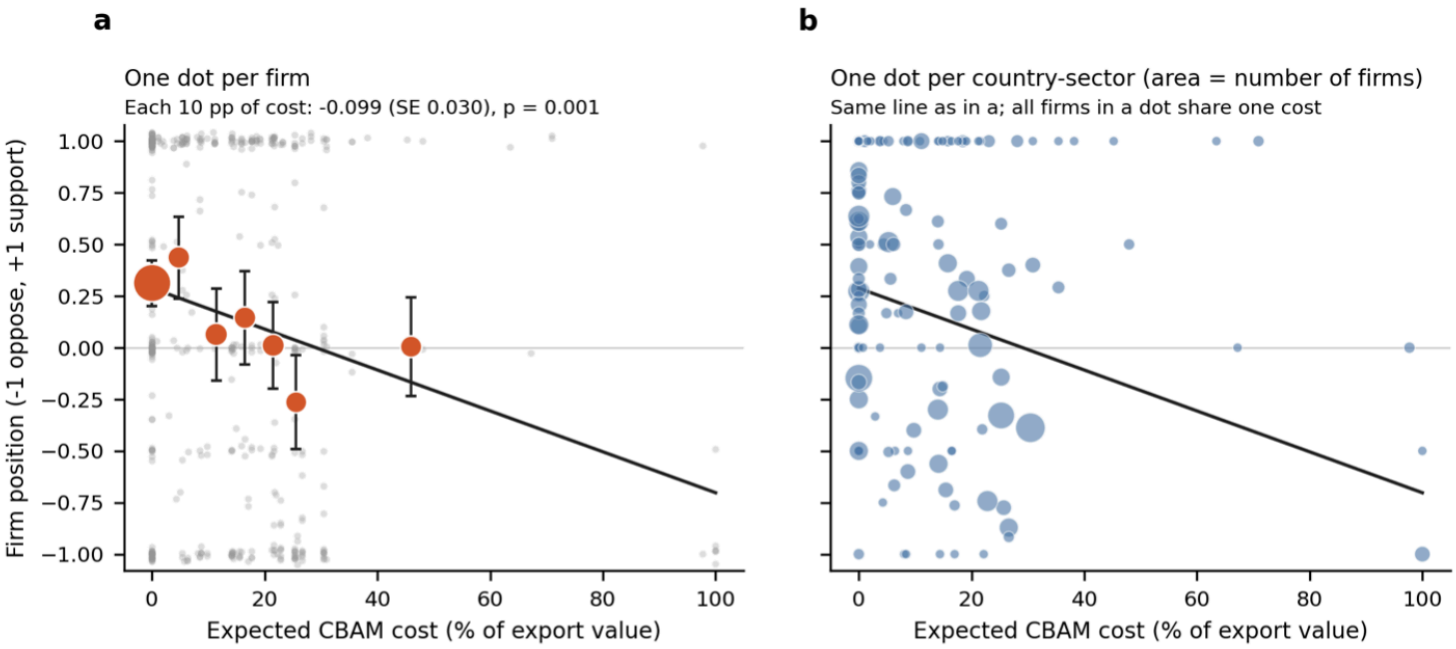


Figure 1

1a and 1b: Firm and sector positions vs Expected CBAM costs

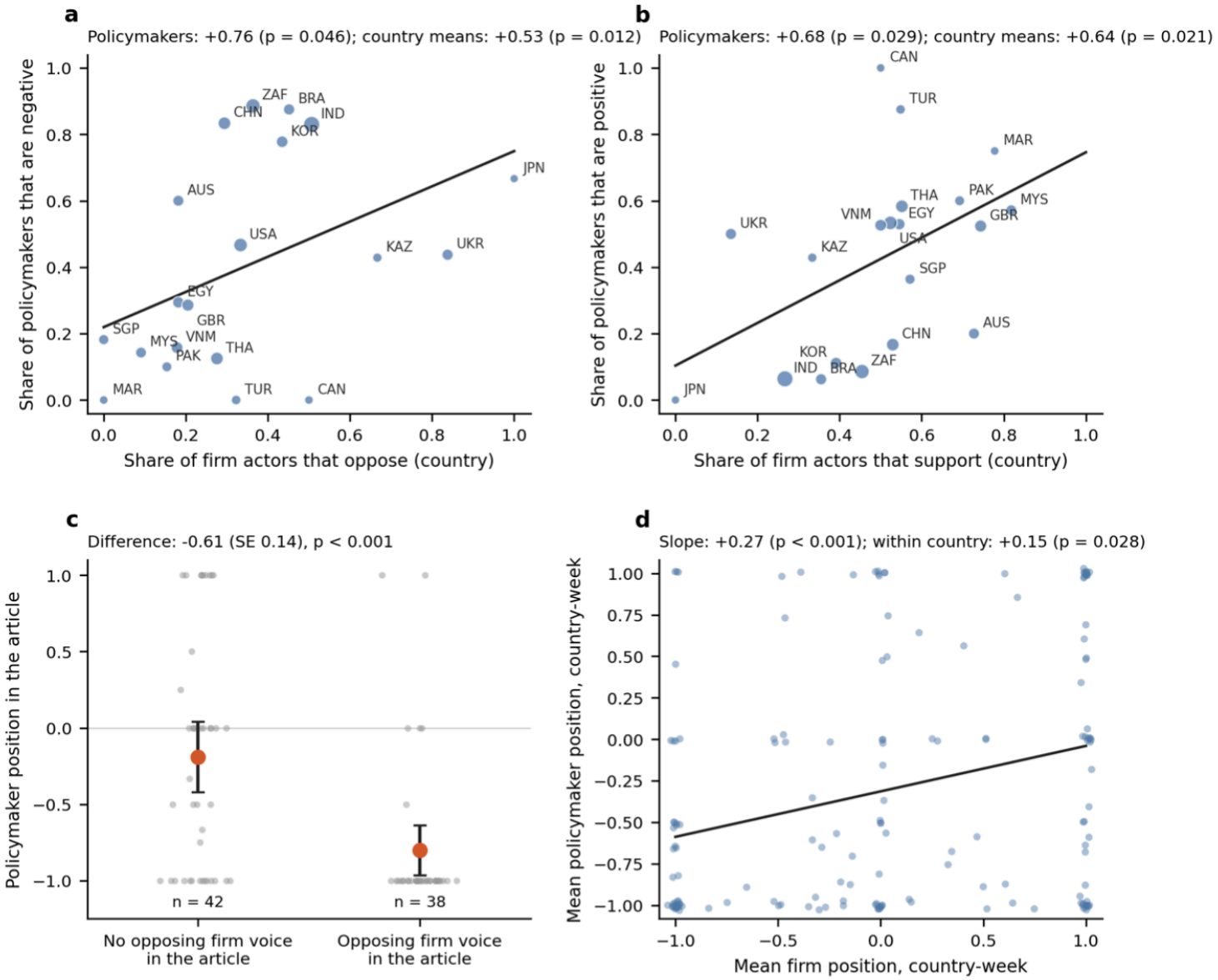


Figure 2

Assessing the relationship between policymaker and firm positions.

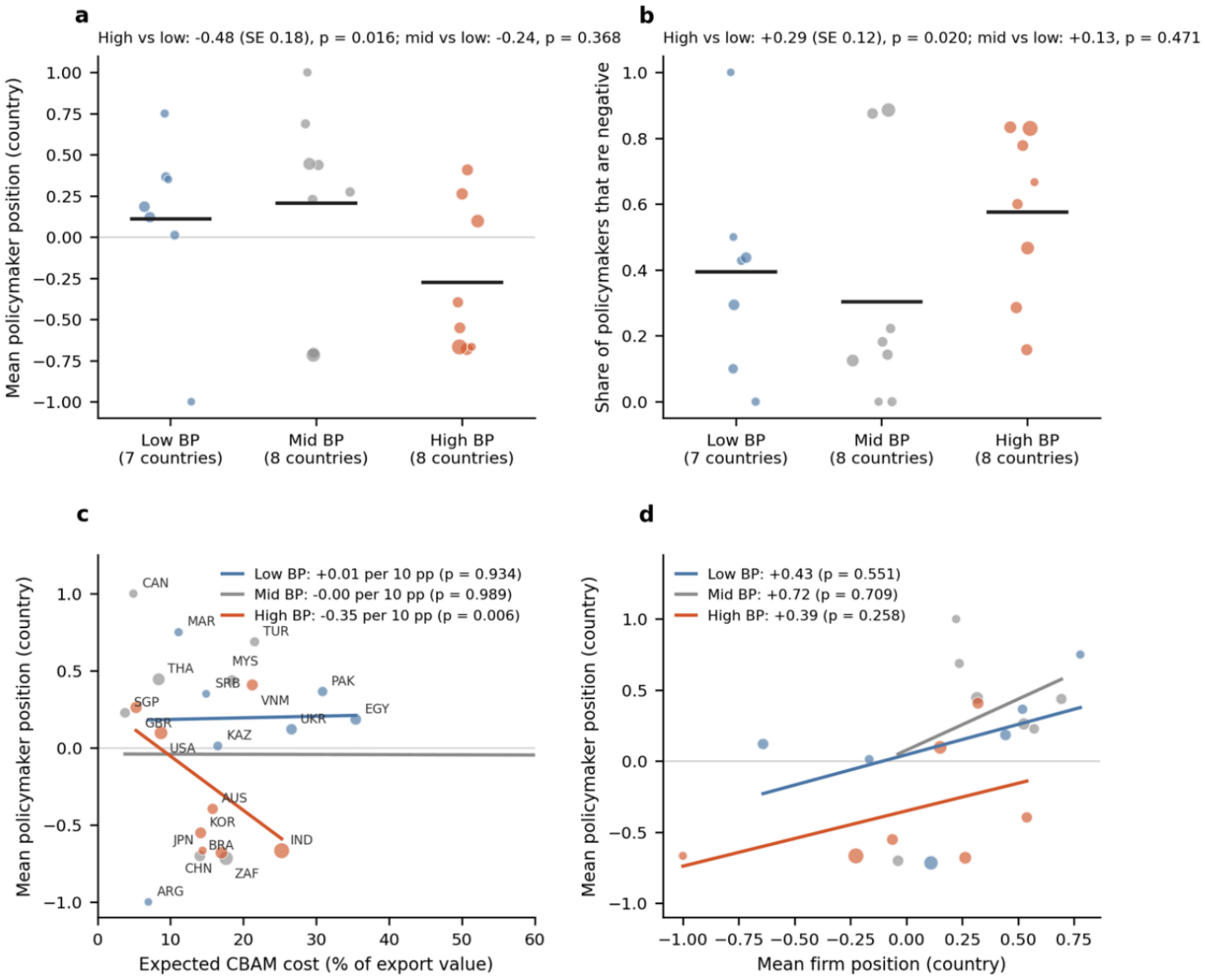


Figure 3

Assessing the relationship between bargaining power and policymaker positions.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Europeanpowerandthestructureofregulatoryupgradingoct28v2AppendixAnonymous.docx