International Studies Quarterly (2019) **63**, 819–836

Sectors, Pollution, and Trade: How Industrial Interests Shape Domestic Positions on Global Climate Agreements

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It is usually assumed that the cost of abating pollution is the main deterrent of domestic support for international climate cooperation. In particular, some scholars have argued that, due to the burden of pollution abatement, businesses commonly constrain governments, which then take less cooperative positions on global climate agreements. I suggest that this argument needs further qualification: pollution-related costs rarely have unconditional effects on preferences for global climate agreements. Instead, a sector's pollution level is more likely to influence preferences for climate cooperation if mediated by its trade exposure. If pollution is high, firms in high-trade sectors may be less able to absorb climate regulation, and hence they should be more sensitive to climate cooperation. If pollution is low, firms in high-trade sectors may support climate cooperation, because by being more efficient they are more capable of adjusting to regulation. These dynamics should then affect governmental positions on global climate politics. I test my sectoral argument with original data from business statements and national communications at the United Nations climate negotiations. In line with my argument, I find that businesses in trade-open sectors are more likely to oppose climate agreement as their sector's emissions increase. I also find that in countries where high-emission sectors are open to trade, governments have low preferences for climate cooperation. The findings have implications for the domestic politics of environmental agreements and the distributive politics of global public good provision.

Introduction

Political scientists often discuss the role that economic interest groups play in international politics. In this regard, political economy scholars provide theory and evidence on the determinants of domestic inclinations for global economic policy and their impact on international organizations. Nonetheless, motivations in certain areas of international cooperation are still little understood. Much is still unknown about how domestic industrial preferences affect international positions on issues such as climate change. The debate in this younger field of global governance is still open: When do business groups support international climate cooperation? How do their preferences influence governments' positions on climate agreements?

One common claim in the context of international climate policy is that companies are concerned about the direct costs caused by global climate agreements, due to the "absolute tension between short-term profitability and the need to reduce emissions."[1] Compliance with an international climate treaty requires new regulation targeting greenhouse gas (GHG) emission levels, and companies are usually expected to adapt to that regulation. Because these arrangements imply significant clean-up costs and technology investment, companies in sectors that require more internal adjustments are often expected to be more sensitive to carbon regulation agreements. Consequently, it is commonly believed that industries that produce higher levels of GHG emissions should be less inclined to support global climate policy cooperation.

Despite the intuitiveness of this argument, anecdotal evidence has questioned its logic. For example, the fact that some U.S. multinationals in high-emission sectors have asked President Trump to remain in the Paris climate agreement has challenged the belief that abatement costs solely drive positions on climate cooperation,[2] leaving a gap in the understanding of the domestic interests of international climate agreements. Seeking to fill this gap, I argue that the direct adjustment to climate policy in terms of GHG abatement alone is insufficient to explain preferences for international climate cooperation. Instead, building on the scholarship of transnational regulatory governance (Vogel 1995) and open economy politics (Frieden and Lake 2005; Gilpin 2016), I claim that another aspect of global policy adjustment conditions abatement concerns: *trade openness*. According to these literatures, a prominent condition to support international agreements is access to international trade. However, international trade is often embedded in economic structures that lack ideal environmental arrangements (Levy and Newell 2005; Andonova and Mitchell 2010). So, if international climate regulation modifies the economic structures in which businesses are integrated, firms that are more exposed to international trade may suffer from climate agreements and refuse to cooperate. Vice versa, when trade exposure is low, firms may be more open to the regulations following international cooperation, granted they do not face significant costs from abatement. The effect of emissions on preferences for global climate agreements may then be contingent on whether domestic groups enjoy trade openness to begin with. In other words, pollution levels could fail to explain positions on climate cooperation *unless* combined with exposure to trade.

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[1] Riley, Tess. 2017. Just 100 Companies Responsible for 71% of Global Emissions, Study Says. *The Guardian*, July 10, https://www.theguardian.com/sustainable-business/2017/jul/10/100-fossil-fuel-companies-investors-responsible-71-global-emissions-cdp-study-climate-change.

[2] Light, L. 2017. Why U.S. businesses said "stay in the Paris accord", CBS News, June 2, https://www.cbsnews.com/news/paris-climate-agreement-us-corporate-support/.

Genovese, Federica (2019) Sectors, Pollution, and Trade: How Industrial Interests Shape Domestic Positions on Global Climate Agreements. *International Studies Quarterly*, doi: 10.1093/isq/sqz062

This paper investigates this joint effect of pollution and trade openness from the sectoral angle. Industrial sectors are known to generate strong collective action in the area of climate politics (Meckling 2011; Kim, Urpelainen, and Yang 2016). Sector characteristics also go a long way to explain variation in climate policy preferences across countries, as some recent empirical analyses have shown (Genovese and Tvinnereim 2019). That said, heterogeneity also lies *within* sectors, and this paper also investigates the impact of industries that compete in different ways on international trade, distinguishing import- and export-intensive sectors.

I explore my argument focusing on cooperation at the United Nations Framework Convention on Climate Change (UNFCCC). I embrace the premise that in global climate politics, sectors are useful levels of analysis because they often effectively aggregate the majority of firms' preferences for climate regulations (Newell and Paterson 1998). Consequently, I postulate that sectors' emissions and trade attributes affect both the firms' preferences as well as the aggregate positions of the governments they lobby. I propose two hypotheses. First, at the firm level, I expect that firms in high-emission sectors would be more dismissive of climate agreements if they are significantly involved in trade, while trade-open firms in low-emission sectors would be more engaged and supportive. Second, at the country level, I expect that high-emission sectors that are more exposed to international trade should make their governments more resentful of global climate governance. By contrast, low-emission sectors should encourage their governments to endorse cooperation.

I identify the preferences of business groups and national governments on international climate cooperation by resorting to political texts as policy positions (Benoit, Laver, and Mikhaylov 2009). First, I investigate eight years of UNFCCC statements of business associations to evaluate how firms in high- and low-trading sectors discuss global climate cooperation given different emission levels. A structural topic model allows me to correlate the business associations' sectoral emission levels and level of trade openness to the words in their texts. The results show that, conditional on increasing emissions, businesses in sectors that are highly dependent on trade present more vague statements compared with businesses in sectors that are less dependent on trade. By contrast, businesses in low-emission trade-exposed sectors present statements where costs and policy actions have large emphasis. Second, I analyze the effect of domestic sectors' emissions and trade openness on national governments' positions on UNFCCC issues, for which I use new data from the UNFCCC national communications between 2001 and 2011. In line with my theory, the data indicate that governments of countries with significant trade-oriented sectors are less likely to support climate cooperation as their emissions increase.

The findings contribute to the understanding of two-level bargaining and business group activity in international environmental politics at large. They also present a number of general insights for the international and comparative politics literatures. First, the evidence indicates that businesses may be sensitive to direct and indirect implications of international political economy agreements. This is in line with other analyses showing that different aspects of global cooperation may be mutually reinforcing (Bechtel, Genovese, and Scheve 2019). It also illustrates that domestic sectoral activities can go a long way in explaining national positions on global issues, and that global politics is still largely centered on domestic economic conflict. Finally, the findings indicate the extent to which national policies can anticipate and influence domestic 'losers' of international agreements, a point I come back to in the conclusion.

The Argument

Sectoral Politics of Global Climate Cooperation: The Role of Pollution and Trade

Like several cross-national issues, climate change is a multifaceted topic of political debate. As such, it is characterized by many contrasting views across the countries that, to respond to this global public "bad," seek to coordinate policies for mitigation and adaptation under the United Nations (UNFCCC) framework. A large part of the literature on international climate cooperation assumes that the conflicts at the UNFCCC are rooted in the interests of domestic economic actors. However, this scholarship has struggled to pinpoint the motivations of businesses and how these are reflected in governments' positions. The notion that the emission-related costs of complying with climate policy generate opposition for climate cooperation is still prevalent, following the argument that polluters resent agreements because of the material costs of adjustment (e.g., Lund 2013). At the same time, some scholars have suggested that businesses may have incentives to embrace climate action. For example, private companies can extract economic benefits (rents) and political clout (reputation) from adjusting to climate regulation. This conjecture is associated with occasional agreements at the international climate negotiations. For instance, the 2015 Paris agreement was considered successful because some companies embraced its competitive economic benefits. Nonetheless, many previous UNFCCC meetings failed because of resistance from domestic economic forces. Hence, the debate on the domestic economic drivers of disagreements over global climate policies is still largely unsettled.

This paper attempts to provide a sector-based explanation for what looks like contrasting preferences for climate change cooperation. The argument pivots on sectors for a number of reasons. First, collective action theory suggests that businesses within the same sector may relate to each other on collective issues such as the environment, therefore sectoral politics may create important observable cleavages across firms' preferences for international climate policy. Sectoral lobbying also seems fruitful not only for the expected losers of cooperation but also for the expected winners, because while expected losers must conglomerate at the sector to prevent losses from international policy, winners must cooperate to secure the passing of a bill to receive rents (Kim, Urpelainen, and Yang 2016). Consequently, sector-level characteristics may provide important explanations of domestic positions on international climate cooperation.

I postulate that the sensitivity of a sector to the direct (emission-related) *and also* indirect (trade-related) implications of international climate policy influences the preferences of businesses and, in the aggregate, a government's position on global cooperation. The international climate politics literature has long argued that the uneven distributions of GHG emissions across economic sectors is a fundamental reason why the politics of climate change are deeply conflicting (Sprinz and Vaahtoranta 1994). One could reasonably expect that whether a firm belongs to a 'pollution-intensive' sector—meaning that its industry consumes high amounts of energy or produces high levels of GHG emissions—matters when discussing its attitudes towards the global climate regime, because emission reduction

is expensive. Clearly, the structural reasons that make the costs of pollution abatement in some sectors higher than in others may have repercussions on their firms' political preferences (Markussen and Svendsen 2005; Bechtel, Genovese, and Scheve 2019). I assume here that preferences of businesses within a sector will have a normal distribution. So, while some firms may be at the opposite ends of the distribution, preferences generally convergence on an average sectoral position.

Of course, this does not imply that firms in high-emission sectors should unconditionally oppose international cooperation. For example, a group of polluting firms such as Serbia's Electric Power Industry should have consistently pushed their government towards less climate cooperation, while the relatively 'clean' Forest Concession Holders Association of Indonesia should have pressed its government towards stricter climate agreements. Yet, the Serbian association supported international mitigation rules, while the Indonesian forestry association has delayed decisions on liability for deforestation.

One explanation for this puzzle lies in a sector's sensitivity to international trade. Trade is an important determinant of attitudes towards global cooperation, as it creates winners and losers in the international economic system that climate agreements seek to reform. I argue that the level of trade openness of a sector may drive its members' preferences for climate governance. If trade opportunities (and constraints) are most concentrated at the sector level, sectors open to trade may face lower trade barriers and higher benefits from global integration. This may then spill over into governmental support for climate cooperation.

Evidently, in the real world, trading sectors are rarely homogenous, and this also has implications for preferences for international climate policy. Insights from the so-called heterogeneous firm theory make clear that industries with significant export activity can have many firms that only sell to the domestic market and vice versa (Bernard et al. 2007). This argument suggests that trade regulation affects sector-level productivity by rewarding the more-productive, export-oriented companies and shrinking the less-productive firms. So, while sometimes climate cooperation may have concrete sectoral implications as a function of its overall trade exposure, sometimes it may affect a sector on the premise of how much this exports or imports.

This discussion has two implications. On the one hand, while studying preferences at the sector level may blend together interests of within-sector winners and losers from trade, the study of preferences *across* sectors should reveal important connections between international trade and preferences for global climate cooperation, at least for the average firm. On the other hand, if the link between trade exposure and preferences for global climate policies is fundamentally centered on the type of competition a sector is subject to in international trade, then it is essential to distinguish the extent to which a sector is export- or import-competing. Import competition seems to capture, for example, why Indonesia's forestry association rejected international forestry projects embedded in international climate agreements in the 2000s, due to concerns with export-competing forestry firms.

I focus on both views in that I explore the implications of sectors' trade openness as a whole as well as their distinct shares of exports and imports, separately. However, it is worth noting here too that the *unconditional* effect of trade openness on positions on climate cooperation could still be as ineffective at predicting positions on global climate cooperation as pollution is. Some scholars have claimed that trade is associated with support for efficient environmental regulation due to reputation gains among liberalized firms (Vogel 1995). Nevertheless, trade openness may undermine environmental goals, because liberalization incentivizes firms to overcome environmental policy and reduces governments' ability to apply stringent environmental control instruments (Andonova, Mansfield, and Milner 2007). So, overall, it is unclear in which direction trade should drive positions on climate agreements, everything else constant.

Precisely because sectoral emissions and sector-level trade openness may be individually inconsistent in predicting domestic preferences for global climate cooperation, I consider them jointly and argue that a sector's trade openness works as a 'magnifier' of pollution-related concerns of climate cooperation. The premise is that a sector's openness to trade is associated with being embedded in global economic structures that, despite some exceptions, are rarely accompanied by strict environmental regulation (Andonova and Mitchell 2010).[3] So, in the absence of environmental agreements, most trade-oriented sectors may gain from global economic activities, as lower trade barriers benefit the welfare of all trading parties. However, in the presence of environmental agreements, the gains from trade can diverge. On the one hand, trade-oriented sectors that generate high levels of pollution may be less likely to quickly absorb environmental regulation, so they become less likely to take full advantage of trade because of the new regulatory burdens. On the other hand, pollution-efficient trade-oriented sectors may be more productive as they are not affected by the costs of the agreement. They may in fact take advantage of the opportunities enabled by environmental regulation.

This conceptual framework relies crucially on sectoral characteristics within countries, but evidently industries are dependent on the domestic policy context and whether home countries are likely to implement climate policies before or even without international cooperation. If industries believe that their country will implement climate policies regardless of the outcome of international climate negotiations, then they could be more in favor of global climate cooperation if they are more trade exposed, because cooperation limits the free-rider problem by imposing regulatory costs on all major players in the world. But I claim this scenario is largely not what we would observe in reality, for two reasons. First, while international cooperation aims at fair cross-national commitments on emission abatement, the politics of the international climate negotiations de facto concentrate on the institutional debate entrenched in differential commitments across developed (so-called Annex I members) and developing (Non–Annex I) countries. Historically, developing countries have been unbound to any emission abatement target. This asymmetry has given advantages to the most competitive emerging economies, e.g., China and India, which have had lower regulatory expectations than Annex I countries. The UNFCCC negotiations have tried to address this asymmetry, but at a slow pace and with major backlash (Victor 2011). In the meantime, several firms have taken advantage of 'regulatory opportunities' in developed countries while exploiting 'pollution heavens' in developing ones (Aklin 2014). Second, unilateral climate policy is still rarely stringent. The most common market-based regulatory policy, cap-and-trade, is far from being effective in many implementing countries (Green 2017). In

[3] One exception may be the European Union (EU), which is open to trade and also a climate regulation frontrunner. However, the EU has a fragmented pollution management in place and some of its policies have been criticized lately for "softness (Green 2017; Genovese and Tvinnereim 2019)."

short, unilateral domestic climate policies have not provided enough of an incentive for internationally competing sectors to favor broad policy coverage, at least not in the years covered by this paper.

This is not to say that my argument dismisses considerations on how the domestic policy context drives firms' support for international environmental action. My theoretical framework ultimately coexists with the conjecture that international trade can channel progressive environmental regulatory standards introduced at home (Vogel 1995). Rather, my goal is to specify when international trade will do so – namely, when mitigation costs (i.e., sectoral emissions) are moderately low, be it for intrinsic industrial reforms or extrinsic domestic policy efforts. The differentiation of import-competing and export-competing sectors pursued in this paper is also motivated by the importance of domestic regulations, in particular by the claim that domestic regulations are often set up to trigger innovation in import-competing sectors (Vogel 1995). This explains, for example, why Serbia's relatively high-emission and low-export power sector, aiming to access the European emission trading scheme—a domestic climate policy flooded with an abundance of cheap emission credits—was supportive of international mitigation agreements.

Having laid the background to the argument proposed in this paper, I now move on to discuss how different intersections of sectors' GHG emissions and trade openness unveil varying sensitivity to international climate cooperation.

Costs and Benefits of Climate Cooperation for Sectors at Different GHG Emissions and Trade Openness Levels

My argument is that sectoral emissions and sector-level trade openness jointly influence preferences for global climate policy as a function of how international climate cooperation affects industries with varying levels of GHG emissions and trade activity. Before moving on to delineate my hypotheses, I first further specify how different levels of sectors' emissions and trade openness may affect the expected benefits and costs of climate cooperation, so to pin down the mechanisms underlying the investigations in the second half of the paper.

To begin, it is important to note that, while the argument so far has mainly concentrated on the costs of global climate policy, the policy can also generate some direct and material gains. For example, "low-carbon technology producers, financial services providers, and investors can seize opportunities" if a climate regime designs markets that increase their profits (Meckling 2011, p. 23). Global climate regulations may allow these firms to access foreign markets, enabling them to emphasize their contributions to society while safeguarding trade interests. Hence, sectors with a stake in a functioning climate regime typically also have interests in stronger international cooperation, and may constitute pressure groups in favor of stronger reduction targets (Paterson 2012). This is relevant to identify the impact that low and high GHG emissions and low and high trade openness, respectively, can have on preferences for climate cooperation.

I expect firms in high-pollution sectors to be on average resentful of global climate cooperation if highly open to trade, because these frequently thrive in a liberalized system that would need critical reforms under stringent global climate policies.[4] For these sectors, the abatement targets of climate agreements could threaten productivity and economies of scales, as they would need to change their trade-intensive operations—e.g., resizing suppliers and reforming facilities abroad in countries that would sign the agreement. Surely trade openness does not only mean extra competition. It may also mean more access to cheaper foreign goods, which might make high-emission industries more able to adapt to a new international regulation. But this access may be strongly contingent on whether sectors are more export- or import-oriented.

In this regard, I speculate that export-oriented low-emission sectors may welcome climate cooperation because they have more to gain from expanding their efficiency and productivity for external markets. Vice versa, export-oriented high-emission sectors have more to lose in the short run. As Batrakova and Dechezlepretre (2013) indicate, high trade integration in less pollution-efficient industries can lower the appeal of climate policies, because they allow pollution to be shifted rather than abated, protracting the phenomenon of "carbon leakage." On the import side, import competition may lead to a drop in innovation and cleanup, although the literature suggests that most of the productivity shifts may occur *within firms* (Bloom, Draca, and Van Reenen 2016). I expect export-oriented polluting sectors to be especially sensitive to global climate agreements, because these have more immediate price adjustments to make in the context of a stringent climate treaty (Fischer and Fox 2011). Farming in India is a point in case, where the major exporting companies have had big reservations against international climate policy.

I anticipate a different set of preferences for high-emission sectors less exposed to trade and thus less sensitive to international climate agreements. While high-emission sectors in a closed system may still face abatement costs, they are also likely to receive protections that could shield them from the cost of global climate regulation. Furthermore, high-emission sectors that are not significantly exposed to international trade may be more inclined to express support for climate cooperation because, without much trade-induced competition of suppliers, they can simply impose compliance costs on consumers, who may presumably have rather inelastic demands.

Moving on to the 'cleaner' sectors, I expect that a low-emission sector that is not deeply exposed to international trade may show low enthusiasm for global climate cooperation, because they are unlikely to enjoy the market-based opportunities that international climate agreements generate for more outward-oriented 'clean' firms. In other words, low-emission low-trade sectors face lower benefits from global climate regulation compared with firms in low-emission trade-intensive sectors. Hence, this group may lack the salience to get involved in the political debate.[5]

By contrast, I expect high-trade sectors that emit low emissions to enthusiastically support global climate cooperation. These may gain from cooperation standards if they possess clean technologies or low emissions alternatives to existing goods.[6] Export-led productivity grows as a function of clean production, so greening supply chains may be a priority for clean trade-integrated sectors (Bloom, Draca, and Van Reenen 2016, 113). Furthermore, low-emission sectors that are more dependent on international consumers are also more likely to prefer environmentally sustainable

[4] Surely regions such as the EU have integrated by way of increased environmental regulation. However, some scholars have suggested that even in the EU, liberalization has trumped deep environmentalism (Gullberg 2008).

[5] They may possibly embrace global climate policy as a tactic to gain domestic reputation and appeal to 'green' consumers at home, but this may still constitute a second-order priority for these sectors.

[6] For example, the advantage of generating low emissions and engaging in international trade may incentivize investments in clean technology earlier than other low-emission and trade-closed sectors (Urpelainen 2012).

production. Hence, low-emission high-trade sectors may ultimately generate the most climate-action-prone preferences of individual companies. These, I argue, should eventually spill over to global policy support at the national government level.

Implications for Business Statements and Country Positions on Global Climate Cooperation

My theory that a sector's trade activity magnifies the costs and benefits embodied by the sector's pollution levels practically means that, as emission abatement costs *increase*, sectors that are more (less) open to international trade decrease (increase) support for international climate cooperation. I expect this sectoral link to have implications for: (1) businesses that seek to influence the international politics of climate change cooperation; and (2) governments negotiating international climate agreements. Here I discuss how I formulate my expectations at each of these two levels of political action.

A crucial assumption for evaluating my sector-based conjecture of business preferences is that the interests of businesses are discernible. However, in the real world, corporate preferences for global climate cooperation do not necessarily emerge as clearly, especially if these are measured through text as in this paper. Not surprisingly, businesses almost never sound explicitly uncooperative to climate mitigation, but rather prefer to remain vague over expressing policy rejection. To surpass this problem, I rely on the research that frames firms' positions in terms of credible political signals. In this regard, the obfuscation theory presented in Kono (2006) suggests that a lack of positional clarity corresponds to weak support for international policy.

Building on this literature, I argue that vagueness captures disengagement with climate cooperation. Vice versa, a sharp message on the prerequisites of climate cooperation should refer to more salience for a proactive position on climate cooperation. Keeping with this intuition, I assume that, in voicing their stances on climate cooperation, the more reluctant businesses should have few clear references to committed cooperation, while more enthusiastic businesses should use more signifiers for regulation and policy action. This leads me to the first testable hypothesis of this paper:

H1 (Business-level Hypothesis): *Conditional on high (low) levels of greenhouse gas emissions, sectors' high trade openness is associated with businesses in those sectors being more (less) vague in their statements on regulatory approaches for international climate cooperation.*

As per the earlier discussion, I evaluate the general trade openness of a sector as well as its export and import exposure. Following the intuition from trade integration and green supply chains research (Batrakova and Dechezlepretre 2013; Bloom, Draca, and Van Reenen 2016), I expect this interaction effect to be especially prominent if considering sectoral exports.

So far I have discussed how sectoral pollution and trade openness may affect the interest of businesses. However, it is important to bring this discussion to the nation state level, as country representatives are the decision makers whose official positions crucially matter for global climate policy. Neoliberal studies of international politics have long argued that corporations and business associations exert influence on a government's international policy because of their effects on the economy as well as their capacity to prompt voters to punish incumbent politicians (Frieden and Lake 2005). Similarly, some comparative scholars have suggested that governments follow the preferences of sectors facing greater exposure to global economic competition, as these make their national leaders more accountable for their policy positions (Levy and Newell 2005). Altogether, these views suggest that governments' positions on international politics are most consistently tilted towards the preferences of the most sensitive industries. Consequently, it is plausible to expect countries with sectors facing high abatement costs and low benefits from trade regulation to express different positions on global climate cooperation than countries whose sectors possess different characteristics.

A formal sketch of the cooperation utility of a country under different trade-intensive polluting sectors (see the Appendix) illustrates that the benefits and costs of high- and low-trading sectors increasingly diverge as emissions increase. At very low levels of emissions, the utility associated with high-trading sectors is higher than the utility associated with low-trading sectors, so countries with clean high-trading sectors should be more likely to support climate cooperation than countries with clean low-trading sectors. However, the slope of the utility associated with high-trading sectors should be steeper, as—following my argument—these are more sensitive to the constraints of climate regulation. So, at high levels of emissions, the utility for high-trading sectors should quickly become lower than that for low-trading sectors, and this should ultimately translate into more national opposition for climate cooperation. This reasoning leads me to the second testable expectation of this paper, which I frame in terms of overall trade openness:

H2 (Country-level Hypothesis): *Conditional on high levels of greenhouse gas emissions, sectors' high trade openness is associated with their countries being less supportive of international climate cooperation.*

Once again, when differentiating within sectors, I expect export values to be more relevant in driving the relations between sectoral emissions and governments' positions.

Before turning to the empirics, a few points about the hypotheses. First, while my theory assumes that an economy is divided between high/low trade sectors and high/low emission sectors, the empirical analysis takes into account the full (continuous) spectrum of pollution and trade variables. Moreover, while the hypotheses are set up linearly, it is possible that the effects of the interaction of pollution levels and trade openness may not be linear. For example, due to the access to cheap foreign abatement technology, trade openness may have positive effects on the preferences of high-emission sectors up to a threshold in which the utility of access to foreign technology peaks and the costs of adjusting prices overwhelm the utility of climate cooperation. More generally, the linearity may only appear at some minimal threshold of emission levels and trade exposure.[7] Hence, I use both linear and locally smoothing specifications of the empirical models. I will show that, while climate positions on pollution levels and trade openness may not be fully monotone, the overall direction of the effects follows the theoretical predictions.

[7] This is also suggested by the formal derivation of the utility functions for global climate cooperation sketched in the Appendix.

Business Analysis: Effects of Sectoral Pollution and Trade on UNFCCC Statements of Business Associations

Data

My first test seeks to estimate how sector-level emissions and trade openness jointly influence business positions on international climate cooperation. Testing this relation is challenging primarily because business positions are hard to observe. To my advantage, in 2007 the UNFCCC agreed to allow "observer participation" at the Conference of the Parties, in order to make the process of international climate policy making more accountable and transparent. Conditional on participating, external observers are asked to submit their views on the negotiations in written form, so to be made public to the international community. For the purpose of this paper, I focus on "business and industry" associations, which are easily distinguishable from the non-business organizations, and include seventy-three submissions in the span of eight years (2007–2014).[8]

The business submissions to the UNFCCC come with some limitations. The submitting observers need to apply in order to register their participation at the UNFCCC meetings, and the executive secretary has the discretion to admit participants following the successful completion of the admission process. While the appointment is not determined by the applicants' monetary capacity, the application requires significant skills and expertise, e.g., in the creation of additional documents to submit with the application. This implies that the selected observers are not representative of the universe of organizations with stakes in international climate policy: sixty-eight of the seventy-three submissions are from business associations headquartered in countries of the Organisation for Economic Co-operation and Development (OECD), and two-thirds are in Europe.

These characteristics of the observed business associations bear on the external validity of my analysis. However, other features make this an appropriate sample to test my theory. Specifically, the business associations in question represent a range of eight different sectors that vary across levels of GHG emissions and level of trade as a percentage of Gross Domestic Product (GDP).[9] In terms of GHG emissions, thirty-one and forty-two of the associations are in sectors that generate, respectively, more and less than their national average sectoral emissions. In terms of exports and imports by GDP, forty-one and thirty-two of the associations are in sectors that, respectively, are more and less open to trade compared with their national average sector.

The outcome variable is based on the text of the business submissions. I am interested in evaluating the themes in these submissions, which my argument suggests to be correlated with the interaction of sectoral pollution and trade openness. Given the relatively concise nature of the business submissions (roughly 2,000 words each), one could employ qualitative content analysis to identify these themes. However, this task would be inefficient and possibly prone to coding error.

To inductively process the business texts, I employed an unsupervised approach to language processing. Specifically, I used topic modelling to identify clusters over interrelated words in the texts. According to the literature, a topic is a proportion of each of a set of documents, and is distributed over words (Blei, Ng, and Jordan 2003; Roberts et al. 2014). Topic models then can help identify and measure latent themes (i.e., topic proportions) in texts such as the business statements.[10]

In terms of explanatory variables, I constructed two sector-level indicators to capture the effect of GHG emissions and trade openness. With regards to *Greenhouse Gases* (GHG), I relied on the GHG emission profiles of the UNFCCC, which summarize million tons of CO2-equivalent emissions for each UNFCCC member across six main Intergovernmental Panel on Climate Change (IPCC) sector groups (see details in the Appendix). I then calculated a standardized value of sectoral emissions by weighing each sector's emission by the total CO2-equivalent emissions of the country where the business association is based.[11]

With regards to the indicator *Trade Openness*, I calculated the trade-to-GDP ratio as the sum of exports and imports divided by GDP generated by each sector. I collected the values of sectoral imports and exports from the Global Trade Analysis Project (GTAP) database (see notes in the Appendix). I inferred the real value of each sectoral value added by multiplying it to total annual GDP of the country where the business is headquartered. Hence, I essentially collected each country-year-sector emission levels for each sampled business group. Because I also intend to investigate the separate effects of sectoral exports versus imports, I also calculated the measure of *Export Intensity* and *Import Intensity*. These correspond to export and imports divided by GDP for each sector, respectively.

The sectoral rate of pollution across the seventy-three business associations ranges between 0 and 30 percent, where the average is 7.1 and the standard deviation is 6.9. By contrast, the rate of trade openness ranges from 0 to 2.1, with an average of 0.5 and a standard deviation of 0.7. Figure 1 reports the correlation of these explanatory variables for all the seventy-three associations (submissions). The figure also shows the correlations for a number of selected countries. In some states (e.g., the UK and Switzerland) the high-trade companies are cleaner than the low-trade companies, while in others (e.g., France and the United States) the opposite is true. Similar mixed correlations emerge looking at sectors. These patterns point to tensions that different businesses in different countries may experience conditional on sectoral characteristics. These questions are evaluated with the quantitative analysis below.

Estimation Strategy

To identify the topics in the business submissions, I employed a structural topic model (STM) (Roberts et al. 2014). The STM produces estimates for document-topic and word-topic probabilities and is built on a Latent Dirichlet Allocation (LDA) specification, which assumes that each document consists of a mixture of topics (Blei, Ng, and Jordan 2003). Practically, the LDA is a hierarchical Bayesian model estimated in three stages. The process begins by drawing

[8] The associations include EU Turbines, the Federation of Electric Power Companies of Japan, the South African Confederation of Agricultural Unions, Allianz, and the U.S. Chamber of Commerce.

[9] The represented sectors are: Agriculture and Fishing; Mining; Manufacturing; Retail and Trade; Transport; Utility, Water and Electricity Supply; Finance and Insurance; and Administration.

[10] They may not be a perfect proxy for preference; however, topic proportions are often interpreted as measures of latent positions. At minimum, the emphasis on a topic (i.e., its proportion) signals an interest in 'owning' such a topic (Benoit, Laver, and Mikhaylov 2009).

[11] This measure captures the proportional size of the sectoral emissions per business association. Additionally, I calculated the *intensity* of sectoral emissions as the GHG proportions relative to each sector's value added to GDP. The results remain qualitatively similar if I use either of these measures.

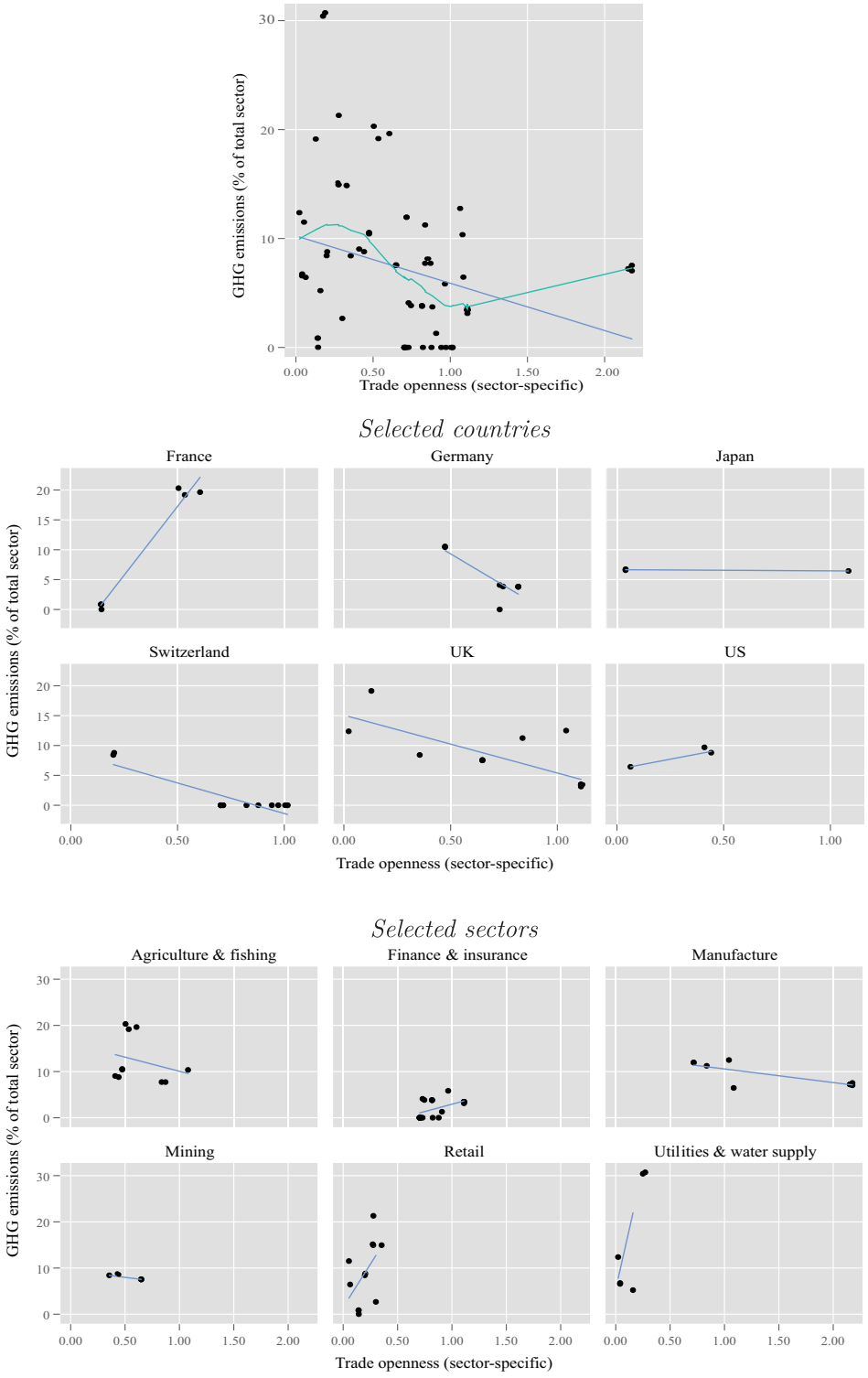

Figure 1. Business associations: distribution on GHG emissions and trade openness
Notes: The figure shows the distribution of the sectoral variables associated with the business associations. The top figure shows the distribution across sectors' GHG emissions and sectors' trade openness. The subfigures show the variables by selected countries and sectors. Data for 2007–2014 are pooled. Straight lines are linear fits (a curvilinear line is a non-parametric polynomial fit).

a multidimensional Dirichlet vector that captures the expected proportion of topics in each document *i*. For each word in each document, the algorithm proceeds by sampling an indicator from a multinomial distribution whose main component denotes which topic each word *j* is associated with. The process ends by sampling the actual word indicator w_{ij} from a multinomial distribution, hence calculating the distributions over terms associated with *k* topics.

The STM's innovation to the LDA estimation structure is that the prior distribution of topics can be influenced by covariates. Hence, the probability of topics within documents can be specified so to test whether these change as a function of contextual, document-level variables (Roberts et al. 2014).

My STM analysis includes three crucial covariates: the sectoral indicator of GHG emissions; the sectoral indicator of trade openness; and their interaction. It also includes year and country fixed effects. Controlling for too many covariates risks making the STM intractable; however—as I show in the Appendix—the results are not sensitive to adding control variables, for example, the sectors' size.[12]

Results

Before describing the structural topic model estimates, I first introduce the topics identified in the UNFCCC business statements and their substantive meaning. I show a four-topic analysis to ease the interpretation of the topics; however, the results are qualitatively similar if they are estimated with a ten-topic model (see the Appendix).

The top of Figure 2 shows the most probable words for each of the identified topics. Topic 1 captures vague language linked to climate change, such as *carbon*, *mitigation*, *mechanism* and *nation*. These generic terms are hardly associated with any precise position on global climate cooperation, as they are often used to refer to UNFCCC jargon (e.g., 'low *carbon* economy'). By contrast, other words seem to refer to more specific discussions on climate policy, especially with preferences for effective regulation. The words *approach*, *risk* and *support* loading on Topic 3 seem to emphasize exhortation to policy. A qualitative evaluation indicates that these terms are prominent in the statements of 'clean' businesses, which have more to gain from climate regulation, such as the International Emission Trading Association (IETA).

The estimated coherence and exclusivity scores (Roberts et al. 2014) of the four-topic model corroborate the interpretation that Topics 1 and 3 reflect different 'sentiments' for climate cooperation. At the bottom of Figure 2, Topic 1 appears as the least consistent topic of the model, while Topic 3 is more exclusive and internally coherent. A way to think about these quality scores in relation to the theoretical expectations is that, if Topic 1 characterizes words that are more ambiguous and, thus, vaguely related to a precise position on climate cooperation, then they should be correlated with high trade openness as emissions increase, because the losers of climate cooperation should concentrate on them. By contrast, words explicitly linked to the implications of active cooperation may be less correlated with high trade openness as emissions increase, because the winners of climate cooperation should place more emphasis on words that support, e.g., market-based regulation and the discussion of 'cost' and 'risk' (Topic 3). Excerpts of the business statements suggest that this may be the case. For example, the oil industry association IPIECA (submission of 2007) did not focus on any of these words, while the low-emission, high-trade Climate Market and Investors Association (submission of 2012) mentioned them multiple times.

The STM analysis allows me to further explore the correlations between these topics and the explanatory variables of interest. The effects of the covariates and their multiplicative term on the prevalence of Topics 1 and 3 are plotted in Figure 3, where the central line is the linear prediction for each variable and the upper and lower lines are the confidence intervals.

The unconditional results (top of Figure 3) indicate that the effect of *Greenhouse Gases* on the prevalence of Topics 1 and Topic 3 virtually constant. So, in contrast to the common wisdom, there is no difference between the relative salience of these topics across associations that produce more or less GHG emissions. The expected proportions of Topics 1 3 vary more substantively as a function of *Trade Openness*.

Crucially for my theory, the central panels in Figure 3 show the linear interaction effects of sectoral *Greenhouse Gases* and *Trade Openness* on the prevalence of Topics 1 and 3. High values of trade openness conditional on high emission levels correspond to more ambiguity (Topic 1) and less regulation-specific language (Topic 3). Thus, high-trade associations that face high costs from pollution abatement resort to more vague words than business associations that face fewer abatement costs. By contrast, the joint effect of emissions and trade openness decreases the proportion of text about Topic 3.

The less-smoothed lines of the proportion of these relevant topics are also plotted in Figure 3. This plot shows that, at least up to a certain threshold, the multiplicative term of emissions and trade openness increases the proportion of text loaded on Topic 1. Although the effects are less stable at high values where information is scarce, the results at the core of the data distribution support the conjecture that less support for climate cooperation emerges in texts of associations that are in high-emission and high-trade sectors. In other words, as sectoral emissions increase, businesses in open trade sectors speak less forcefully of the *market approaches*, *risk* and *implementation* related to deep climate cooperation. The opposite is true of businesses in open trade sectors where emissions are low.

This evidence is in line with my first main hypothesis. It is also robust to a number of alternative measures of GHG emissions and trade exposure as well as the inclusion of sectoral size and other specifications reported in the Appendix. However, a corollary of the first hypothesis is that export-involved sectors may be the more sensitive sectors – in other words, the sectors where the low and high levels of GHG emissions may make the biggest difference in predicting preferences for or against global climate cooperation. In order to evaluate this additional angle, I estimated the same STM models with, respectively, the measures of import and export intensity described above.

Figure 4 presents the non-parametric illustration of these results. The effects are overall similar, in that the interaction of sectoral GHG and the sectoral level of imports (on the left side) and exports (on the right side) is negatively correlated with the more specific, action-related words. Contrastingly, the joint effect is initially positive and then eventually negative with respect to Topic 1. Most strikingly, in the calculations with import values the two effects overlap and are hardly indistinguishable, while the effects calculated with export values are much more distinct and statistically distinguishable. This means that the export values are much more relevant in identifying the effect of pollution and trade on the topics embedded in the businesses texts. This largely supports the claim that the most competitive—but also more exposed—forces within a sector may be the main drivers of the debate on global climate action.

[12] One of the limitation of the STM approach is the direct interpretation of covariates' marginal effects. In this study I mostly focus on the directionality of the results.

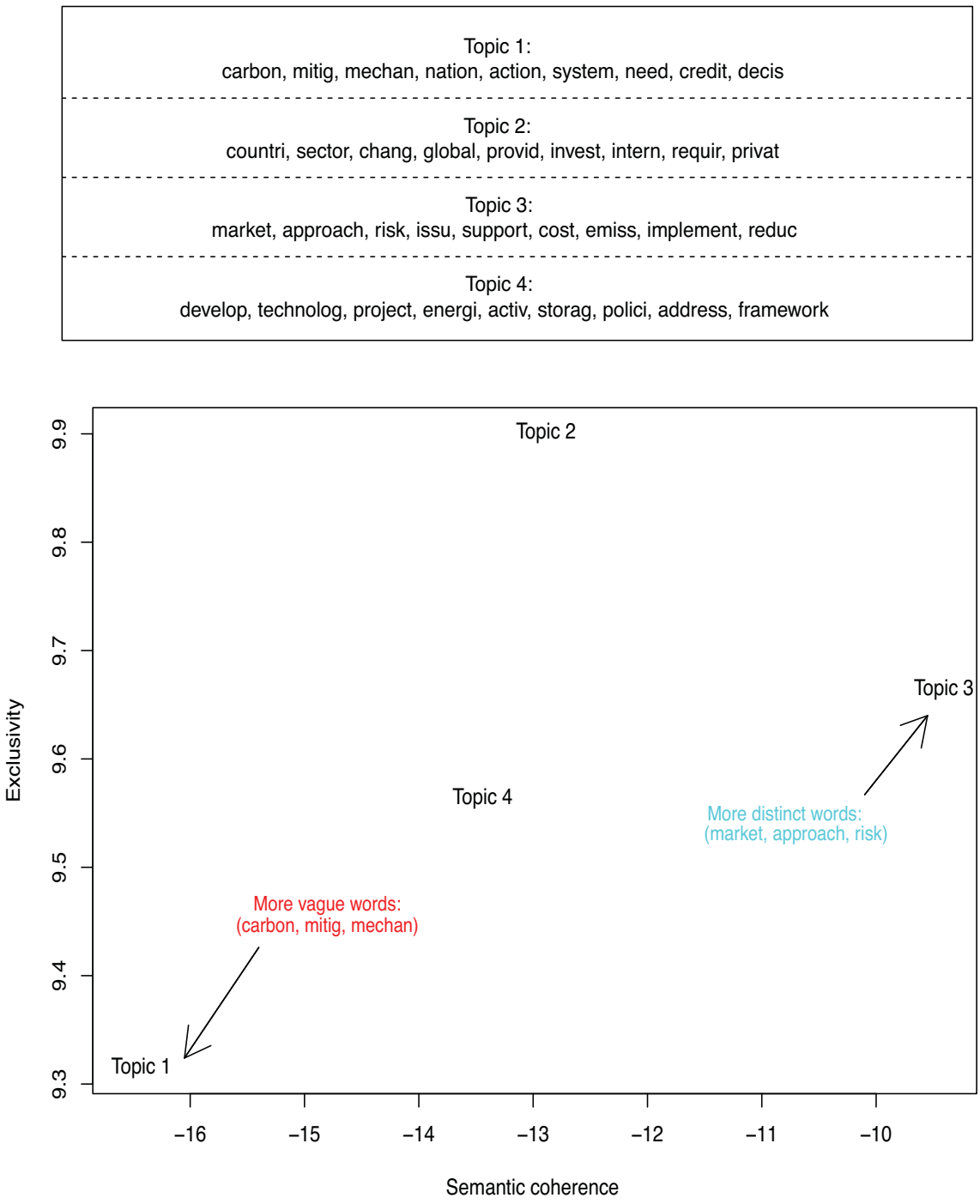

Figure 2. Four-topic model metrics of business statements—most probable words and quality scores
Notes: The top of the figure shows the eight most probable words of a four-topic model of the business submissions, while the bottom right of the figure shows the most semantically coherent and exclusive topics of this model.

Cross-Country Analysis: National Positions on Climate Cooperation at the UNFCCC

Data

The previous analysis showed that the trade openness of industrial sectors, moderated by their emission levels, influences business attitudes towards climate cooperation. In this section I test whether this mechanism explains the variation of governments' positions at the UNFCCC. As for the previous set of tests, the main challenge with pursuing this analysis is that standard measures of national positions on international climate cooperation are virtually inexistent. I address this problem with data based on the National Communications (NCs) that national governments periodically submit to the UNFCCC. The NCs are not ideal for topic model analysis because they are structured into chapters and they are long and complex. Consequently, the state-level positions were collected with a careful qualitative coding exercise.

The data coding followed a measurement procedure in which governments' positions were coded for the most

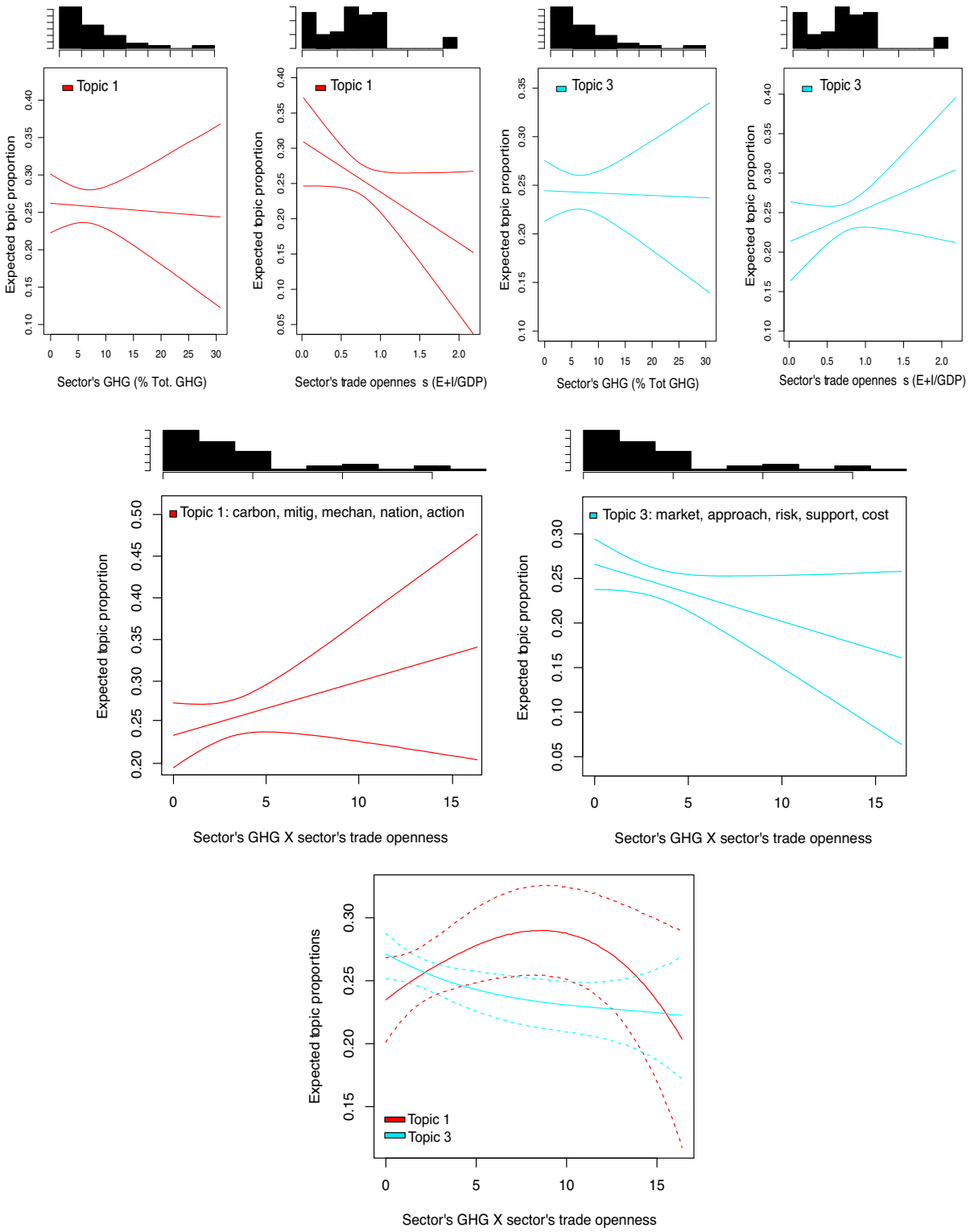

Figure 3. The effect of sectoral considerations on business submissions at the UNFCCC
Notes: The plots report the correlation between the sectoral covariates and the topical content of the business texts. The results are based on an STM specified with four topics (Figure 2). Central lines correspond to the estimated linear effect for Topic 1 and Topic 3 respectively, while the external lines correspond to the 90% confidence interval.

relevant agenda points discussed at two moments at the climate negotiations, namely the meetings before the Kyoto Protocol's entry into force (2001–2004) and the post–Kyoto Protocol negotiations (2008–2011). The NCs were divided into natural language passages (one sentence or a logical set of sentences). Then the coders evaluated the passages, and placed them on predetermined issue-specific scales. The dataset includes 43 UNFCCC issues for 173

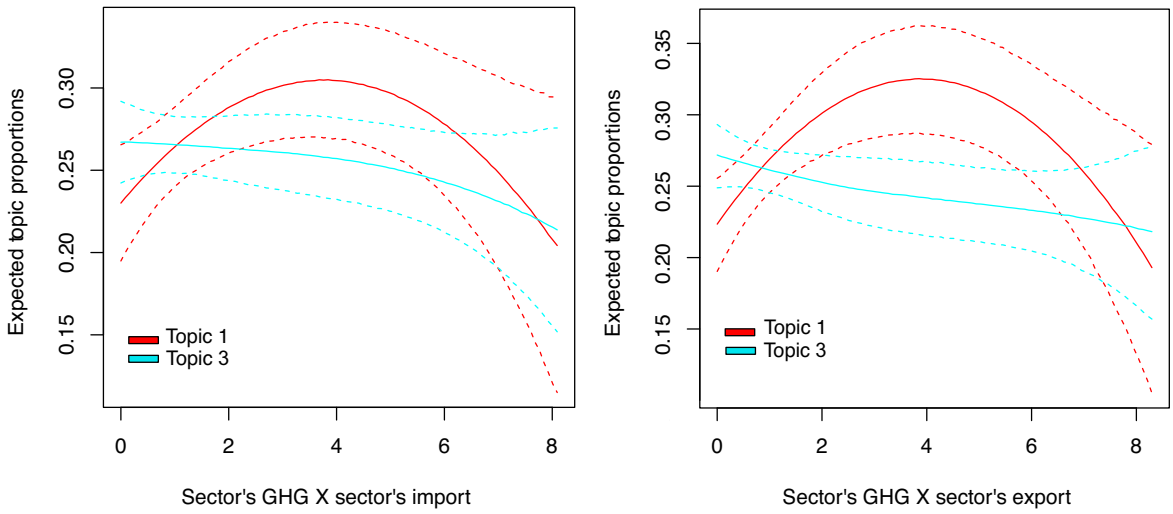

Figure 4. The effect of sectoral considerations on business submissions by import and export intensity values
Notes: The plots report the nonlinear effect of the interaction of sectors' GHG emissions and their sectoral import (left) and export (right) values on the topical content of the business texts. The results are based on an STM specified with four topics (Figure 2).

national governments (115 countries, of which 60 observed at both times).[13]

The data are unique in that they are the first to provide comparable information on national positions across policies in international climate agreements. For example, the dataset measures how countries mention the principle of historical but differentiated responsibility. Their positions are thereby coded on a binary scale where zero corresponds to the preference for maintaining the principle, and 1 the preference for modifying the principle. Similarly, the dataset captures what level of temperature increase each country would be willing to accept by 2020–2050 from one to three degrees Celsius, how much money they would invest/provide in adaptation funds (as a fraction of GDP), and how they best perceive technology transfers to be channeled via international assistance (ranging from minor priority to technology transfers in assistance schemes to maximum priority). As Figure 5 shows, the issue-specific positions are distributed on standardized, interval-based scales, where the lowest values correspond to a preference for a minimal level of cooperation, i.e., the status quo.

Although the data are purposefully coded at the issue level to provide rich information on national positions, the purpose of this paper is to estimate preferences for a broadly defined measure of global climate cooperation. To quantify such a position, I make use of an aggregated score calculated with a factor analysis of the issue-specific data. To accommodate the ordinal and continuous variables in the dataset I used an estimator for Bayesian mixed factor analysis. Leveraging the estimated latent scores of the main factor identified by the Bayesian estimator, I constructed an issue-aggregate indicator for each national position at the global climate negotiations.

Figure 6 reports the country means on the main latent factor scores for each of the two periods, which roughly range on a scale between ±1.75. The factor loading can be interpreted as a variance between 'cooperation-optimistic' and 'cooperation-skeptic' countries. Many developed countries cluster on the top right-hand of the scale, while several developing countries are located at the low end of the distribution. Note, however, that the figure also highlights other types of cross-national differences. For example, exporters of green technologies like France, the Netherlands and Germany are at the top of the distribution, while natural resource exporters like Congo and Jordan are at the bottom. The estimates with little association to either side of the dimension (close to zero) include the United States (for period 2) but also Brazil (for period 1), and China and India (for both periods).

It is worth noting that the qualitative coding behind the factor scores passes typical thresholds of intercoder reliability and validation tests with other text analysis methods.[14] These checks show that a large part of the variance of words reflects the main dimension of national positions estimated with the factor analysis, therefore confirming the strength of this factorization. Nonetheless, it is possible that the UNFCCC bargaining space is multidimensional. After all, not all issue-specific positions align with each other on the first factorized dimension, which suggests that the analysis of issue positions may be warranted.[15] Thus, in additional analyses I also investigate issue-specific positions that may be especially relevant to one sector and not the others, to test whether a sector's emission and trade levels better fit the government position on issues where that sector should have more salient concerns.

The main explanatory variables closely reflect the variables described for the analysis of business statements: GHG emissions and trade openness by GDP. However, in this analysis these indicators cover only a subset of the sectors covered by the previous analysis for two reasons. First, with regards to the GHG emissions, while data for natural resource-based industries are easy to access, for many

[13] See the Appendix for the list of countries by period of analysis. The criteria used to identify and scale the issue spaces, in addition to coding reliability and imputation techniques, are described in Genovese (2014).

[14] I estimated the unidimensional preference scale through the Wordfish algorithm, which assumes that words follow a Poisson distribution (Slapin and Proksch 2008). The correlation between the Wordfish score and the latent score is ~0.7.

[15] The factor analysis reveals a non-negligible factor 2. See discussion in the Appendix.

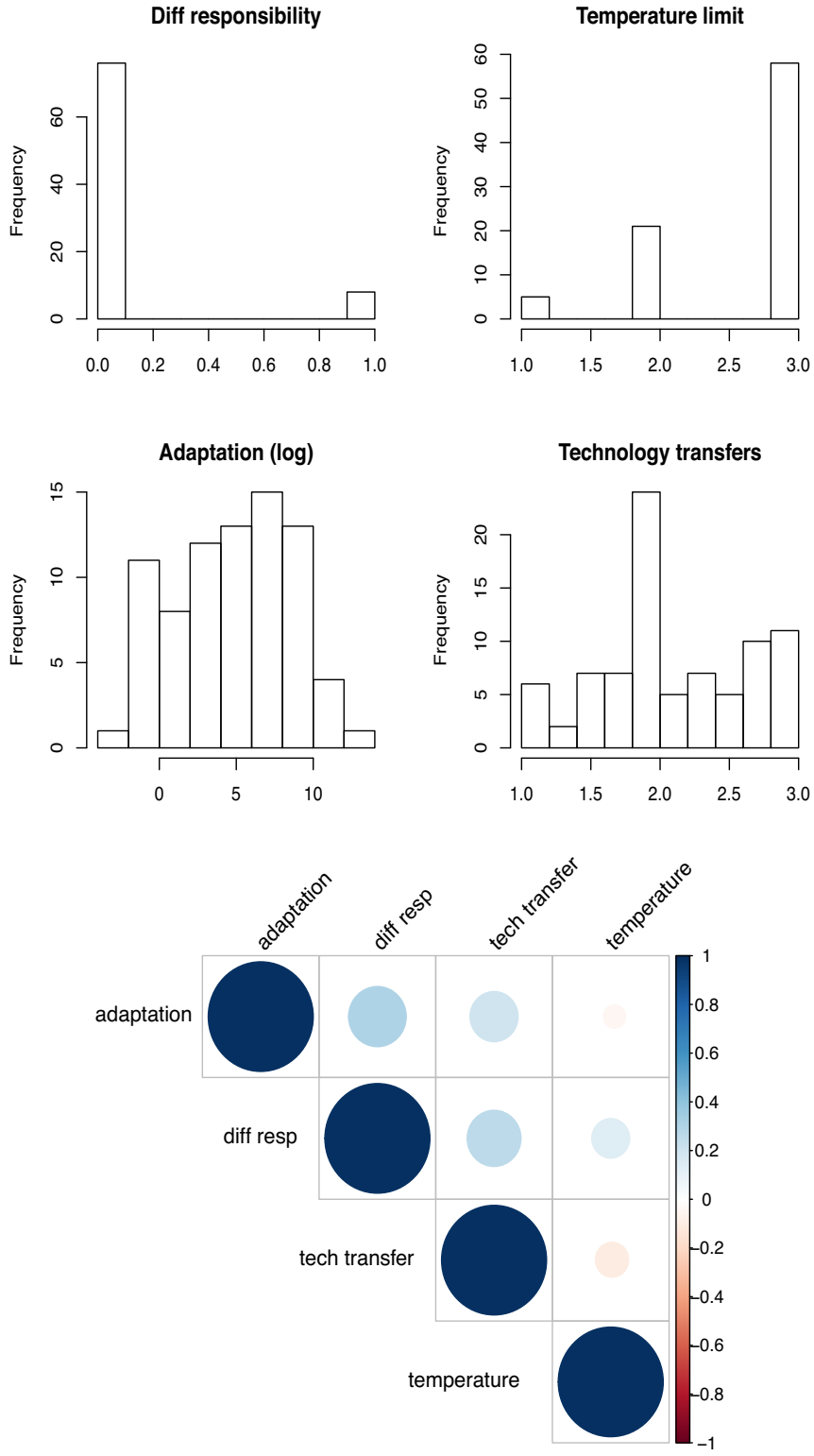

Figure 5. Distribution of selected issue-specific positions at the UNFCCC
Notes: The histograms illustrate the distribution of national positions on a subset of issues at the post–Kyoto Protocol climate negotiations (2008–2011). The plot below shows the correlations of the positions across these issues.

countries there is no reliable information on residential, transportation, and general service sectors. Furthermore, the distribution of trade values for some of these sectors is extensively skewed towards developed countries, driven by the fact that rich states tend to import or export more from industries such as transportation, communication, or finances. To strive for the most balanced variables, I concentrate only on sectors where data were abundant and development-related selection biases could be limited. Consequently, I focus on GHG emissions and trade openness

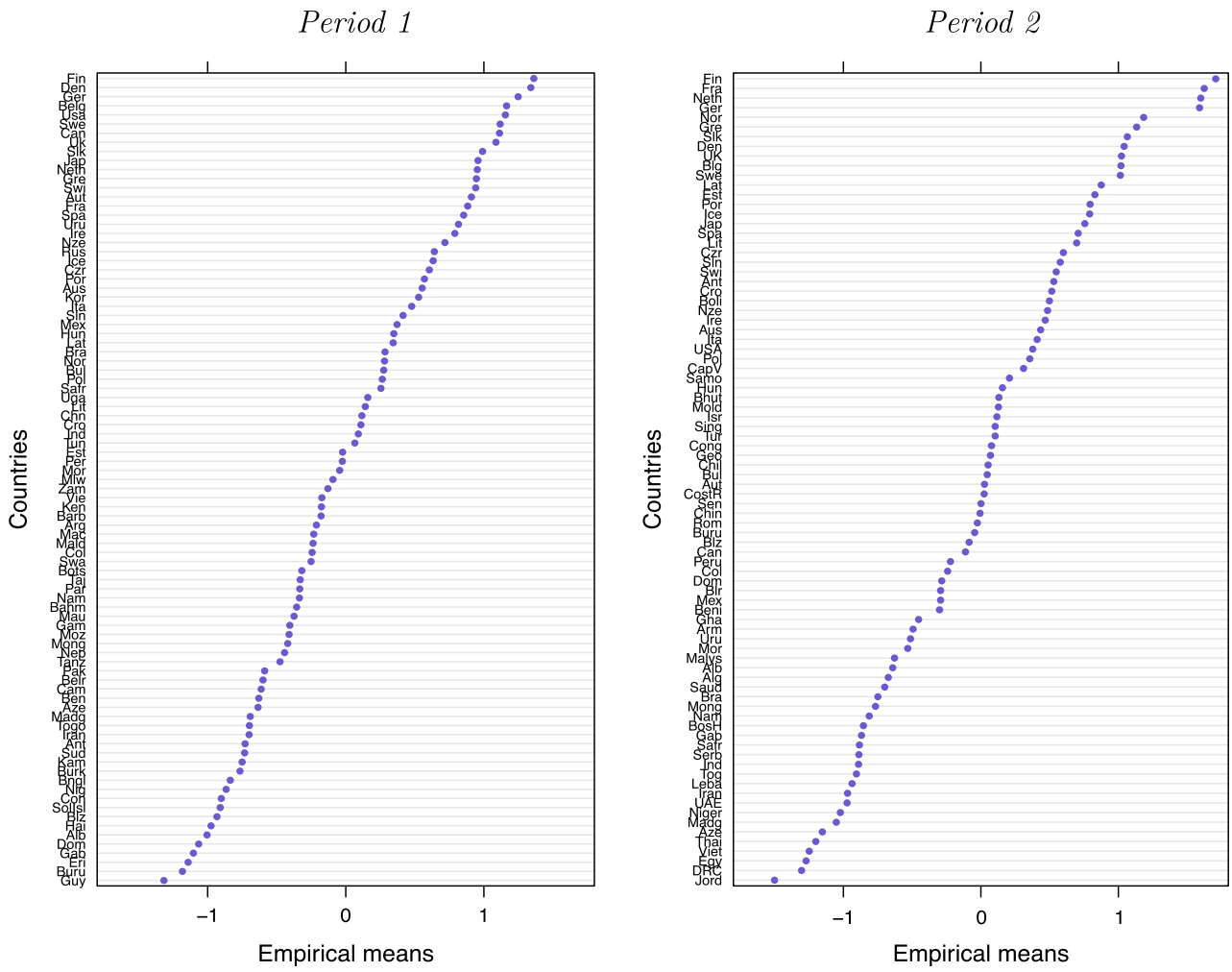

Figure 6. Main factor score distribution
Notes: The plots illustrate the distribution of the mean country scores calculated with the mixed factor analysis of the NCs for period 1 and period 2, respectively.

levels of three sectors: *agriculture*, which includes farming and forestry (ISIC A); *mining*, which includes oil, gas, and mineral extraction (ISIC B); and *manufacturing* (ISIC C), which includes textiles, electronic equipment, machine assembling, and food processing.

As for the previous measurement, each sectoral emissions indicator comes from the GHG Emission Profiles of the UNFCCC, and is the million tons of CO2-equivalent emissions divided by each country's total CO2-equivalent emissions. Because national positions are measured at the 2001–2004 and 2008–2011 time windows, I take the mean of the sectoral CO2-equivalent emission for those years, respectively. Additionally, sectoral trade openness is the sum of exports and imports divided by the GDP generated for each sector as reported in the GTAP database. I use GTAP 6 for the trade values for the 2001–2004 period, and GTAP 7 for the 2008–2011 period. Due to a wider distribution compared with the business-level trade openness measure, in this analysis I use its logged transformation.

The distribution of countries across these indicators shows large variation. For example, on the agricultural sector, the data suggest that more than twenty percent of national emissions in most African countries come from farming. However, agriculture in these countries is not equally dependent on international trade. For instance, while Nigeria and Botswana have similar agricultural emissions levels (around twenty-five percent of their national emissions), in the 2000s the former became a much bigger trader of agricultural goods than the latter. Following my theory, the concerns with abating emissions together with the expectations of market regulation should have pushed Nigeria towards a less cooperative position at the UNFCCC. In other words, Nigeria's aggregate position on the climate cooperation dimension should be systematically lower than the position of Botswana, which is what the descriptive data suggest. I validate this further with the econometric analysis that follows.

Estimation Strategy

Given the structure of my country-level data, I resort to a linear statistical model with robust standard errors, although the results are not sensitive to the error clustering. The model follows the specification:

$$Position_{it} = \alpha + \beta_1 GHG_{it} + \beta_2 TradeOpenness_{it} + \beta_3 GHG_{it} * TradeOpenness_{it} + \gamma X_{it} + \eta_i + \theta_t + e_{it}$$

where i indexes each country, t indexes each of the two time periods, η_i and θ_t are respectively country and period

Table 1. The effect of pollution and trade openness on national positions on climate cooperation

	Y: Climate cooperation position (main factor loading)					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Agriculture: GHG	0.010	0.031*				
	(0.012)	(0.015)				
Agriculture: trade openness	0.026	0.248***				
	(0.065)	(0.117)				
Agriculture: GHG* trade openness		−0.007*				
		(0.003)				
Mining: GHG			−0.005	0.057**		
			(0.016)	(0.023)		
Mining: trade openness			0.087	0.223***		
			(0.032)	(0.056)		
Mining: GHG* trade openness				−0.012**		
				(0.003)		
Manufacture: GHG					−0.013	0.111**
					(0.009)	(0.034)
Manufacture: trade openness					0.174*	0.351***
					(0.067)	(0.086)
Manufacture: GHG* trade openness						−0.030***
						(0.009)
Control variables	√	√	√	√	√	√
Adjusted R^2	0.697	0.708	0.703	0.718	0.714	0.727

Notes: The table reports the coefficients of linear panel models with clustered standard errors. Constant, period, and country fixed effects are omitted for presentation. $N = 173$. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

fixed effects parameters, and e_i is the error term. The variable $Position_i$ corresponds to each country's factorized score of climate change positions obtained from the NCs. GHG_i is the emissions indicator for each of the three sectors for which I estimate separate regressions, while $TradeOpenness_i$ is the equivalent (logged) trade-related indicator. The multiplicative term is the parameter of interest. I expect β_3 to be negative for all sectors, following the conjecture that pollution abatement costs should be exacerbated if industries are international traders, in which case sectoral lobbies should push governments to be more opposed to international climate agreement.

The parameter X_i is a vector of additional variables that account for possible confounders.[16] Following the literature, income may significantly affect the climate policy attitudes of governments. So, to control for income, I control for the logged GDP per capita in constant U.S. dollars (Gleditsch 2002). I include the logged CO2 emissions per capita from the UNFCCC website to keep constant the levels of population-weighted pollution that could drive countries' preferences for climate cooperation. I also control for the squared term of CO2 per capita, as there may be an inverted-U-shape relation between positions and pollution per capita. Furthermore, some research points to risk perception and vulnerability to climate change as a determinant of governmental policy preference (Leiserowitz 2006), so I control for the log of the averaged national values of the Germanwatch 'Climate Risk Indicator' (CRI). Additionally, the literature suggests a strong relation between democracy and environmental protection, so I use a binary variable that takes the value of 1 for democracy and 0 for non-democracy.[17]

These variables are the core controls of my main specification. In additional analyses, I also operationalize a measure for government ideology adopted from the Database of Political Institutions (Knack and Keefer 1995), because party politics may affect government orientations towards international climate cooperation (Neumayer 2003). I also keep constant the sectors' tariff rates to capture trade idiosyncrasies that may affect the trade openness measure and spoil my inference. Finally, the domestic pressure by environmentalist non-governmental organizations (ENGOs) may also influence states' positions at the UNFCCC. To address the simultaneous yet separate effect that ENGOs may have on governments' positions, I ran the models including the total number of national ENGOs (Bernauer, Böhmelt, and Koubi 2013), which I calculated taking the average sum of environmental groups present in each country.

Results

Table 1 illustrates the main results from the regression analysis. I report separate models for agriculture, mining, and manufacturing, but the results are also consistent if I include all sector-specific variables (see the full model in the Appendix). For each set of sector-specific regressions, I report one baseline model that excludes the main multiplicative term and a model with the interaction. In the interest of space I focus on the effects of the central variables. Regarding the control variables, which are reported in the Appendix, it is worth noting that among the control variables the most reliable covariates are the democracy dummy and the vulnerability indicator, both of which are positively correlated with pro-climate cooperation positions across all sectors' specifications (p value < 0.05), in concordance with the literature.

The results from the unconditional models show that *GHG* and *Trade Openness* are consistently insignificant. In other words, the models that ignore the interaction between

[16] These variables are respectively averaged for the years that constitute the two periods under analysis.

[17] I define democracies following Bormann and Golder (2013). My indicator is binary and takes the value 1 for their regime value of 0–2, and 0 for values above 2.

sectors' pollution levels and trade openness suggest that neither pollution nor trade have partial effects on countries' positions on climate cooperation. This is evidence against the common perception that either of these two factors unconditionally predicts support for climate agreement. Moving to the models that include the interaction term, I find that both the *GHG* and the *Trade Openness* coefficients are positive and, especially for the trade variable, statistically significant across all models. This means that international trade openness is correlated with more cooperative government positions when the sector's GHG emissions are equal to zero – and vice versa for *GHG*. More crucially for my theory, the term *GHG* Trade Openness* is negative and statistically significant across the three sets of models. The interpretation here is that a country where economic sectors are trade exposed and environmentally inefficient is more likely to take an overall less cooperative position on climate cooperation. The results are qualitatively identical if I control for government attributes, trade tariffs, and number of ENGOs, and they hold if I estimate all the partial correlations in the full model specification. So overall, the data confirm the hypothesis that, conditional on high expectations of abatement costs, the trade dependence of domestic sectors turns governments against global climate cooperation.

Although the coefficients of the interaction term take small values, recall that the outcome variable is measured on a ± 1.75 range, so a small change on this scale is nontrivial. To illustrate the substantive meaning of the interactions, in Figure 7 I plot the marginal effects of trade openness on the score of climate cooperation as the level of GHG emissions changes.

The upper plots assume strict linear effects, while the bottom plots are calculated with a local non-parametric regression that allows for non-monotonicity. The linear plots indicate that, while at low levels of emissions (below twenty percent) all estimated effects of trade openness are above zero, as emissions increase the effects drop below the zero line. Thus, as a sector increases its emissions by one percent, a one percent change in trade openness causes roughly a 0.1 negative change on the climate cooperation scale. This interpretation is substantively similar to the inference one can draw from the non-parametric regression, although here the plots suggest that the negative changes occur only above twenty percent emission levels and may be positive below ten percent. This is not inconsistent with the theoretical argument. It is also reasonable if one concentrates on very protective sectors in a state of autarky, as for example some manufacturing industries in developing countries. Hence, the statistical results for countries above a minimal threshold of development confirm that high-emission, trade-open sectors are more likely to constrain governments' positions.

The results are robust to a range of different measures and alternative tests reported in the Appendix. One may ask, what aspect of trade openness really drives positions on climate cooperation? In particular, is it the sensitivity to imports or the opportunities of exports? I tackle this question by unpacking trade openness and separating the import side from the export side. The results in Table 2 indicate that only export openness has significant effects when interacted with emission levels. This is in line with the argument that more competitive firms are more exposed to the costs and benefits of climate policy adjustment. One way to think about this is that access to international consumers and opportunities to sell abroad make climate policy overall more salient. Hence, while trade openness as a whole may still matter, the propensity to export more crucially deteriorates or strengthens national support for climate agreements depending on how emission intensive a country's industries are.

I presented aggregate evidence in the direction of my theory, but one may still ask how these results capture the fine-grained causal process assumed in my argument. It turns out that zooming into some specific cases corroborates the highlighted quantitative findings. Consider for example Denmark and Iceland, two similarly small-sized European democracies that actively participate in international climate politics. Both countries owe circa fifteen percent of their GDP to their industrial sectors. However, their manufacturing sectors are substantively different. While both Denmark's and Iceland's manufacturing are oriented to export, Denmark's manufacturing is notoriously 'green', because of the large emphasis on high-technology equipment and—noticeably—due to the focus on renewable energy technology production. In the 2000s, Denmark spent around one-and-a-half percent of its GDP in trade-incentivizing instruments to strengthen its renewable energy production, in particular wind. In contrast, Iceland's manufacturing has more heavily relied on the 'dirty' production of aluminum and silicon, which are the most widely exported manufacturing goods.

Following my theory, these internal industrial arrangements would indicate that, in relative terms, these countries have adopted different domestic positions on international climate policies. In support of this view, the country scores in Figure 6 indicate that Denmark is by roughly. 5 points more cooperative than Iceland. Along similar lines, several reports indicate that, a few months before the 2009 Copenhagen meeting, the Confederation of Danish Industries approached the government of President Lars Rasmussen proposing a public–private partnership for wind-powered energy. The government eventually supported the proposal of the Danish lobby, making it a part of its argument for international clean technology exchange through the UNFCCC. By contrast, Iceland has been less ambitious on agenda issues related to technological development and exchange. This difference pertains to the years analyzed in this paper, but has also persisted more recently. For example, recent contributions of Denmark and Iceland to Global Environmental Facility projects have differed, where Denmark has shown relatively more enthusiasm than Iceland.[18] This maps on the fact that, while Denmark achieved large emission reductions in competitive sectors between 1990 and 2011, Iceland has in fact increased its emissions.[19]

Conclusion

Political scientists have long debated the motivation of domestic economic actors in international politics and the mechanisms through which these affect states' positions on international agreements. There is a general consensus that business groups support global policy cooperation as long as their material interests are protected. However, the nature of these interests is often unspecified. I argued that this lack of qualification has limited the analysis of business preferences and governments' positions in international climate cooperation. Here, the common wisdom is that pollution

[18] UNFCCC. 2018. *Report of the Global Environment Facility to the COP.*

[19] Nordic Council of Ministers. 2014. "Nordic Climate Policy". Copenhagen: Nordic Council of Ministers.

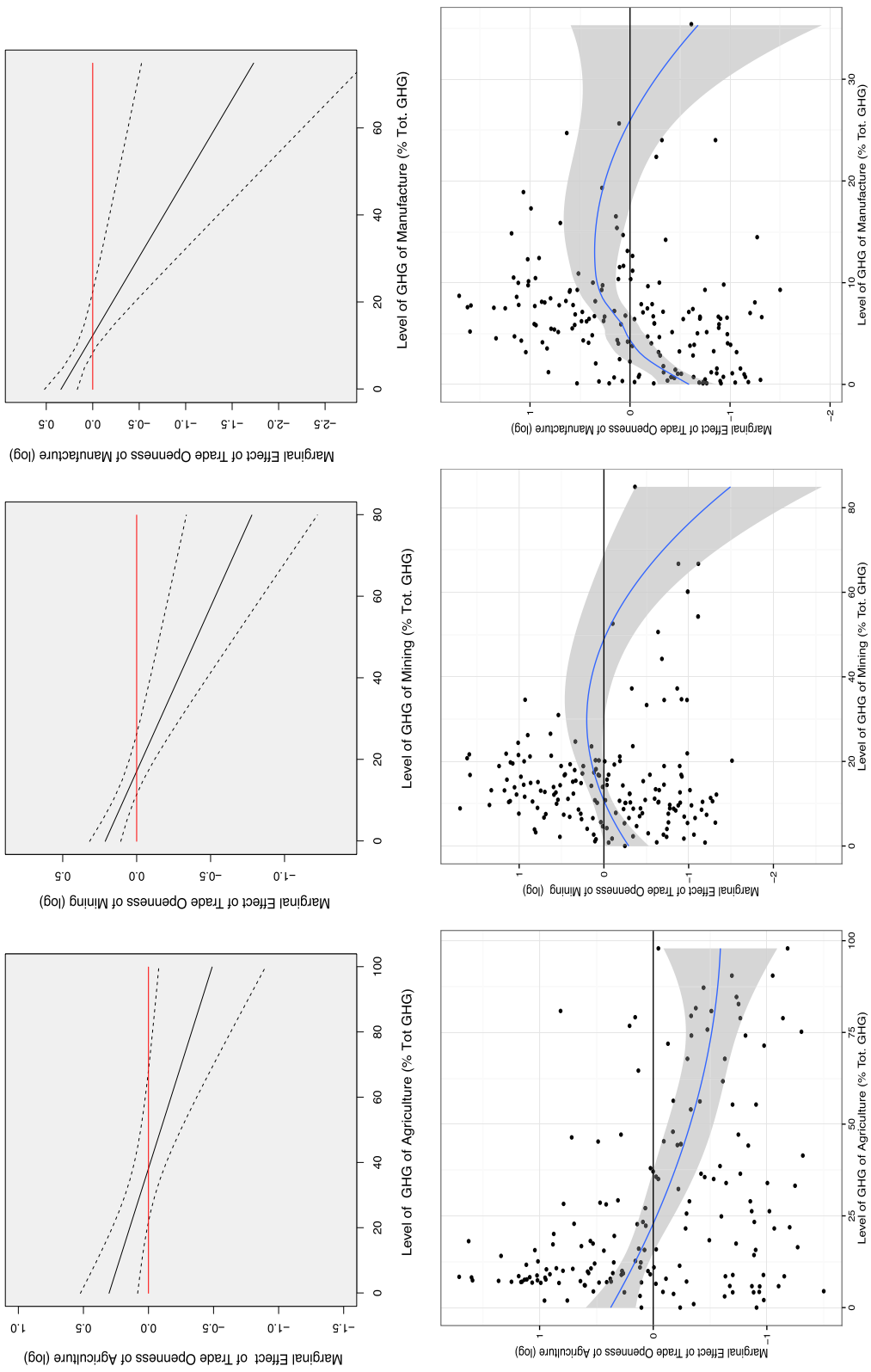

Figure 7. The effect of sectoral considerations on national positions on climate cooperation: trade openness as GHG emissions increase *Notes:* The plots illustrate the linear (top) and non-parametric (bottom) marginal effects based on the interactions in Table 1.

Table 2. The effects of sectoral GHG emissions and sectors' import and export values on national positions on climate cooperation

	Y: Climate cooperation position (main factor loading)					
	Agriculture		*Mining*		*Manufacturing*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Sector's GHG	0.017	0.029	0.012	0.046*	−0.055*	0.055*
	(0.015)	(0.013)	(0.022)	(0.018)	(0.022)	(0.020)
Sector's import openness	0.033		−0.028		−0.073	
	(0.121)		(0.070)		(0.067)	
Sector's export openness		0.242*		0.219***		0.276***
		(0.138)		(0.060)		(0.075)
Sector's GHG* sector's import openness	−0.003		−0.001		0.008	
	(0.003)		(0.004)		(0.005)	
Sector's GHG* sector's export openness		−0.008*		−0.011***		−0.022***
		(0.003)		(0.002)		(0.007)
Control variables	√	√	√	√	√	√
Adjusted R^2	0.693	0.720	0.692	0.730	0.697	0.719

Notes: The table reports the coefficients of a linear model with clustered standard errors. Constant, period, and country fixed effects were calculated but are omitted for presentation. $N = 173$. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

abatement costs drive firms to oppose global cooperation. However, this expectation has led to mixed empirical findings.

This paper seeks to provide a careful evaluation of motivations for climate cooperation that stem at the sector level. I argued that a sector's openness to international trade mediates the effect of abatement costs on preferences for international climate cooperation. Furthermore, I posited that the trade openness and emission levels of a country's major sectors jointly explain not only business attitudes but also national positions on international climate cooperation. To test the argument, I proposed two empirical studies that employ industries' emissions and trade openness measures on the explanatory side and textual data on the outcome side. The results are consistent with each other and support the central argument of the paper: trade openness exacerbates climate policy opposition of high-emission sectors while it intensifies support of trade-open sectors with low emissions.

The presented findings contribute to the understanding of the domestic foundations of global agreements, proposing clear economic justifications for national opposition for global climate policy. They engage with classical political economy debates on how to incentivize private economic actors to provide public goods (Newell and Paterson 1998; Urpelainen 2012). They also provide additional evidence to the body of research arguing that sectoral politics have important implications for global public policies (Meckling 2015). At the same time and perhaps more importantly, the study invigorates the argument that compensating losing sectors may give momentum to international environmental agreements, which is an increasingly relevant topic in current international affairs (Bechtel, Genovese, and Scheve 2019). Furthermore, the paper advances new political implications of cheap talk and the signaling of sectoral actors, and revamps the long yet salient discussion of trade implications for environmental policy (Vogel 1995).

The findings also have real-world implications for policy. The paper ultimately supports the premise of the post–Kyoto Protocol climate regime embodied in the 2015 Paris accord. By showing the impact of economic sectors on preferences for international climate cooperation, it gives legitimacy to an international agreement that—like the one in Paris—emphasizes countries' calibrating policies best tailored to their domestic economic necessity. At the same time, the paper suggests that opposition to climate policy comes as a function of liberalization and competition in high-energy-intensive sectors. This implies that the success of the 2015 Paris agreement will hinge on how policy makers will credibly compensate the vulnerable sectors and how fast the transition to more sustainable industrial systems will be. Meanwhile, policy makers need to continue supporting the champions of international climate policy whilst being cautious of regulatory capture. In sum, the paper provides real-world decision makers a framework of the motivations of industrial winners and losers of international climate policies. Their implications have affected past international climate negotiations and will likely influence the politics of global decarbonization in the future.

Supplementary Information

Supplementary information is provided in the Appendix. Replication data are available at the *International Studies Quarterly* data archive.

Acknowledgments

Previous versions of this paper were circulated at meetings of the European Political Science Association, the Political Economy of International Organizations, and the International Studies Association, as well as at seminars and workshops at the University of Konstanz, Stanford University, the University of Essex, the University of Mannheim, the University of Bergen, the London School of Economics and Political Science, the University of Strathclyde, the University of Pittsburgh, and the University of Oxford. I am thankful for comments and feedback from the ISQ editors, two anonymous reviewers, as well as Thomas Bernauer, Tobi Böhmelt, Stephen Chaudoin, Robert Keohane, Will Lowe, Christopher Marcoux, Charles Roger, Ken Scheve, Delef Sprinz, Endre Tvinnereim, and Hugh Ward, among others. I am also grateful to the German Academic Exchange Service (DAAD) for enabling the data collection.

References

Aklin, Michael. 2014. "Re-exploring the Trade and Environment Nexus Through the Diffusion of Pollution." *Environmental and Resource Economics*: 1–20.

Andonova, Liliana, Edward D. Mansfield, and Helen V. Milner. 2007. "International Trade and Environmental Policy in the Postcommunist World." *Comparative Political Studies* 40 (7): 782–807.

Andonova, Liliana B., and Ronald B. Mitchell. 2010. "The Rescaling of Global Environmental Politics." *Annual Review of Environment and Resources* 35: 255–82).

Batrakova, Svetlana, and Antoine Dechezlepretre. 2013. "Is there a tradeoff between 'dirty' imports and 'clean' innovation?" LSE Grantham Research Institute Working Paper.

Bechtel, Michael M., Federica Genovese, and Kenneth F. Scheve. 2019. "Interests, Norms, and Attitudes toward Global Public Goods: The Case of Climate Cooperation." *British Journal of Political Science*, (forthcoming).

Benoit, Kenneth, Michael Laver, and Slava Mikhaylov. 2009. "Treating Words as Data with Error: Uncertainty in Text Statements of Policy Positions." *American Journal of Political Science* 53 (2): 495–513.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott. 2007. "Firms in International Trade." *The Journal of Economic Perspectives* 21 (3): 105–30.

Bernauer, Thomas, Tobias Böhmelt, and Vally Koubi. 2013. "Is There a Democracy-Civil Society Paradox in Global Environmental Governance?" *Global Environmental Politics* 13 (1): 88–107.

Blei, David M., Andrew Y. Ng, and Michael I. Jordan. 2003. "Latent Dirichlet Allocation." *Journal of Machine Learning Research* 3: 993–1022.

Bloom, Nicholas, Mirko Draca, and John Van Reenen. 2016. "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity." *The Review of Economic Studies* 83 (1): 87–117.

Bormann, Nils C., and Matt Golder. 2013. "Electoral Systems Around the World: 1946–2011." *Electoral Studies* 32 (2): 360–9.

Fischer, Carolyn, and Alan K. Fox. 2011. "The Role of Trade and Competitiveness Measures in US Climate Policy." *American Economic Review* 101 (3): 258–62.

Frieden, Jeffry, and David A. Lake. 2005. "International Relations as a Social Science: Rigor and Relevance." *Annals of the American Academy of Political and Social Science*. 136–56.

Genovese, Federica. 2014. "States' Interests and Bargaining Positions at the UN Climate Change Negotiations: Exploring a New Dataset." *Environmental Politics* 23 (4): 610–31.

Genovese, Federica, and Endre Tvinnereim. 2019. "Who Opposes Climate Regulation? Business Preferences for the European Emission Trading Scheme." *The Review of International Organizations* 14 (3): 511–542.

Gilpin, Robert. 2016. *The Political Economy of International Relations*. Princeton, NJ: Princeton University Press.

Gleditsch, Kristian S. 2002. "Expanded Trade and GDP Data." *Journal of Conflict Resolution* 46: 712–24.

Green, Jessica F. 2017. "Don't Link Carbon Markets." *Nature* 543 (7646): 484–86.

Gullberg, A.T. 2008. "Lobbying Friends and Foes in Climate Policy: The Case of Business and Environmental Interest Groups in the European Union." *Energy Policy* 36 (8): 2964–72.

Kim, Sung Eun, Johannes Urpelainen, and Joonseok Yang. 2016. "Electric Utilities and American Climate Policy: Lobbying by Expected Winners and Losers." *Journal of Public Policy* 36 (2): 251–75.

Knack, Stephen, and Philip Keefer. 1995. "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures." *Economics and Politics* 7 (3): 207–27.

Kono, Daniel Y. 2006. "Optimal Obfuscation: Democracy and Trade Policy Transparency." *American Political Science Review* 100 (3): 369–84.

Leiserowitz, Anthony. 2006. "Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values." *Climatic Change* 77 (1–2): 45–72.

Levy, David L., and Peter J. Newell. 2005. *The Business of Global Environmental Governance*. Cambridge, MA: MIT Press.

Lund, Emma. 2013. "Environmental Diplomacy: Comparing the Influence of Business and Environmental NGOs in Negotiations on Reform of the Clean Development Mechanism." *Environmental Politics* 22 (5): 739–59.

Markussen, Peter, Gert T, and Svendsen. 2005. "Industry Lobbying and the Political Economy of GHG Trade in the European Union." *Energy Policy* 33 (2): 245–55.

Meckling, Jonas. 2011. *Carbon Coalitions: Business, Climate Politics, and the Rise of Emissions Trading*. Cambridge, MA: MIT Press.

——. 2015. "Oppose, Support, or Hedge? Distributional Effects, Regulatory Pressure, and Business Strategy in Environmental Politics." *Global Environmental Politics* 15 (2): 19–37.

Neumayer, Eric. 2003. "Are Left-Wing Party Strength and Corporatism Good for the Environment? Evidence from Panel Analysis of Air Pollution in OECD Countries." *Ecological Economics* 45 (2): 203–20.

Newell, Peter, and Matthew Paterson. 1998. "A Climate for Business: Global Warming, the State, and Capital." *Review of International Political Economy* 5 (4): 679–703.

Paterson, Matthew. 2012. "Who and What are Carbon Markets For? Politics and the Development of Climate Policy." *Climate Policy* 12: 82–97.

Roberts, Margaret E., Brandon M. Stewart, Dustin Tinley, Christopher Lucas, Jetson Leder-Luis, Shana Kushner Gadarian, Bethany Albertson, and David G. Rand. 2014. "Structural Topic Models for Open Ended Survey Responses." *American Journal of Political Science* 58: 1064–82.

Slapin, Jonathan B, and Sven-Oliver Proksch. 2008. "A Scaling Model for Estimating Time-Series Party Positions from Texts." *American Journal of Political Science* 52 (3): 705–22.

Sprinz, Detlef, and Tapani Vaahtoranta. 1994. "The Interest-Based Explanation of International Environmental Policy." *International Organization* 48 (1): 77–105.

Urpelainen, Johannes. 2012. "Costly Adjustments, Markets and International Reassurance." *British Journal of Political Science* 42 (3): 679–704.

Vogel, David. 1995. *Trading Up: Consumer and Environmental Regulation in a Global Economy*. Harvard, MA: Harvard University Press.

Victor, David. 2011. *Global Warming Gridlock: Creating More Effective Strategies for Protecting the Planet*. Cambridge: Cambridge University Press.