Teaming up with the Enemy: Firms and the Information Environment of Climate Regime*

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Abstract

    Firms play a significant role in shaping climate change policy. In addition to directly influencing legislators via lobbying or campaign contributions, they attempt to influence the information environment where regulators gather information. This paper studies, in particular, the ways in which carbon-intensive firms join pro-climate groups to take the focus away from aggressive emission standards. As evidence, I combine a unique dataset of policy comments on Greenhouse gas emission standards, which reveal a systemic issue slant towards R&D and technology in comments by environmental groups affiliated with business interests. I further suggest that a strategic partnership with environmental groups is a compelling political strategy by which firms successfully translate their expertise into political influence. Not only does such strategic partnership increase the quality of information in comments, but it can alleviate regulators' uncertainty over the strategic use of information. I show that this joint effort has meaningful impact on policy amendments by quantifying political influence based on information theory.

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Introduction

Historically, U.S. climate-related legislation has faced political resistance from polluting industries including coal, oil, and gas. For example, the Waxman-Markey Bill[1] was introduced in the 111th United States Congress to propose a cap and trade system, but the bill was faced with strong opposition from business interests. Firms exert political influence in Congress and other rulemaking bodies, and academics have conjectured that extensive lobbying activities by private actors have constituted the major underlying causes that led to the failure of climate legislation (e.g., Grumbach, 2015) . Global greenhouse gas emissions have been concentrated on a few number of corporations[2], and the expected economic costs imposed by climate legislation leads them to become the most prominent stakeholders of climate policy-making.

However, despite their active engagement and influence in shaping climate policy outcomes, firms' informational tactics and political influence in creating environmental regulations have not been illuminated enough. Interestingly, not all firms take a clear political stance toward environmental policy. In the face of economic costs imposed by global climate change regulations, several firms have actively engaged with pro-climate groups that are in favor of domestic regulations (e.g., Kennard, 2020; Cory et al., 2021). For example, the American Council for an Energy-Efficient Economy, one of the non-profit coalitions that support action on climate, has been affiliated with Baltimore Gas and Electric Company and Dow Chemical. Baltimore Gas and Electric Company is a subsidiary of the Exelon Corporation, while Dow Chemical is ranked 39th in the Greenhouse 100 Polluters Index (2021) Report [3]. Another example is the Alliance to Save Energy, a nonprofit coalition of environmental and consumer groups founded in 1977. This coalition has partnered with Exxon Mobil, Exelon, and Duke Energy. The same index ranks Exxon Mobil as 10th, Exelon as 78th, and Duke energy as 2nd.

Why do such carbon-intensive firms partner with pro-climate coalitions despite their anti-regulation incentives? Previous research on corporate behavior and environmental politics has provided the following explanations: 1) scholars have conjectured that business interests intend to green-wash their images (e.g., Vos, 2009; Zingales, 1998) or 2) they use environ-

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[1]Its official title is the American Clean Energy and Security Act of 2009 (ACES), under which the government would set a limit on the total amount of greenhouse gases that can be emitted.

[2]Heede (2014) finds that 90 big firms including Chevron, Exxon Mobil, BP, Exelon, or Shell are emitting two-thirds of global greenhouse gas emissions.

[3]This edition of the Greenhouse 100 ranks companies by C02-equivalent greenhouse gas emissions (including CO2, methane, nitrous oxide, and fluorinated gases, but not biogenic CO2) directly released by large facilities in the US in 2019, https://peri.umass.edu/greenhouse-100-polluters-index-current. https://peri.umass.edu/greenhouse-100-polluters-index-current, The University of Massachusetts Amherst

mental regulations to dominate market competitors (e.g., Kennard, 2020). However, some big firms such as Exxon Mobil are already notoriously known for being a polluter, and funding a few pro-climate coalitions may not put an impressively more agreeable face on their political interests. Moreover, given that citizens tend to be unfamiliar with coalitions and their political orientation (Druckman and Lupia, 2016), the fact that business interests are affiliated with pro-climate coalitions is unlikely to be widely known to broad consumers or voters. Next, while the market competition theory helps understand why individual firms engage in pro-climate actions to dominate their market competitors, it stops short of explaining why they prefer to lobby in a crowd instead of lobbying alone. Why would firms partner with pro-climate groups, and why is the strategic partnership a effective corporate political strategy in response to global climate change?

Within this ongoing debate, as well as the research on corporate political activities and their influence on the environmental regulatory regime, this work introduces a new mechanism through which business interests channel their influence by informing politicians through the partnership with pro-climate coalitions. I argue that firms strategically communicate their expertise via the pro-regulation camp to take the focus away from aggressive clauses of emission standards. Business interests aim to pull potential climate legislation closer to their interests, shape future political terrain, and shift the political debate in their favor to make regulation lax. This political calculus on environmental regulations motivates firms to partner with environmental groups and influence the climate policy conversation in the opposing camp. By collecting 13,129 public comments submitted in response to greenhouse gas emissions standards between 2010 and 2020, I demonstrate that policy comments submitted by environmentalist groups in partnership with business interests tend to be slanted toward R&D and technology, vis-a-vis emissions.

This work further sheds light on the mechanism of how firms' strategic partnership with pro-climate groups translates into political influence. Even though corporate actors' preferences may not be fully represented, the joint effort of environmentalists and business interests leads to higher quality in both "hard" and "soft" information. Each political actor has expertise in different areas and corporate actors can increase the informational value of their policy comments to regulators by collaborating with environmentalists. Moreover, a strategic partnership with actors with contrasting preferences makes legislators place even weight on the importance of the business interests' information. Epistemologically, the informational value of policy comments is to facilitate the choice of policies based on the maximum amount of available information and the consistency with the majority rule. However, given that information asymmetry presents opportunities for the strategic use of information by policy proposers(e.g., Fudenberg and Tirole, 1989; Gilligan and Krehbiel, 1990; Austen-Smith and

Wright, 1992), the normative goal of informed decision-making may not be consistent with rational behaviors by individuals or entities whose preferences are heterogeneous. Concerning these rulemaking dynamics, policy comments jointly submitted by groups of heterogeneous political actors not only increase the informational value of comments (hard information), but also help legislatures maximize benefits from specialized expertise and knowledge by signaling that involved actors are not exaggerating the extreme preferences (soft information).

Focusing on the dynamics of regulatory politics and global climate change, this paper explains and quantitatively demonstrates the political influence by which business interests shape the information environment that is available for regulators. The next section further discusses the broader literature on climate politics and private actors and outlines theoretical expectations regarding the strategic partnership between business interests and environmentalists. I then describe my dataset and empirical strategies. The third section presents the findings and a series of robustness tests, followed by an analysis of the influence of joint comments on the legislative outcome. The final section discusses the implications of strategic partnership in environmental politics, as well as the contribution to broad literature on corporate influence on politics.

Climate Lobbying and Business Interests

Studies in environmental politics have assumed that corporate political preferences are structurally determined (e.g., Keohane et al., 1998; Falkner, 2017). Firms have been expected to evaluate the possible impact that regulations would have on their stakes and the competitive balance in the market. They consider the extent to which they can adapt to new environmental standards through technological innovations, product changes, and process modifications and how their competitors will be affected. This consideration leads them to oppose regulations, if the regulations impose costs on them, and support them if they do not. For instance, firms generating coal generational capacity are expected to oppose action to fight climate change (e.g., Cory et al., 2021) as the firms believe that they would suffer if such climate-related legislation passed.

Indeed, a closer analysis of business strategies in climate change reveals that restrictions on greenhouse gas emissions pose a significant challenge to particular industries. Some (e.g., Shell, BP) have begun to pursue diversification into other energy sources that have a lower greenhouse effect, or no effect at all, as a strategic opinion. However, none of these alternative energy sources can provide business opportunities on the same scale as that of oil and coal production (Stokes, 2020). While placing a price on carbon emissions through a trading

system or carbon taxes is considered to be the most efficient policy for reducing greenhouse gasses (Stern, 2008), the policy has been politically contested (Hess, 2014) as climate-related policy measures have an immediate impact on these corporations.

Based on inferences concerning corporate preferences, scholars have emphasized the link between corporate political activities and climate policy outcomes (Aklin and Urpelainen, 2013; Hess, 2013; Kennard, 2020; Tvinnereim and Ivarsflaten, 2016). Firms translate their preferences into political lobbying strategies to influence a policy (e.g., Rogowski, 1990; Frieden, 1988) but they do not necessarily translate their preference explicitly into political actions. In fact, the process of reflecting business interests in policy-making is not always straightforward even when they choose to translate their preference. Not all interests may be fully represented, and the political strategy that they choose is influenced not only by the underlying preference structure but also by the political environment in which firms operate.

While the analysis of corporation preference formation has been essential to the study of the business influence on politics, the way their preferences are realized via political strategies has not been rigorously explained. There are several strategies business interests can adopt, such as engaging in direct lobbying activities to create political ties with politicians or targeting a broad audience for public persuasion (Baumgartner et al., 2009; Kraft and Kamieniecki, 2007; Layzer, 2012; Sell and Prakash, 2004). In this work, I particularly analyze a corporate lobbying strategy through which corporate actors form a joint coalition with environmental groups and influence the regulatory landscape. Through strategic partnerships with pro-climate groups, corporate actors influence issue attention given to a particular topic during the rule-making process and achieve higher information efficiency. The next section further elaborates on this mechanism.

Business information and regulatory politics

Building on the literature on regulatory politics and the value of information during the rule-making process, I provide a business interests-centered explanation of why carbon-intensive firms partner with pro-climate groups. Namely, business interests strategically become affiliated with the pro-climate coalitions to influence the political environment where policy-makers gather information. The strategy of forming a joint coalition is a compelling approach by which business interests translate their political interests into policy outcome. A joint effort by political actors with contrasting preferences increases the quality of information that policymakers seek during the legislative process, in both enhanced expertise (hard information) and reduced uncertainty (soft information). I further discuss the dynamics of

information provision in the process of climate policy-making and derive observable implications for examining corporate political behaviors.

Theory: Communicating via climate groups as an effective corporate strategy

The core of politics has focused on competition over issue selection within a particular topic. It has long been recognized that the allocation of attention across policy agenda is fundamental to understanding the political process (e.g., Cobb and Elder, 1972; Kingdon and Stano, 1984; Schnattschneider, 1960; Romer and Rosenthal, 1978) and an important source of political power (e.g., Bachrach and Baratz, 1962). In addition to political parties or public interest groups, business interests have been emphasized as one of the primary actors influencing agenda (Kamieniecki, 2007; Acs and Coglianese, 2022). They can keep issues off the table to obviate the risk of an aggressive proposal rising to a vote, by successfully controlling the agenda or they can emphasize relatively overlooked issues to distract attention given to the aggressive clauses.

Firms exercise leverage over the federal rulemaking process by conveying their information to regulators. The Administrative Procedure Act (APA) of 1946 mandates the notice and comment period in which a proposed policy is open for public review. During this stage, all interested parties are invited to provide written comments regarding the content of the proposed rule. Political actors including business interests and environmental groups introduce facts that agencies should take into consideration, define policy problems and develop the details in the proposed government rules (Yackee, 2012; Baumgartner and Leech, 1998; Baumgartner and Jones, 2010). After reviewing the comments submitted by interested parties, the agency issues a final rule that is enforceable as law.

My argument is centered on firms' incentives to get affiliated with the pro-climate coalitions to open their information up to regulations. To communicate their expertise more effectively, firms strategically join pro-climate coalitions and collaborate with environmentalists. Abundant qualitative evidence suggests that business actors attempt to reframe climate policy and take the issue attention away from emission cuts by highlighting R&D and technological issues (e.g., Grumbach, 2015; Downie, 2017). To give an example, ExxonMobil highlights its contributions in climate actions with advertorials citing "our industry-leading investments in research and development," such as the Global Climate and Energy Project at Stanford University, which implies that current solar or wind technologies are inadequate (Supran and Oreskes, 2021). Business interests suggest that scientific research or technology rather than emission cutbacks would provide the key solutions that manage the long-term

risk of global climate change. Based on related witnesses and testimonies, I expect more coverage about R&D or technology in comments jointly written by business interests and environmentalists, as opposed to the environmentalist group without business affiliations. When pro-climate groups have received corporate money or have been in partnership with business interests, their policy comments would place more emphasis on R&D and technology compared to emissions.

Hypothesis 1 *(Motivation) Comments submitted by pro climate groups affiliated with business interests are more likely to discuss R&D and technology compared to comments submitted by pro-climate groups without business affiliation.*

Communicating via pro-climate groups has a widespread influence on environmental politics beyond hedging against reputation crises. The fact that some industries (e.g., oil and gas industries) are fragile to their reputations has been widely cited to explain why firms support pro-climate actions; firms are constrained by public opinion, and therefore they are expected to maintain a green image to a broad audience. Yet, beyond protecting themselves from possible backlash stemming from their political preferences against climate actions, firms take proactive actions to influence the regulation standards. Communicating via pro-climate groups does not persist in the same form as green washing, in a way that firms do affect the Final rule by, at a minimum, framing the debate and scope of action available for regulators. The next section further explores how the strategic partnership between firms and environmental groups translates into meaningful political influence during the rulemaking process.

Achieving higher quality of information and political influence

In the course of rulemaking, policy comments submitted by interested parties have substantial informational value to regulators as they seek to apply regulations where their success is dependent on their ability to collect or analyze information (McCarty, 2017). Rulemaking is one of the most resource-intensive and time-consuming activities (Kerwin and Furlong, 2018), therefore information plays a particularly vital role as the development of regulation requires fine-grained, technical judgment concerning how to design these major operations (e.g., Breyer, 1982; Hawkins and Thomas, 1989). This is particularly true for environmental regulations which require an understanding of the options for reducing pollutants and greenhouse gas, or the economic consequences of various alternatives and regulatory standards. While business influence has been described in terms of financial resources such as hiring

lobbyists or making campaign contributions, their political influence during the regulatory process comes from their expertise and specializations.

Concerning the informational value of political comments, the joint effort of business interests and environmentalists improves the quality of information that regulators collect. Private actors typically have a better understanding of which pollution control measures will be effective in their facilities, as well as the extent to which certain measures would create unintended consequences or unexpected economic costs (e.g., Wagner, 2003; Michael, 1996). Similarly, environmental groups also use similar information-based strategies that are used by firms or business associations (Vormedal, 2008).[4] They exercise leverage by communicating public demands, conveying information on the distributional consequences of regulations in communities or suggestions for developing national climate change strategies or climate change adaptation (Nachmany et al., 2014). By partnering with environmentalists, firms can improve their policy design such as information gathering and the acquisition of expertise.

Hypothesis 2 *(Mechanism): Joint comments by business interests and environmentalists contain more informational values than that of other groups.*

While expertise is a necessary condition, it might not be a sufficient condition for achieving information efficiency. The political usage of information and scientific knowledge denotes the probability that actors pick the evidence that supports their political objectives and discard information that undermines their position. (e.g., Weible, 2008; Austen-Smith and Riker, 1987). When suggesting issues or information in need of government redress, political actors intentionally portray issues in ways that will gain support for their side, all the while making it seem as though they are simply describing the facts (Stone, 1989). The information asymmetry between regulators and private actors further makes the rulemaking process more susceptible to the strategic use of information. Firms have an incentive to share self-serving information with the government, such as information regarding how likely the expected benefits of the regulations would be lower or how likely the incurred economic costs would be huge (Quirk, 2014).

The alert for political use of expertise poses uncertainty over the trustability of information. Regulators cannot be induced to trust all the private information delivered by interested parties, particularly since the interested parties in the rulemaking process can take advantage of information asymmetry. Analogous to Gilligan and Krehbiel (1989)'s insight on committee-legislature decision-making, high-demanders, preference outliers or any

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[4]Environmental NGOs include research units of environmental NGOs and think tanks dedicated to influencing the policy-making process via research outputs and information provision. (Gough and Shackley, 2001)

actors with extreme preferences prevent policymakers from benefiting from their expertise and specialization since they are likely to portray information in ways favorable to their policy stakes. To make expertise and specialization available for regulators, preferences must not be too extreme vis-a-vis those of the median actors as

In this regard, the strategic partnership between firms and pro climate groups reduces the uncertainty that regulators face concerning the strategic use of information. The joint effort of political actors signals that one's specialization has undergone critical scrutiny by other political actors and that their policy comment is a consensus agreed upon by both extremes of interested parties (soft information). Thus. joint comments by business interests and environmental groups would reduce the regulators' concern over the trustability of information, indicating that their policy proposal is not skewed to extreme preferences. This enables scientific claim made by business interests to be considered unbiased and makes business information coming through pro-climate coalitions much more available to regulators, compared to comments written by single firms or business associations. Based on this idea, I predict that policy comments submitted by joint effort would have stronger influence than other types of comments submitted in notice and comment period.

Hypothesis 3 *(Outcome): Comments written by the joint effort of business interests and environmentalists are more likely to influence a policy amendments than comments written by a singular firm or a group of firms.*

Empirical Analysis

A key consideration in assessing the degree of corporate influence in the rulemaking process is to establish an objective benchmark. The benchmark refers to points within the agenda that business interests strategically emphasize to remove attention that is given to the risk of climate change and stringent emission standards. Regarding these considerations, I assess corporate influence by examining the coverage of research, development, and technology (R&D and technology) and the degree of issue slant towards R&D and technology. The topic of R&D and technology has obvious implications for expertise and specialization of business interests, as in most cases, businesses have better knowledge about what they produce. Since business interests have informational supremacy based on their private knowledge of R&D as opposed to other commenter types, the information asymmetry concerning the agenda of R&D becomes worsened and the chances of the strategic use of information by corporate actors are more prevalent than other policy issues.

Data and classification

I utilize an original dataset containing 13,129 comments officially submitted on *Greenhouse Gas Emissions Standards* from 2010 to 2020 without duplicates.[5] The policy comments were for EPA's regulatory review of national emission standards for air pollutants and control guidelines under the Clean Air Act. EPA proposed rules 12 times and announced policy amendments nine times. By company/organization identifiers and automated text analysis, I filter 903 comments submitted by companies, entities, or organizations and use them as the basis of my analysis. Then I classify documents by five commenter types: 1) joint coalition of environmental groups and business interests [6], 2) environmental groups without business affiliation, 3) business associations (e.g., trade associations), 4) single businesses and 5) others, including universities or government agency. The category of joint coalitions includes environmental advocacy groups 1) that list firms or business associations as partners, 2) that are financed by corporate actors, or 3) that are seeking business partnership.

I used a variety of sources to identify joint climate coalitions examined in this analysis, including white papers, blogs, and other grey literature, coalition membership lists, media reports, and internet searches.[7] I particularly relied on three sources: environmental groups' websites, IRS Form 990 and Cory et al. (2021)'s classification framework. I retrieved past websites of environmental groups using Wayback Machine and traced back if environmental groups have listed firms as partners or sought business partnership. Next, IRS Form 990 series was an useful resource to track the history of charitable donations of business interests towards environmental groups. Lastly, I reference Cory et al. (2021)'s classification framework to double-check the validity of memberships lists I collected from other sources.[8] Table 1 shows the examples of joint coalitions that participated in the rulemaking process. It has been widely known that the Sierra Club has received corporate money from oil and gas industries. Consumer Energy Alliance Consumer is the leading U.S. consumer advocate in support of affordable, reliable energy for citizens but its members includes, Chevron, ConocoPhillips and BP. In addition to them, Environmental Defense Fund, American Council for an Energy-Efficient Economy have partnered with firms.

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[5]Duplicates are not considered in this paper; the total number of comments after removing duplicates is 13,239.

[6]I used another three criteria to identify joint coalitions. First, these groups were required to have a mission primarily relating to climate change and public policy. Second, the groups had to be membership-based organizations. Finally, the group's membership had to include diverse categories of political actors, such as citizens, consumers, environmentalist and firms. For instance, even though it was introduced as pro-climate coalition on press, the group was categorized as business association when the membership was limited to firms.

[7]Please see the Codebook for further details.

[8]Unfortunately, Cory et al. (2021) classification covers less than 100 climate coalitions so it was never enough to fully validate the membership lists of all joint coalitions examined in this analysis.

Commenter	Descriptions	Affiliated Business Interests
Sierra Club	Nonprofit environmental group	Chesapeake Energy
Consumer Energy Alliance	Nonprofit environmental group	Exxon Mobil Chevron Corp ConocoPhillips BP
Environmental Defense Fund	Nonprofit environmental group	Walmart Lyft FedEx
American Council for an Energy-Efficient Economy	Nonprofit environmental group	Dow Chemical Co Alcoa Xcel Energy

Table 1: Examples of public comments submitted by the joint effort of environmental groups and corporate actors

Communicating via pro-climate groups focusing on R&D and technology topics

Measuring R&D and Technology Coverage

After identifying commenter types, I empirically demonstrate strategic communication by business interests exhibited in public comments. In essence, the empirical strategy has two basic components. I compare issue coverage of R&D technology by (1) environmentalists with business ties versus pro-climate coalitions without business interests and (2) across all company/organization proposals. By comparing the issue coverage of public comments, I examine the effects of business partnerships on the issue attention allocated for the topic of R&D and technology. I define R&D and technology coverage by using two metrics: comment level, the indicator of whether a comment mentions research, development, or technology at least twice; and word level, the frequency of the occurrences of R&D words normalized by the total number of tokens of a comment. I first examine whether proposals associated with business interests are more likely to cover $R\&D$ than those that are not affiliated with business interests, using a comment-level metric.

$$Pr(Y_{it} = 1) = \Phi(\alpha + \beta_1 \text{Business Influence}_i + \tau_t)$$

where Y_{it} is a binary variable that indicates a comment that mentions research, development, or technology at least twice; Business Influence$_i$ is a binary indicator for business ties coded based on commenter types; and τ is a vector of year fixed effects. For a word-level metric, I use negative binomial models rather than a Poisson or OLS because there exists

overdispersion in the distribution of the dependent variable across observations and the dependent variable cannot have negative values (King, 1988). The main analysis analyzes the sample of company/organization comments to reduce the sparsity of data.

Metrics	Comment-level			Word-level		
Sample	Environmentalist	Company/Organization		Environmentalist	Company/Organization	
	(1)	(2)	(3)	(4)	(5)	(6)
Business Influence	0.703***	0.282***	0.158	0.538**	0.281**	0.193
	(0.220)	(0.104)	(0.120)	(0.258)	(0.131)	(0.153)
Environmentalist			−0.043			0.101
			(0.131)			(0.162)
Business Influence×Environmentalist			0.550**			0.520*
			(0.247)			(0.311)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	232	903	903	232	903	903

A binary probit model is used for the comment-level R&D coverage. For word-level R&D coverage, negative binomial model is used.
*p < .1; **p < .05; ***p < .01

Table 2: Binary probit and negative binomial models estimating R&D coverage

The main parameter of interest is β_1, the coefficient for business influence. Table 2 presents the estimation results with marginal effects in the main entries and standard errors in parentheses. The results suggest that proposals affiliated with business interests mention more R&D coverage. business influence appears to be positive and statistically significant at the 0.01 level in the first and second columns, and its interaction term is significant at the 0.05 level in the sample of organization/company comments (Column 3). This result is maintained when the word-level metrics are used.

Measuring the degree of issue slant towards R&D and Technology

The analysis in the previous section has limitations in that the word-count-based metrics do not convey any information concerning the context in which words are used. For instance, the analysis in the previous section does not describe the context in which the term, 'technology', is used; the context might be the need for technological investment for alternative energy sources or might be related to carbon technology. To handle this limitation, I apply a text embedding method, allowing words to encode meaningful information about analogies. The measure constructed in this section indicates how issue attention is characterized in the languages used by commenters.

Political science research has utilized *Word2Vec* which embeds words in a low-dimensional vector space using neural network structure. This method results in a set of vectors where proximity in vector spaces implies similar meaning context-wise, while vectors distant from each other have different meanings. For instance, "diligent" and "industrious" would be

close together while "diligent" and "lazy" would be relatively distant. Based on embedding methods, I let the algorithm assign each word to a vector in a shared space during the training stage, and this creates clusters of words semantically connected. As a result, the similar the context is, the closer the two words are located in geometric space.

Built on this advance in modern natural language processing technique, I employ *Paragraph Vector* proposed by Le and Mikolov (2014), an unsupervised framework that learns continuous distributed vector representations at the comment level. In the *Paragraph Vector* framework, each document is mapped to a unique vector, and each token is also mapped to a unique vector. The paragraph vector and word vectors are averaged to predict the next words in each sentence. Similar to Word2Vec's continuous-bag-of-words model, this approach uses distributed memory where document vectors can be acquired by the task of predicting a word based on an average in consideration of context and full document levels. Similarly, analogous to the skip-gram model of *word2vec* model, the distributed bag of words enables us to predict a target word just from the full document's document vector. I construct a model with a window size of five and do not consider words that are observed less than ten times in the entire corpus.

As explained above, a key feature of word embeddings is that the difference between word vectors in the geometric space conveys meaning. For instance, the difference between the two vectors, $\overrightarrow{R\&D} - \overrightarrow{Emission}$, identifies an issue dimension in the space by taking the difference between the normalized vector across a set of research words and the average normalized vector across a set of emission words [9]:

$$\overrightarrow{R\&D} - \overrightarrow{Emission} = \frac{\sum_n \overrightarrow{R\&D_n}}{|N_{R\&D}|} - \frac{\sum_n \overrightarrow{Emission_n}}{|N_{Emission}|}$$

Therefore, the vector difference corresponds to the issue slant in the R&D direction and can be substantively interpreted as a degree to which a proposal is leaning toward the issue of R&D, compared to emission cuts. By the geometry of vector space, I measure the cosine of the angle between the inferred vectors of the issue slant and each document vector. The connotation of this approach is measuring the similarity of a proposal to the dimension of the issue slant towards $R\&D$ and technology. This metric for non-zero vectors, $\overrightarrow{x}$ and $\overrightarrow{y}$, is defined as

$$similarity(\overrightarrow{x}, \overrightarrow{y}) = cos(\theta) = \frac{\overrightarrow{x} * \overrightarrow{y}}{||\overrightarrow{x}|| ||\overrightarrow{y}||} = \frac{\sum x_i y_i}{\sqrt{\sum x_i^2} \sqrt{\sum y_i^2}}$$

where θ denotes the angle between vectors and $|| * ||$ indicates the 2-norm. The similarity

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[9]Please see the Appendix for more details

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score ranges from -1 to 1 and, a score close to 1 indicates that a document tends to emphasize R&D compared to emissions. If the score is negative, this implies that the issue slant in the emission direction.

Figure 1 shows the schematic illustration of vector projection of this method. Words related to R&D and technologies are colored blue, while vocabulary belonging to emission words are colored yellow. We see that the policy comments submitted by joint coalitions, including the Sierra Club or Environmental Defense Fund, tend to be associated with positive issue slant scores and are more likely to cover R&D and technology words. However, comments by environmental groups without business affiliation tend to be associated with a negative issue slant score and are more slanted towards emission reductions. Human-based exercise to examine machine performance is provided in the Appendix (Table 3).
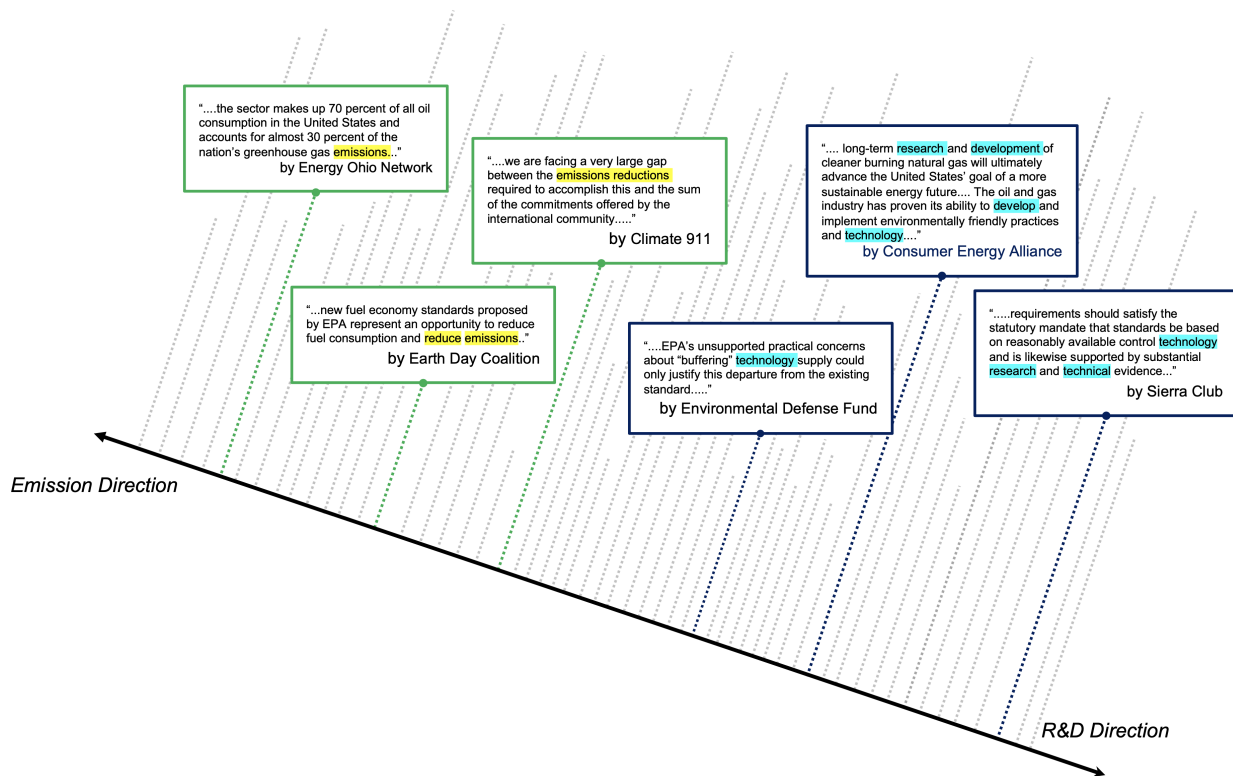

Figure 1: Schematic illustration of vector projection

I use the score for each comment as a dependent variable and run an ordinary least squares regression to analyze the issue slant of joint comments versus other types of groups. If corporate actors communicate via pro climate groups, we would find that business influence leads to increased issue slant toward R&D and technology direction. Table 3 shows the positive relationship between business ties and issue slant in the $R\&D$ directions, and the finding is statistically significant at the 0.01 level (Columns 1 and 2). Overall, comments by

Sample	Environmentalist	Company/Organization Comments	
	(1)	(2)	(3)
business	0.027**	0.028**	−0.009
	(0.013)	(0.012)	(0.014)
Environmentalist			−0.008
			(0.015)
Business×Environmentalist			0.037*
			(0.019)
Year FE	Yes	Yes	Yes
N	232	903	903

*p < .1; **p < .05; ***p < .01

Table 3: OLS estimating the degree of issue slant towards R&D and technology

coalitions with business affiliations are more likely to be slanted to R&D and technology, as opposed to emissions, and its positive relationship is stronger than the relationship between general proposals and issue slant. The regression analysis based on a measure of issue slant toward R&D supports the claim that business interests can successfully take the focus away from emission cuts by highlighting R&D and technology.

Measuring the quality of information

The previous section empirically demonstrates the positive associations between corporate ties and issue slant toward R&D within a sample of environmental groups. This section further explores why the strategic partnership with environmentalists is a compelling political strategy for conveying expertise. In the course of rule-making, a key consideration is the informativeness of the comments written by political actors that can help regulators improve political decisions. Related to this information quality story, this section examines the hypothesis of whether a strategic partnership of corporate actors and environmental groups further achieves a higher quality of information that informs regulators of details of policy implementation.

To construct a measure of information quality, I use entity recognition techniques to capture the particular semantic types such as organization (e.g., companies, agencies, institutions.), geopolitical entity (i.e. countries, cities, states), person, time, cardinality, location, percent, money, event or natural phenomenon, or jargon that may indicate technical information. This empirical strategy involves extracting and identifying essential information from the text.[10] Based on this technique, I count the sum of detected entities for each comment

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[10]The information that is extracted and categorized by this technique is called entity, and it can be any

and use this variable as a measure of information quality.[11]

Figure 2: Example of the application of entity recognition approach (Comment submitted by Environmental Justice Health Alliance)

Sample	Environmentalist		Business		Company/Organization	Business
	(1)	(2)	(3)	(4)	(5)	(6)
Business Influence	0.581***	0.570***			−0.353	
	(0.188)	(0.187)			(0.186)	
Environmentalist			0.771***	0.768***	−0.267	
			(0.163)	(0.163)	(0.201)	
Business Influence×Environmentalist					1.012***	
					(0.258)	
Business Coalition						4.661***
						(0.122)
Joint Coalition						5.248***
						(0.180)
Issue Slant towards R&D		2.956***		0.201	0.766*	0.083
		(0.934)		(0.533)	(0.460)	(0.532)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	232	232	665	665	903	665

The baseline for Column 6 is single firm.
*p < .1; **p < .05; ***p < .01

Table 4: Negative binomial model estimating the quality of information

In this analysis, I include a measure of issue slant towards R&D and technology as a control variable as this topic tends to be accompanied by technical details. Table 4 suggests that policy comments jointly written by business interests and environmental groups have a higher quality of information compared to other comments (Columns 1 and 2); business comments are associated with higher quality when they are working together with environmentalist groups (Columns 3 and 4). Column 6 indicates a higher association between each

word or a series of words that consistently refers to the same thing. I customize entities present in policy comments- supplementary documents, figures, or tables.

[11]This measure is intended to capture the absolute amount of technical information contained in the comment so normalizing by the total count of tokens is not necessary.

group of comments and business interests, but the magnitude of the coefficient is bigger in comments submitted by the joint effort of corporate actors and environmental groups. These findings suggest that policy comments can bring more informative content to regulators when environmental groups and corporate actors work together.

Even though this paper is focused on explaining the incentives of firms in the regulatory process, this empirical analysis using a measure of information quality provides explanations as to why environmentalists allow business interests to become involved in policy discourse despite their contrasting preferences. Not only business actors but also environmental groups benefit from this partnership; environmentalists can access the business information and improve their suggestions concerning climate change adaptations based on resources corporate actors provide. As rulemaking is a process of developing technical details of regulation based on expertise, the informativeness of comments is one of the primary determinants of political influence. By investing in a joint effort, both environmental groups and firms achieve higher quality information that helps regulators develop details of regulations.

Quantifying the political influence of the strategic partnership

The previous analysis suggests that corporate actors strategically communicate their expertise via a joint effort with environmentalists and that a strategic partnership increases the informativeness of comments. This section further analyzes how the transmission of expertise via pro-climate coalitions connects to political influence in regulation politics. While specialization is a necessary condition, it remains unclear whether specializations are a sufficient condition for achieving information efficiency given opportunities for the strategic use of information; political actors pick the evidence that supports their political objectives and discard information that undermines their position (e.g., Weible, 2008; Austen-Smith and Riker, 1987; Stone, 1989). By capturing the statistical distance between policy comments and amendments, this section examines whether the joint effort of actors with conflictual policy goals relay regulators' concerns over the strategic use of information.

Measuring political influence via statistical distance between policy comments and final amendments

During the rulemaking process of Greenhouse gas emission standards, the Environmental Protection Agency proposed policies twelve times and made amendment nine times after collecting comments. Using EPA's responses in response to comment submission as a basis of analysis, I examine the likelihood that policy comments and a set of updated clauses

come from the same probabilistic distribution. Estimating the influence of policy comments on the entire policy would underestimate the regulatory influence of comments; a finalized policy is an approximately 900-page-long document and policy comments tend to focus on particular provisions of a proposed policy. Therefore, I construct a document, a set of clauses updated after the comment period and test the statistical proximity between comments and policy amendments. If a policy amendment is likely to be from the same distribution of comments by joint comments, we can infer that the strategic partnerships between firms and environmental groups exercise political leverage over environmental regulations.

In this section, I suggest an approach combining hypothesis testing with distribution similarity. To quantify the influence of policy comments on environmental regulations, I borrow the divergence scores from information theory as relative entropy captured via divergence score denotes how close two samples are from each other. I further tailor this technique so that it can be applied to our context of analyzing political influence via texts. Please see the Appendix for proofs and details of this approach. Given that the vectors in this context indicate probability distribution, the cosine angle is inappropriate as it fits for vector space modeling. For the distance metrics, I employ Kullback-Leibler (KL) divergence. KL divergence has already been widely used in advanced social science research as a similarity measure of sparse data. The KL divergence metric is defined as follows.

$$D(P||O) = \sum_i P_i log(\frac{P_i}{O_i})$$

where the expectation value of the log difference between the two probability distribution computed with weights of P_i.

The test statistics used in this approach are inferred from Jensen-Shannon (JS) divergence. Following Wolpert (1995) and entropy approximation, the test statistic below is derived [12], which is approximated by the JS divergence. JS divergence is a symmetric distance and smoothed version of the KL divergence as a test statistic. For both metrics, the lower divergence scores near zero indicate the closer statistical distance between the two distributions. JS divergence is defined as

$$J(P||O)) = \frac{1}{2}(D(P||M) + D(O||M))$$

where $M = \frac{1}{2}(P + O)$ is a mean distribution.

Table 5 reports the KL and JS divergence scores that measure the statistical proximity between each cluster of comments and the finalized policy. At all measurements, policy

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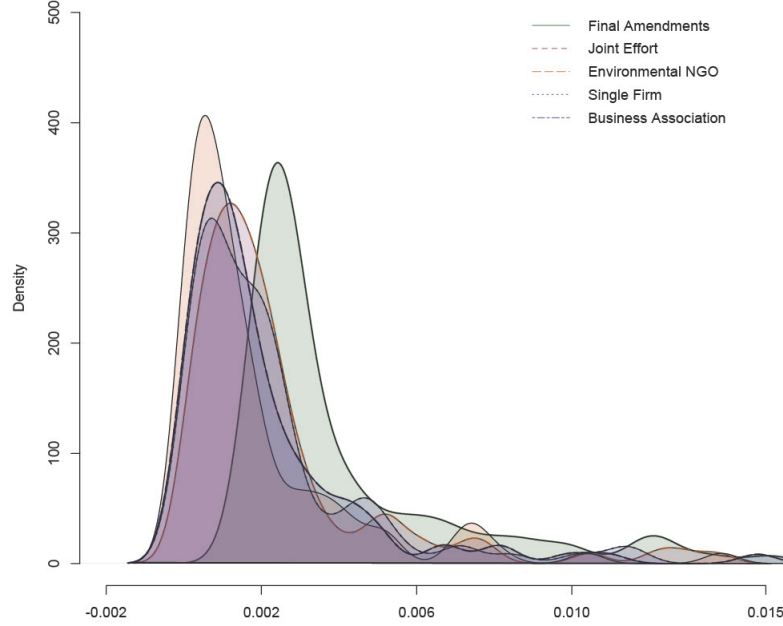[12]Detailed proofs are provided in Appendix.

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Figure 3: Kernel density estimate for each cluster of proposals

comments submitted by environmental groups affiliated with business interests have the closest statistical distance to final amendments, compared to other groups' policy comments.

Commenter Types	JS divergence scores	KL divergence scores
Joint Coalitions[*] (with business affiliations)	0.319	1.324
Environmental NGOs	0.417	1.886
Single Firm	0.355	1.523
Business Associations	0.324	1.603

[*] Joint Coalitions include Environmental NGOs 1) receiving corporate money, 2) working with corporate partners and 3) seeking for corporate partnership.

Table 5: KL and JS divergence scores for each cluster of policy comments & final amendments

There might be some concerns that this analysis would end up capturing linguistic similarity or legal formalism between comments and policies, rather than their influence on policy changes. In response to this concern, I repeat the same analysis using a proposed policy published before the notice and comment period, instead of final amendments. We can infer that linguistic properties do not dominate analysis if the ordering of the statisti-

cal distance between an initial policy and comments is different from that of the distance between finalized policy and comments. Table 6 indicates that policy comments submitted by business associations have the closest distance from a proposed policy, followed by single firms and joint coalitions. Therefore, we conclude that the influence of policy comments on final amendments is not driven by the linguistic characteristics of texts.

Commenter Types	JS divergence scores	KL divergence scores
Joint Coalitions* (with business affiliations)	0.3536187	1.589078
Environmental NGOs	0.4112866	1.827071
Single Firm	0.3557707	1.550576
Business Associations	0.3463794	1.517257

*Joint Coalitions include Environmental NGOs 1) receiving corporate money, 2) working with corporate partners and 3) seeking for corporate partnership.

Table 6: KL and JS divergence scores for each cluster of policy comments & a proposed policy

As a robustness check, I repeat the analysis using Latent Dirichlet allocation (LDA). I take the harmonic mean of a set of samples generated by the Gibbs sampler to approximate the marginal corpus likelihood and find that 14 is the optimal number of topics for data [13]. LDA results in the probabilistic distribution over topics for each comment and I calculate the statistical distance between distributions for each category. Another exercise for robustness check includes calculating divergence scores for each comment and running a regression analysis. Results are presented in Appendix and are consistent with prior analysis.

This finding is aligned with Yackee and Yackee (2006)'s argument that firms wield significant influence during policy implementation and business comments are more frequently associated with changes that tend to make rules less stringent. While uncovering a causal effect of business influence on politics would require a comprehensive analysis that incorporates contact information (e.g., lobbying expenditures, campaign contributions, or communication between lobbyists and legislators), my examination particularly focuses on how political actors try to have laws reinterpreted for their ends, by working to influence regulators and agencies. Furthermore, this empirical evidence is consistent with theoretical predictions in policy-making literature (e.g., McCarty, 2019; Hirsch and Shotts, 2012) that joint effort by involved actors can increase the quality of information and provide more efficient conditions

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[13]Please see Appendix for details

for legislators to make the most out of them. The analysis focused on the rulemaking process and the strategic partnership between actors with contrasting policy preferences identifies new channel of political influence through which business interests make their expertise and specialization more available to regulators.

Conclusion

This paper explores corporate influences on the rulemaking process. Firms do not just target single politicians for policy revision and they also target regulators. Addressing joint coalitions of environmental groups and firms, this paper shows how firms attempt to shift issue attention in regulation standards by strategically discussing R&D technology and demonstrates how strategic partnership with environmental groups and firms influences the policy implementation. The advantage of forming a partnership is substantial: firms achieve a higher quality of information and their joint comments exercise significant leverage over final amendments than other groups of comments. Drawing on recent development in machine learning techniques, this paper develops a new measure of issue slant and a new measure of information quality to test this mechanism.

Specifically, this paper pertains to the growing literature demonstrating the need to understand business influence on environmental regulations. Despite the high salience of climate change and heated discourse on environmental regulations, the US produced more than six billion metric tons of carbon dioxide equivalent greenhouse gas emissions in 2019 and has been ranked second in total greenhouse gas emissions worldwide. By focusing on greenhouse gas emission standards, this paper empirically demonstrates how business groups wield influence over government decision makers to take focus away from strict emission standards in the continuous discussion on environmental standards. EPA officials recognize that information by business interests would be self-serving, and so firms know that regulators might not be inclined to process information at face value. Therefore, firms strategically partner with environmental groups to translate their superior knowledge into political power. This theory provides supporting evidence to literature on business influence on regulation standards (e.g., Lowi, 1979; Moe, 1989); firms try to structure regulatory bodies to meet their goals and are likely to dominate bureaucracy by information supremacy.

Even though the analysis is focused on business interests-centric explanations, its theory provides a piece of suggestive evidence on why some environmental groups partner with firms: environmental groups benefit from business information and grow their influence

on climate policy conversation. By working with business interests, environmental groups can acquire competitive advantage with private information as opposed to environmental groups without business partnerships. This implies that the formation of joint coalitions of environmental groups and firms might have been driven by the strategic needs of both sides. One possible speculation is that increased competition between environmental groups motivates some of them to be affiliated with firms. Each group would like to take a lead in climate policy conversation and business information might be one of tools available for environmental groups to have the upper hand in this competition. Future research focusing on environmental groups' political incentives would further enrich this story of strategic partnership.

My results contribute to both conceptual and practical debates on business influence on politics. By highlighting an overlooked channel of influence, the strategic partnership with environmental groups, I contribute to efforts in capturing hidden circuit of political influence. Most research has focused on money expenditures measured by PAC and lobbying expenditures to estimate firms' influence on the legislative process. However, much of what is substantively meaningful always remain unobservable, as capturing political influence requires the consideration of the broader set of political instruments available to business interests. In this regard, my findings highlight the challenges in identifying all of the possible pathways through which influence is expressed and emphasize the need of identifying the full set of political instruments available by firms. Exploring this challenge is important to reduce bias in a assessment of business influence.

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