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Supply Chain Linkages and the Extended Carbon Coalition

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Abstract: *Which firms oppose action to fight climate change? Networks of input sourcing and sales to downstream customers ought to propagate and reinforce opposition to decarbonization beyond direct emitters of CO_2. To test this claim, we build the largest data set of public political activity for and against climate action in the United States, revealing that the majority of corporate opposition to climate action comes from outside the highest-emitting industries. We construct new measures of the carbon intensity of firms and show that policy exposure via carbon-intensive inputs and sales to downstream emitters explains this large volume of opposition from non-emitting industries. Sixty-six percent of U.S. lobbying on climate policy has been conducted by an extended coalition of firms, associations, and other groups that have publicly opposed reducing carbon emissions. Public opposition to climate action by carbon-connected industries is therefore broad-based, highly organized, and matched with extensive lobbying.*

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Carbon dioxide emissions are the primary cause of global warming, and producers—firms and industries—account for most of these emissions. An extensive literature in environmental politics examines how direct emitters of carbon dioxide[1] and heavy industrial consumers of electricity[2] have sought to thwart effective climate action, and asks how this narrow slice of the industrial spectrum has managed to exert such powerful influence. For scholars of special interest politics, the primary answer has been that the "narrowness" of these actors is precisely their advantage: Concentrated costs of decarbonization among a small number of firms give opponents of climate action advantages in collective organization.[3]

In this article, we argue and provide evidence for a more encompassing theory of opposition to climate action among producers that emphasizes the role of carbon-intensive industries' downstream customers and upstream suppliers. The throughline in our theoretical and empirical contributions is that the full breadth of opposition to climate action from special interests has not been described, and the set of industries that oppose climate action is not all that narrow. As such, we provide the foundations—in firms' preferences and political action—for an additional explanation of why effective climate action has been defeated. Put briefly, supply chain linkages create shared interests among a strikingly diverse array of producers, providing a motive force behind extensive collective efforts to oppose climate action among an extended carbon coalition.

Our theory builds on literature examining the distributive consequences of climate action: Firms that

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[1]See Goel (2004), Markussen and Svendsen (2005), Martin and Rice (2010), Hughes and Urpelainen (2015), Kim, Urpelainen, and Yang (2016), Genovese and Tvinnereim (2019), and Brulle (2019).

[2]See Cheon and Urpelainen (2013), and Kelsey (2018).

[3]See Biber, Kelsey, and Meckling (2016), and Kim, Urpelainen, and Yang (2016).

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directly emit CO_2 or consume CO_2-intensive electricity are likely to suffer from efforts to price carbon (Kim, Urpelainen, and Yang 2016; Meckling 2011, chap. 3). However, these firms' customers may also bear some of the incidence of carbon taxation, and so apparently "green" producers may face negative exposure to carbon taxation via their input purchases. From the opposite direction, the suppliers of carbon-intensive industries face negative demand shocks from efforts to restrict carbon emissions as their customers confront heightened costs and reduced profitability. In these ways, carbon intensity travels both forward and backward through the industrial supply chain, implicating a much larger set of interests in climate policy than just direct emitters and electricity consumers. Our focus on the suppliers and customers of carbon-intensive industries therefore builds on long-running interest in the exposure of workers and consumers to climate policy, as well as the recent focus on production networks in the politics of trade.[4]

Our theory predicts that firms exposed to carbon taxation through the emissions and electricity consumption of their input suppliers or their downstream customers will be more likely to oppose action on climate change. We test this hypothesis by examining two public forms of political behavior: the formation of climate policy–related ad hoc coalitions and lobbying. Because these modes of political engagement are costly, we expect that carbon intensity up and down the supply chain will be particularly associated with public action opposed to carbon taxation among the largest firms, though we extend our analysis to industry associations too.

Testing our argument about the breadth of opposition to climate action requires examining the broadest possible picture of producers' activity around climate action. To do so, we develop an original data set of memberships in U.S. ad hoc coalitions that have either supported or opposed action on climate change. Our data describe 83 such coalitions operating from 1990 to the present with 13,783 unique members. These data are the largest of their kind and respond to Brulle's (2018) call for data on producers' preferences to complement data on lobbying. We also match these data to a key source on industrial CO_2 emissions and employ input-output tables to contribute new industry-level measures that capture how the effects of decarbonization spread through the supply chain. We find support for each of our main claims.

We also develop original findings on the role of climate opponents in lobbying that complement the existing literature. Carbon in the supply chain leads to individual lobbying on climate issues by firms just as much as it leads to collective organization. Consequently, more than 50% of lobby expenditures on climate change in the United States over the past 20 years have been spent by firms above the 90th percentile in either direct, input, or downstream carbon intensity. Even more striking, around 66% of lobbying on climate change has been done by firms or associations that have publicly opposed climate action.

Our findings therefore paint a rich picture of the breadth and depth of opposition to climate action among U.S. producers. Motivated by the negative costs associated with decisive action to reduce carbon emissions, an expanded carbon coalition of firms and associations emerged in the 1990s and has continued to thrive. These firms directly emit carbon, purchase critical inputs from industries that emit carbon, and sell their products to industries that heavily emit. As such, their reach extends well beyond the direct emitters and electricity generation industries that are the focus of current scholarship. This broad array of firms and associations is politically active and highly organized. We discuss in our conclusion the implications of this breadth for understanding the pluralistic structure of special interest politics, the design of regulatory policy, and the optimal targeting of compensation to build a winning coalition for climate action. These lessons apply to the climate crisis and potentially to many other areas of regulatory policy where firms, workers, and consumers are embedded in complex networks of supply.

Firms' Responses to Climate Action

Firms and industries take positions on proposed climate change mitigation policies in response to social factors, political pressures, and anticipated distributive consequences (Meckling 2015). Firm positions on climate policy have been traced to internal social factors like characteristics of the workforce and corporate structure.[5] Social forces outside of the firm are also important, such as public campaigns from environmental groups (Cheon and Urpelainen 2013; Damert and Baumgartner 2018; Markussen and Svendsen 2005). A second class of determinants relates to the political and institutional context in which a firm operates. If corporate leaders see policy developments as inevitable, they may proactively seek to

[4]On workers, see Bechtel, Genovese, and Scheve (2017), Kono (2020), and Bayer and Genovese (2019). On trade, see Jensen, Quinn, and Weymouth (2015), Meckling and Hughes (2017), Zeng, Sebold, and Lu (2020), and Osgood (2018).

[5]See Jones and Levy (2007), Delmas, Lim, and Nairn-Birch (2016), Hillman, Keim, and Schuler (2004), and Hansen, Mitchell, and Drope (2005).

shape policy in their favor.[6] This is especially the case when firms have the resources, expertise, and access to be successful in their lobbying efforts.[7] Multinational firms may focus on regulatory harmonization across jurisdictions to minimize compliance costs and maintain their global reputation (Levy and Kolk 2002).

Our article focuses on a third set of determinants: the distributional consequences of climate policy. The literature finds that firms oppose climate policies if they are in industries that emit large quantities of greenhouse gases, since they anticipate greater mitigation costs.[8] Firms that heavily consume electricity, especially from fossil fuel sources, are also likely to oppose climate action.[9] Because carbon emissions are heavily concentrated in a few industries (and within those, among a few very large firms), the literature has argued that opponents of climate change have structural advantages in collective organization (Biber, Kelsey, and Meckling 2016; Kim, Urpelainen, and Yang 2016).

The climate politics literature's focus on heavily emitting industries and electricity consumers misses a potentially important part of the story of climate opposition, however. Although efforts to curb carbon emissions are likely to significantly raise the costs of firms that heavily emit carbon or use electricity, some of those price increases may be passed on to consumers of those firms' products. As an example, aluminum smelting requires large amounts of electricity. Heavy consumers of aluminum in the construction and auto industries will bear some of the costs of an increasing electricity bill for aluminum producers. In mirror fashion, the bauxite mining industry, which supplies aluminum producers with ore, will face reduced demand if aluminum production becomes more expensive.

The importance of climate policies' effects on upstream suppliers and downstream consumers is widely acknowledged (Kolk and Pinkse 2004). This is particularly so for workers[10]—one key "supplier" of carbon-intensive industry—and for ordinary (nonfirm) consumers of carbon-emitting products. The ways in which climate policy's effects accumulate through the supply chain are also widely studied,[11] particularly in the context of policy evaluations (Mansur 2011). More generally, the ways that regulation can spread costs up and down the supply chain are key themes in the study of public finance and of trade politics.[12] It is surprising, then, that we can find no large-N or systematic qualitative study that investigates the role of producers who are downstream and upstream of carbon- or electricity-intensive industries in opposing action on climate change. This gap was recently highlighted in Hughes and Lipscy (2013, 460–61).

Why might this be? One possible explanation is the prominent role of direct emitters, especially the fossil fuel and electricity generation industry, in the public debate over climate change. Is it possible that there simply is not significant organized public opposition from outside heavily emitting or electricity-dependent industries? We investigate this open question below and answer it emphatically in the negative, but we highlight that our effort to build the largest data set of producer support and opposition to climate action in the United States is integral to this effort. Previous work on firms' climate positions has focused on case studies or on particular coalitions. Our data collection is much greater, allowing us to describe the full breadth of opposition to climate action among U.S. firms and associations.

A second possible explanation for this gap is a natural tendency to think about legal incidence before economic incidence. For example, the literature on trade politics has long focused on the effects of trade protection on improving domestic producers' profits. Only subsequently did scholars focus on the role of producers as consumers of internationally traded inputs.[13] Only a tiny sliver of literature considers the effects of trade policies on upstream suppliers, even though these are critical for understanding policy effects (e.g., think of the role of parts suppliers in the auto industry). A related empirical obstacle in studying these upstream and downstream effects is that input-output tables are challenging to work with and the data on greenhouse gas (GHG) emissions that are needed to match to those tables are not available in most countries. In this regard, the United States presents a good opportunity with high-quality data on both narrowly defined industry input requirements and GHG emissions. An important contribution here is to marry these sources

[6] See Bumpus (2015), Kolk and Levy (2001), and Hale (2011).

[7] See Pinkse and Kolk (2007), Layzer (2007), and Hillman, Keim, and Schuler (2004).

[8] See Goel (2004), Markussen and Svendsen (2005), Cho, Patten, and Roberts (2006), Martin and Rice (2010), and Kim, Urpelainen, and Yang (2016).

[9] See Cheon and Urpelainen (2013), Kelsey (2018), and Kennard (forthcoming).

[10] See Bechtel, Genovese, and Scheve (2017), Kono (2020), and Bayer and Genovese (2019).

[11] See Wiedmann (2009) and Damert et al. (2018).

[12] On tax policy, see Cox (2013). On endogenous trade policy, see Gawande, Krishna, and Olarreaga (2012).

[13] See Gawande, Krishna, and Olarreaga (2012), Meckling and Hughes (2017), Osgood (2018), Kim et al. (2018), and Zeng, Sebold, and Lu (2020).

to create measures of the upstream and downstream effects of climate policies.

Carbon Dioxide Emissions and Climate Policy

Greenhouse gases are by far the most important human-controlled factor contributing to climate change (Hansen et al. 2011), and carbon dioxide (CO_2) accounts for over 81% of U.S. greenhouse gas emissions.[14] CO_2 emissions therefore account for the major part of anthropogenic climate change. As of 2006, 30.4% of human-caused CO_2 emissions in the United States were generated by energy use and other emissions from households and 4.8% from government entities.[15] The remaining 64.8% were created by producers, most prominently manufacturing (25.0%) and transportation (15.1%).

Estimates of carbon emissions for U.S. industries are available across agriculture, mining, construction, manufacturing, and transportation from Henry, Khan, and Cooke-Hull (2010). We focus on these sectors, which we call the "goods+ industries," in our analysis. In these industry-level estimates of CO_2 emissions, emissions from utilities are assigned to utility-consuming end users.[16] 'Direct' carbon emissions in our data (and theoretical development) therefore means that an industry either emits CO_2 through its own activities or consumes electricity whose generation emitted CO_2. This measure of industry-level carbon emissions therefore embodies the literature's findings on the importance of both direct emissions and the use of electricity in one variable.

America's industrial sectors differ dramatically in the intensity of carbon emissions, which is the ratio of emissions generated to the value of the output produced by a given industry or sector. CO_2 intensity is measured in millions of metric tons per billion dollars of real gross output using constant 2007 dollars, abbreviated $MmtCO_2$/b.$.[17] We call the variable we employ CO_2 intensity$_i$, where i represents a six-digit 2012 North American Industrial Classification Systems (NAICS) industry. Overall, carbon intensity is highly heterogeneous and right-skewed across U.S. industries, with a median of .125, a mean of .487, and a standard deviation of 2.76. To illustrate, Figure 1 provides running examples of U.S. industries and the intensity of their CO_2 emissions. We focus on the industries in the center of the implied supply chain. Phosphate rock mining generates roughly 4 million metric tons of CO_2 for every billion dollars in revenue, due to its own activities and electricity usage. Cement manufacturing is also carbon-intensive, generating around 11 $MmtCO_2$/b.$.

Because carbon dioxide is by far the largest man-made contributor to climate change, any credible effort to mitigate climate change must reduce carbon emissions. This may be achieved by putting a price on carbon though a cap on carbon emissions (paired with trading), an emissions tax/fee, or technology standards. Any of these approaches will impose costs on direct emitters of carbon dioxide, so they each will act as a tax whose statutory burden is likely to fall most heavily on the direct emitters of carbon dioxide. In particular, carbon intensity is likely to be the most relevant metric for the statutory burden of any policy that raises the price of carbon. As an example, the non–transportation services industries account for a significant share of total U.S. CO_2 emissions (18.4%) but also a vast share of the U.S. economy. As such, the impact of a carbon tax on their bottom line could be modest. In contrast, carbon-intensive industries like phosphate rock mining, cement manufacturing, and aluminum production will face a large bill from efforts to put a price on carbon.

These are general statements, and three important caveats are in order. First, the design and implementation of policies shape their distributive effects, so bureaucratic decision making and political power are critical factors in understanding the ultimate effects of policies (Bayer, Marcoux, and Urpelainen 2013). Second, the capacity to reduce carbon intensity may vary across firms and industries. An industry that is carbon-intensive *ex ante* carbon pricing may have easy access to substitute technologies or energy sources, for example. Third, and most importantly, the statutory burden of a tax is not the same as the economic burden of the tax. We now develop this point further.

Carbon Emissions, Up and Down the Supply Chain

Carbon Intensity of Input Suppliers. The consumers of carbon-intensive products can be hurt by a carbon tax along with the producers of those products because the prices of carbon-intensive products are likely to grow as the price of carbon grows. Some of these costs will be borne by ordinary individual consumers, but many of the

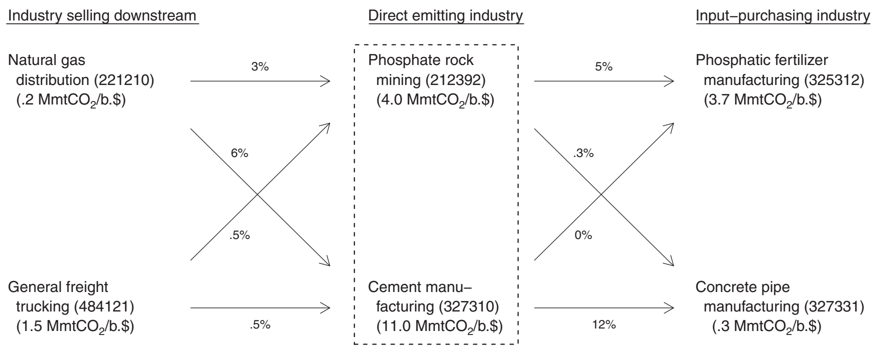
[14] These figures are provided by https://www.epa.gov/ghgemissions.

[15] These data are taken from Henry, Khan, and Cooke-Hull (2010); 2006 is the most recent available year.

[16] We examine estimates of carbon intensity for utilities from the Environmental Protection Agency's Greenhouse Gas Reporting Program in separate models in the supporting information (pp. 99–100).

[17] We map carbon intensity using Inforum's industry classification to six-digit NAICS 2012 industries.

FIGURE 1 Illustrating the Carbon Supply Chain



customers of carbon-intensive products are not individuals, but firms, industries, farms, and other *producers.* Indeed, indirect exposure via consumption of carbon-intensive inputs may be a far greater concern for industries than exposure through their own emissions. In this way, the costs of a carbon tax may spread beyond the small set of highly carbon-intensive industries.

To see this idea illustrated, consider again Figure 1; however, this time we will look at two downstream industries that are supplied by phosphate rock mining companies and cement manufacturers. Phosphatic fertilizer production is itself carbon-intensive, but it also relies very heavily on a carbon-intensive industry: phosphate rock mining. Manufacturers of fertilizer are therefore doubly exposed to a carbon tax from whatever incidence of the tax falls on their own manufacturing's direct emissions and through their consumption of phosphate rock, which will likely be more expensive once the price of carbon increases. Concrete pipe manufacturing is an even more dramatic case, suffering little direct exposure to a carbon tax but significant indirect exposure due to its reliance on cement. In sum, industries that rely heavily on carbon-intensive inputs are likely to have to pay higher costs if the price of carbon dioxide goes up. In this way, opposition to a carbon tax can propagate forward through the supply chain, as heavy consumers of carbon-intensive products face higher input bills when carbon becomes priced.

In order to measure the exposure of firms and associations to higher carbon prices through their supply chain, we match U.S. input-output tables to our measure of industry-level carbon intensity.[18] Each row of the input-output matrix **IO** represents an input, and each column is a final product. $\mathbf{IO}_{kl} \leq 1$, for example, is the total value of input k that goes into producing a dollar of output l.[19] Using this matrix, we then define a measure of exposure to carbon-intensive inputs for industry i, which we call Inputs CO_2 intensity$_i$. This is given by

$$\text{Inputs } CO_2 \text{ intensity}_i = \sum_k \mathbf{IO}_{ki} \cdot CO_2 \text{ intensity}_k.$$

This measure is akin to a weighted average of the carbon intensities of all input-supplying industries, weighted by the extent to which they contribute to a dollar of industry i's output. Looking at the four-digit NAICS level, the industries with the highest average Inputs CO_2 intensity are cement and concrete product manufacturing (3273), lime and gypsum product manufacturing (3274), other nonmetallic mineral products (3279), and iron and steel mills (3311).

With this measure in hand, we can answer two contextual questions about our theory. First, does negative exposure to decarbonization via input purchases vary significantly across industries? If all industries were equally exposed, then our theory would not provide much traction for understanding variation in firms' attitudes toward climate action. We find instead that exposure to carbon taxation via inputs is quite variable and right-skewed, with a median of .193 $MmtCO_2$/b.\$, a mean of .224, and a standard deviation of .177. Second, are the same industries that directly emit also indirectly exposed via input purchases? If this were the case, then our argument would suggest that supply chain considerations mainly reinforce opposition to climate action among heavily emitting industries. We find instead that the Spearman correlation of CO_2 intensity$_i$ and Inputs CO_2 intensity$_i$ is only .23,

[18]We use the Bureau of Economic Analysis's benchmark Input-Output "Direct Requirement Detail" table from 2002 from https://www.bea.gov/industry/benchmark-input-output-data#2002data. We convert the table into a matrix defined using 2012 six-digit NAICS nomenclature. The resultant matrix **IO** is 1019 × 1019.

[19]We set $\mathbf{IO}_{kk} = 0$ so that own-industry value added is not considered part of the input mix.

suggesting some reinforcement but also considerable potential for the extension of opposition to climate action due to the use of CO_2-intensive inputs.

Carbon Intensity of Downstream Customers. Effective efforts to price carbon will force carbon-intensive industries to contract and to cut input expenditures and consumption. Reduced sales and increasing price pressures will therefore negatively impact the industries that supply these carbon-intensive customers. Industries that heavily rely on selling their products to carbon-intensive customers are therefore likely to face a significant demand shock associated with increased carbon prices or caps on carbon emissions.

This idea is again illustrated in Figure 1. Natural gas distribution accounts for 3% of costs in phosphate rock mining and 6% of costs in cement manufacturing. Because these are large industries, an effective carbon tax could significantly dent demand for natural gas. Similarly, freight trucking could also be harmed by a carbon tax that could shrink these industries, as two important costumers would be facing negative shocks to costs. In sum, industries that rely heavily on selling their products to downstream carbon-intensive industries are likely to face negative shocks to demand if the price of carbon goes up. In this way, opposition to a carbon tax can propagate backward through the supply chain, as heavy sellers of inputs to carbon-intensive producers face reduced demand for their products as their customers are weakened.

We again define a measure of the exposure of input-supplying industries to carbon-intensive customers, which we call Downstream CO_2 intensity$_i$. Due to the structure of input-output tables, our definition for this variable is more complicated, although it is analogous:

$$\text{Downstream } CO_2 \text{ intensity}_i = \frac{\sum_k \mathbf{IO}_{ik} \cdot \text{Sales}_k \cdot CO_2 \text{ intensity}_k}{\sum_k \mathbf{IO}_{ik} \cdot \text{Sales}_k}.$$

This variable is a weighted average of carbon intensity of all downstream industries supplied by an input producer, weighted by the extent to which those downstream industries are a share of total sales to downstream producers. Looking at the four-digit NAICS level, the highest average downstream CO_2 intensities lie in shipbuilding (3366), nonmetallic mineral quarrying (2123), apparel knitting mills (3151), metal ore mining (2122), and support activities for mining (2131).

As above, we again find that Downstream CO_2 intensity$_i$ varies meaningfully across industries and is in fact noticeably right-skewed, with a median value of .205 MmtCO2/b.$, a mean of .330, and a standard deviation of .377. Moreover, we find that this measure is only modestly correlated with CO_2 intensity$_i$ (.21) and Inputs CO_2 intensity$_i$ (.12), and so it is possible that exposure to decarbonization via supply of heavily emitting industries could be growing the ranks of opposition to climate action.

Carbon Lobbying, Inside and Out

How do firms and industries likely to be negatively affected by carbon pricing—whether directly or through their purchases from or supply of carbon-intensive industries—make their preferences on climate policy heard? Firms can choose among a variety of mechanisms to convey policy preferences (Downie 2017; Meckling 2015): formal meetings with policy makers ("inside" lobbying), the formation of issue coalitions that engage in public or private advocacy ("outside" lobbying), membership in government-formed committees, testimony before Congress, and participation in notice and comment. We focus on the first two, especially outside lobbying.

Formal or "inside" lobbying occurs when interest groups seek to meet directly with policy makers to shape legislation or regulation. It is highly regulated and subject to disclosure requirements under the Lobbying Disclosure Act of 1995. The identities of lobbying groups, their issues of interest, and the volume of their lobbying activities are directly observable from lobby disclosure reports. Lobby disclosure rules do not require a corporation to describe whether they lobbied in favor of or against some particular rule or piece of legislation. Positions are unknown absent further information.

"Outside" lobbying is the creation of interest groups, coalitions, or other groups in order to signal to policy makers and potential allies the importance of an issue to that group (Brulle 2019; Kollman 1998). Among firms and industries, outside lobbying often takes the form of ad hoc or issue-specific coalitions designed to support a particular policy position or piece of legislation. These groups are often of short duration, but not necessarily so. Indeed, environmental politics in the United States often sees the creation of longer-term organizations that are still ad hoc coalitions in that they cover only one policy domain and span many industries. These longer-term organizations provide more informational and political resources, but they require more sustained engagement (Mahoney 2007).

Like inside lobbying, outside lobbying is a costly exercise of political influence—groups do not organize or fund themselves, and memberships are often priced—that reveals a meaningful stake in an issue. Data on outside lobbying are not as rich as data on lobbying. For example, they lack full disclosure on expenditures. The universe of outside lobbying is also not as clearly defined as with inside lobbying. This form of political activity has a crucial advantage, however: Firms and associations reveal their *positions* on particular issues through their membership in ad hoc coalitions with particular positions. For this reason, we focus on membership in ad hoc coalitions that have opposed (or favored) policies to reduce carbon emissions or tackle climate change as our primary outcome, and then consider secondarily formal lobbying on climate change issues.

As a first cut, we then expect firms (and industries) that face more negative exposure to carbon pricing will be more likely to join coalitions that are opposed to action to abate climate change. The literature on political action has long noted that larger firms tend to be more politically active than smaller firms. This may be for several reasons: Small firms free-ride on the efforts of large firms; large firms have more free capital and staff to invest in political efforts; or large firms are more able to pay fixed costs associated with political action. We therefore introduce the moderating impact of firm size into our initial predictions:

Hypothesis 1: Firms (and associations) that are more exposed to an increase in carbon prices—whether directly via their carbon intensity, or via their input mix or sales to downstream customers—are more likely to join public coalitions opposed to action on climate change. This should be especially so for larger firms.

Following Brulle (2018), we expect a similar relationship to hold for inside lobbying, although we highlight that the argument requires one more theoretical piece. Suppose that the average carbon-intensive firm faces just as significant negative effects from climate action as the average non-carbon-intensive firm faces benefits from climate action. Given this symmetry, we would not expect carbon-intensive firms to be more likely to lobby. Rather, we would predict parity between carbon-intensive and non-carbon-intensive firms in lobbying over climate policy, and we would be forced to look to data on public positions of firms to understand the effects of carbon intensity.

This set of distributive consequences is unlikely to hold, however. Carbon-intensive firms face significant costs associated with pricing carbon, whereas many (perhaps most) non-carbon-intensive firms face few real benefits from action to abate climate change. Instead, pockets of strong support for climate change action are likely to be concentrated in particular "green" industries: alternative forms of energy, non-emitting modes of transportation and construction, and environmental consulting and other climate adjustment services. As such, we expect that carbon-intensive industries will be more likely to lobby on climate change policy than non-carbon-intensive industries, and we leave the detailed investigation of carbon pricing's supporters to future work.

Hypothesis 2: Firms that are more exposed to an increase in carbon prices—whether directly or via their input mix or sales to downstream customers—are more likely to lobby on climate change, especially if they are large.

Data

Coalitions and Lobbying

Ad hoc coalitions are a highly regular feature of environmental politics among producers in the United States. To provide two examples, "We Are Still In" is a coalition of over 2,900 firms, government agencies, and nongovernmental organizations that formed to protest the Trump administration's withdrawal from the Paris Agreement; and "Americans for Balanced Energy Choices" is a coalition of only 27 firms and trade associations that operated from 2000 to 2008 and advocated against action to curtail fossil fuel consumption to abate climate change. We seek to explain why U.S. firms have joined ad hoc coalitions opposed to action to address climate change over the past several decades.

To do so, we identify coalitions that have organized to engage in outside lobbying on climate change over that time span. We consider only coalitions that include at least some membership from American firms or their trade associations. We focus on coalitions that concentrate on climate change as an issue (potentially among others) or are focused on broader environmental issues (energy efficiency, sustainability, energy prices) that are closely tied to climate policy. We have identified 83 such coalitions, which are shown in Table 1 and described in the supporting information (pp. 6–84).

We see relative balance across positions toward action to slow or stop climate change among these groups: 40 of our coalitions took a position strongly in favor of action; 24 have strongly opposed action to halt climate change. A further nine, three, and seven have weakly favored, weakly opposed, or been apparently neutral on climate advocacy. We highlight that those coalitions differ in many other ways, for example, membership

TABLE 1 Climate and climate-related coalitions

		Number of:		
	Years	Members	Firms	Assocs.
Coalitions that supported action on climate change:				
Advanced Energy Economy	2012-	189	188	0
Advanced Energy Management Alliance	2014-	30	28	2
Alliance for Climate Strategies	2003-2008	15	0	15
Alliance to Save Energy	1977-	329	221	50
American Business for Clean Energy	2010-	132	130	1
Am. Col. and Univ. Pres.' Climate Commitment	2009-2015	756	756	0
American Council for an Energy-Efficient Economy	1980-	103	82	8
American Council on Renewable Energy	2006-	895	763	36
American Sustainable Business Council	2012-	373	248	45
Apollo Alliance	2003-2010	200	91	5
Building Decarbonization Council	2018-	83	48	2
Business Council for Sustainable Energy	1999-	84	55	20
Business Council on Climate Change	2008-	21	19	0
Business Environmental Leadership Council	1998-	77	76	1
Business for Innovative Climate and Energy Policy	2009-	49	48	1
California Business Alliance for a Clean Economy	2014-	1368	1304	27
Carbon Pricing Leadership Council	2015-	274	171	7
Ceres	1989-	848	649	5
Climate Action Business Association	2014-	125	123	1
Climate and Clean Air Coalition	2015-	226	39	10
Climate Leadership Council	2017-	33	20	1
Climate Markets and Investment Association	2017-	19	18	0
Coalition for Emission Reduction Projects	2009-2011	23	23	0
Connecticut Sustainable Business Council	2016-	22	15	1
Corporate Climate Alliance	2018-	11	11	0
Global Alliance for Energy Productivity	2015-	224	166	15
Global Investor Coalition on Climate Change	2009-	731	587	0
International Climate Change Partnership	1996-2014	47	35	9
Interwest Energy Alliance	2008-2018	66	51	2
Iowa Sustainable Business Alliance	2012-	13	13	0
Midwest Energy Efficiency Alliance	2001-	346	251	12
New Jersey Energy Coalition	2007-	129	98	9
New Jersey Sustainable Business Council	2018-	27	17	1
North American Climate Smart Agriculture Alliance	2018-	68	13	32
Northeast Energy Efficiency Partnerships	1996-	128	94	6
Northwest Energy Coalition	1997-	223	40	9
Oil and Gas Climate Initiative	2014-	15	15	0
Second Nature	1993-	126	66	4
Sustainable Business Network of Massachusetts	1988-	74	69	1
Sustainable Energy Coalition	2002-2019	45	10	13
Sustainable Silicon Valley	2000-	46	24	0
The Climate Group	2004-	227	114	0
United States Climate Action Partnership	2006-2013	38	31	0
University Climate Change Coalition	2018-	19	18	0
Utah Clean Energy	2001-	100	81	0

(Continued)

TABLE 1 Continued

	Years	Number of: Members	Firms	Assocs.
We Are Still In	2017-	2948	2265	11
We Can Lead	2008-2010	185	181	2
We Mean Business	2014-	1167	1080	8
World Business Council for Sust. Dev.	2003-	343	343	0
Coalitions that opposed action on climate change:				
Alliance for Energy and Economic Growth	2001-2005	1358	604	706
American Coalition for Clean Coal Energy	2008-	49	44	4
Americans for Affordable Climate Policy	2008-2010	5	5	0
Americans for Balanced Energy Choices	2000-2008	27	23	4
Balanced Energy Arkansas	2013-	11	7	2
Balanced Energy for Texas	2011-2017	16	14	1
Carbon Utilization Research Council	1998-	119	83	13
Center for Energy and Economic Development	1992-2008	201	143	41
Center for North American Energy Security	2007-	6	4	2
Coalition for Affordable and Reliable Energy	2001-2009	63	4	43
Coalition for American Jobs	2011-2013	6	0	5
Coalition for Vehicle Choice	1990-2003	148	36	84
Consumer Energy Alliance	2005-	383	156	166
Cooler Heads Coalition	1998-	45	0	2
Electric Reliability Coordinating Council	2001-	11	11	0
Domestic Energy Producers Alliance	2011-	33	0	29
Energy Institute of Alabama	2016-	24	14	8
Global Climate Coalition	1989-2001	116	70	40
Informed Citizens for the Environment	1990-1992	8	5	3
Midwest Ozone Group	1998-	47	37	6
NextGen Energy Council	2006-2008	12	10	0
Partnership for a Better Energy Future	2014-	179	3	162
Partnership for Affordable Clean Energy	2011-	22	1	14
Pennsylvania Coal Alliance	2013-	201	199	1
Utility Air Regulatory Group	1997-2019	58	54	3
West Virginia Coal Association Friends of Coal	2002-	388	387	0
Wisconsin Industrial Energy Group	1973-	27	27	0
Coalitions that were publicly neutral on climate change action:				
Alliance for Industrial Efficiency	2016-	22	11	4
Energy2030	2013-	138	93	15
Northwest Energy Efficiency Alliance	2010-2019	22	14	0
South Central Partnership for Energy Effciency	2011-	77	59	5
Southeast Energy Efficiency Alliance	2007-	149	109	10
Southwest Energy Efficiency Project	2001-	128	66	11
Western Business Roundtable	2001-2009	57	49	6
Summary figures:				
Total coalition members (unique)		13783	10048	1315
Total lobbying groups (unique)		2173	1182	458
Total lobbied or joined coalition		15132	10702	1607

composition, duration, and the level of interest in climate change among other environmental issues. Despite these differences, our view is that systematic patterns in climate preferences and activity can be uncovered by combining these disparate sources.

Overall, we find 13,783 unique members that have joined these coalitions and a total of 17,776 memberships (because some actors join multiple groups). The modal member (11,560 of 13,783) has joined only one ad hoc coalition; Duke Energy, an electric utility based in Charlotte, North Carolina, has joined 21 coalitions, the most in the data. Of the organizations that have joined coalitions, 10,048 are firms, 763 are trade associations, and 552 are peak associations. We combine our codings of the coalitions' orientations toward climate action (for details, see the supporting information, pp. 4–5) with the membership data to define the set of all firms that have joined a pro– or anti–climate action coalition.

We illustrate the distribution of opposition to climate action across industries in Figure 2. For each firm in our data, we allocate its six-digit NAICS industries proportionally across the right side of the figure. For example, a firm with two industries contributes .5 to each of those industries' bars in the graph. The left side of the figure does the same for industry associations. We find predictably high densities of opposition in mining and utilities, but also evidence of an extended carbon coalition in intermediate and advanced manufactures, construction, and transportation.

Because the extent of opposition outside of direct greenhouse gas–emitting industries (and heavy electricity consumers) is a key descriptive finding, and also motivates our theory, we quantify this feature of the data by asking: What percentage of firms and associations opposing climate action have no business whatsoever in the top 20% of the most CO_2-intensive industries? We find that 73% of firms and 53% of associations that opposed climate action have no business activity in these industries. To put this in context, that top 20% of industries accounts for 67% of all U.S. emissions.[20] Looking within the goods+ industries only, we find that 58% of firms and 42% of associations have no business in the top 20% of the most-emitting industries. Among this subset of industries, the top 20% of the most carbon-intensive industries account for 79% of emissions. These striking findings reinforce the need to understand the determinants of opposition to climate action among firms and industries that are neither significant direct emitters nor heavy electricity consumers.

We supplement our data on outside lobbying through coalitions with data on ordinary inside lobbying on climate change. To do so, we use data from the Center for Responsive Politics on lobbying around climate change issues. To identify lobbying about climate change, we use a series of keywords and bills for our queries (described in the supporting information, pp. 87–88). We use these data to round out the description of firms (and others) that are politically active on climate issues. Overall, we identify 2,173 groups that lobbied on climate issues, 824 of whom also joined climate coalitions. Among firms, 1,182 lobbied on climate issues, 528 of whom joined climate coalitions.

Sample and Empirical Strategy

We wish to examine the impact of firms' carbon intensity on their opposition to climate action, as manifested by joining an ad hoc coalition opposed to climate action over the past two decades. Recall that our industry-based measures of carbon intensity relate to direct emissions and electricity consumption (CO_2 intensity$_i$), exposure to heavily emitting industries through input purchases (Inputs CO_2 intensity$_i$), and sales to heavily emitting industries (Downstream CO_2 intensity$_i$). Because we do not have usable variation over time in carbon intensity (which is measured in 1998, 2002, and 2006 only), we employ the firm as the unit of analysis.

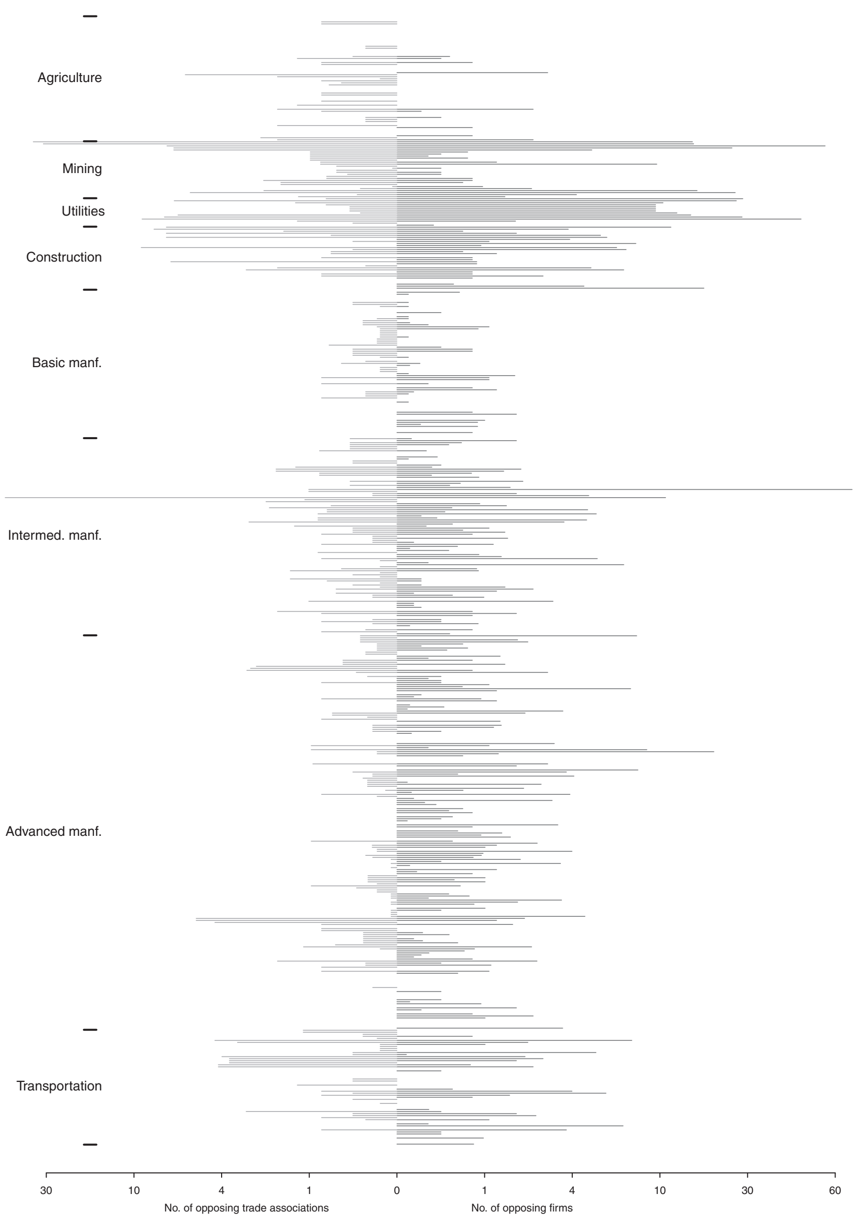
Our representative sample of firms is somewhat complicated, so we describe our process in detail. We begin with all of the groups that have undertaken climate-related political activity in the United States, whether by joining coalitions or lobbying (these are 15,159). We remove all non-firms, leaving 10,703 politically active firms; 459 of these firms could not be matched to NAICS industries, and 6,673 of them fall outside of the goods+ industries described above, leaving 3,571 firms.[21] Of these, 2,759 are U.S. firms. Since we have the population of politically active American goods+ firms, we give each of these firms a weight of 1.

Our analysis requires that we sample politically inactive firms. To do so, we undertake a stratified sample of U.S. firms from the Orbis database, sampling 100,000 firms each of sizes small or medium/large/very large, from

[20]These figures exclude political activities by utilities because those emissions are allocated to end users of electricity and natural gas. Sixty-four percent and 49% of opposing firms and associations have no business in either the top 20% of the most-emitting industries or any utility industry (NAICS code 22).

[21]The remaining services sectors see substantial participation by firms in wholesale and retail trade (836 firms); finance, including pension and investment funds (1,021); professional services like environmental consulting, architecture, and programming (1,967); and education, including universities (937).

FIGURE 2 The Spectrum of Opposition to Climate Action across U.S. Industries



both goods industries (agriculture, mining, and manufacturing) and the relevant services industries (utilities, construction, transportation) where intra-industry variation in carbon intensity is available. Our resulting random sample of goods+ firms is 400,000, but we remove from this sample any firms that already appear in the population of politically active firms (leaving 399,422 randomly sampled politically inactive firms). Sampling weights are based on the true distribution of weights in the Orbis population. Our total sample is therefore 399,422 + 2,759 = 402,181 firms. Finally, we analyze utilities separately from the other goods+ industries. After deleting a small number of observations with missing data, the sample size for our main models is 398,309 firms, while among utilities our sample is 3,826.

Our main outcome variable is Opposed$_f$, which equals 1 if firm f has joined at least one coalition strongly or weakly opposed to climate action. Although this outcome is dichotomous, we use linear models so that we may incorporate fixed effects.

We map our industry-based measure of carbon intensity to firms by using the 2012 NAICS codes of firms supplied by Orbis. We average industry-level variables over all NAICS codes to provide a firm-level estimate

TABLE 2 Carbon Intensity Drives Opposition to Climate Action

	Oppose			
	(1)	(2)	(3)	(4)
CO_2 intensity	0.01			0.01
	(0.00)			(0.00)
CO_2 intensity × Large	0.52*			0.43*
	(0.04)			(0.04)
Inputs CO_2 intensity		0.01		0.00
		(0.01)		(0.01)
Inputs CO_2 intensity × Large		0.52*		0.32*
		(0.07)		(0.07)
Downstream CO_2 intensity			0.00	0.00
			(0.01)	(0.01)
Downstream CO_2 intensity × Large			0.50*	0.34*
			(0.06)	(0.06)
Large	0.49*	0.51*	0.37*	0.83*
	(0.03)	(0.05)	(0.03)	(0.06)
Δ CO_2 intensity	−0.00	−0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Multinational	2.20*	2.20*	2.20*	2.21*
	(0.08)	(0.08)	(0.08)	(0.08)
Delisted	0.64*	0.67*	0.64*	0.66*
	(0.07)	(0.07)	(0.07)	(0.07)
Listed	1.25*	1.32*	1.26*	1.25*
	(0.07)	(0.07)	(0.07)	(0.07)
Sub. of U.S. parent	0.22*	0.22*	0.22*	0.22*
	(0.02)	(0.02)	(0.02)	(0.02)
Sub. of foreign parent	0.06*	0.06*	0.06*	0.06*
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	−0.00	0.00	−0.00	−0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Sector fixed effects	Yes	Yes	Yes	Yes

Note: All models are weighted least squares (WLS). Foreign firms, non-goods firms, and utilities are excluded. Unweighted sample size is 2,296 politically active firms and 396,013 randomly sampled firms; hence, N = 398,309. Sample sizes reflect deleted observations due to missingness. Sector fixed effects are at the two-digit NAICS level.
*$p<0.05$.

of carbon intensity. For example, CO_2 intensity$_f$ would be equal to the average CO_2 intensity$_i$ for all industries in which f is coded as belonging. The median firm in our data has only one six-digit industry, and the average firm has 1.87. Note, furthermore, that we average CO_2 intensity$_i$ over the three years (1998, 2002, 2006) in which data are available.

Orbis provides several firm-level covariates. We measure the size of firms using a discrete classification into small, medium, large, and very large categories. This is the only measure of firm size that is available for private firms. We collapse the large and very large categories into a dummy variable called *Large* to facilitate interpretation of our interaction terms. We also gather from Orbis a variable on whether a firm or its parent owns any foreign subsidiaries (*Multinational*), whether it is currently public (*Listed*) or formerly public (*Delisted*) as of 2018, and whether the firm is a subsidiary of a U.S. firm or of a non-U.S. firm (*Sub. of U.S. parent*, *Sub. of foreign parent*). Each of these factors might shape motivations to publicly engage in climate politics. In order to investigate whether industries that were willing and able to lower their carbon intensities from 1998 to 2006 are less likely to oppose climate action, we also control for the average change in carbon intensity between 1998 and 2002, and 2002 and 2006. We call this variable ΔCO_2 *intensity*.

TABLE 3 Alternative Outcomes to Capture Intensity of Opposition

Outcome	Strongly Oppose	Oppose (Climate Excl.)	# Opp. Coalitions	# Opp. Coalition-Years	Wtd. Opp. Coalition-Years
CO_2 intensity × Large	0.50*	0.12*	0.20*	0.46*	0.14*
Inputs CO_2 intensity × Large	0.45*	0.11*	0.17*	0.42*	0.10*
Downstream CO_2 intensity × Large	0.50*	0.08*	0.18*	0.44*	0.12*

Note: Each column is the set of estimates of the relevant CO_2 intensity measure interacted with firm size from models analogous to 1–3 of Table 2. For each column, the dichotomous $Oppose_f$ outcome variable is replaced by a different measure of intensity of opposition: whether a coalition "Strongly opposed" to climate action was ever joined, whether a coalition exclusively focused on opposing climate action was ever joined, the total number of opposing coalitions ever joined, the total number of opposing coalition-years ever joined, and the total number of opposing coalition-years joined with each coalition given a total weight of 1. Each of these outcomes is added to 1, logged, and then premultiplied by 100 (the latter to avoid too many significant digits). Sample sizes are the same as in Table 2.
*$p<0.05$.

Our primary models of the decision to oppose climate action are variations of the following:

$$\begin{aligned}
\text{Oppose}_f = {} & \beta_1 \cdot \ln\ CO_2\ \text{Intensity}_f \\
& + \beta_2 \cdot \ln\ CO_2\ \text{Intensity}_f \cdot \text{Large}_f \\
& + \beta_3 \cdot \ln\ \text{Inputs}\ CO_2\ \text{Int.}_f \\
& + \beta_4 \cdot \ln\ \text{Inputs}\ CO_2\ \text{Int.}_f \cdot \text{Large}_f \\
& + \beta_5 \cdot \ln\ \text{Down.}\ CO_2\ \text{Int.}_f \\
& + \beta_6 \cdot \ln\ \text{Down}\ CO_2\ \text{Int.}_f \cdot \text{Large}_f \\
& + \beta_7 \cdot \text{Large}_f + \gamma_1 \cdot \Delta\ CO_2\ \text{Intensity}_f \\
& + \gamma_2 \cdot \text{Multinational}_f + \gamma_3 \cdot \text{Listed}_f \\
& + \gamma_4 \cdot \text{Delisted}_f + \gamma_5 \cdot \text{Sub. of U.S. parent}_f \\
& + \gamma_6 \cdot \text{Sub. of foreign parent}_f + \mu_s + \epsilon_f,
\end{aligned}$$

where μ_s refers to sectoral fixed effects at the two-digit NAICS level. We examine fixed effects at the four-digit NAICS level in robustness checks. In addition, we investigate subsets of this model because some of the interaction terms are quite correlated.

Additional Empirical Implications. Our theory suggests several additional testable implications. First, rather than examine the differences between firms that oppose climate action and all other American firms, we examine the differences between firms that have opposed climate action and firms that have supported climate action. This dichotomy is not strict because 51 of the politically active American goods+ firms that joined some coalition on climate action joined at least one coalition opposing action and another coalition supporting action. We examine these cases in the supporting information (pp. 101–2) and for now compare firms that opposed climate action with firms that supported and never opposed climate action. Our model in these cases is therefore as follows:

$$\begin{aligned}
\text{Oppose}_f = {} & \beta_1 \cdot \ln\ CO_2\ \text{Intensity}_f \\
& + \beta_2 \cdot \ln\ \text{Input}\ CO_2\ \text{Int.}_f \\
& + \beta_3 \cdot \ln\ \text{Down.}\ CO_2\ \text{Int.}_f \\
& + \gamma_{1-3} \cdot \text{Size}_f \\
& + \gamma_4 \cdot \Delta\ CO_2\ \text{Intensity}_f \\
& + \gamma_5 \cdot \text{Multinational}_f \\
& + \gamma_4 \cdot \text{Listed}_f + \gamma_5 \cdot \text{Delisted}_f \\
& + \gamma_6 \cdot \text{Sub. of U.S. parent}_f \\
& + \gamma_7 \cdot \text{Sub. of foreign parent}_f \\
& + \mu_s + \epsilon_f.
\end{aligned}$$

We do not need sampling weights for these models because we have the population of firms joining coalitions. Note also that we do not interact our carbon intensity measures with firm size. Firm size is a crucial enabling condition for becoming and staying politically active. Politically active firms have already overcome the obstacles to political engagement, so we do not expect a larger firm size to increase the effect of carbon intensity in this population.

Second, we examine an analogous model for industry associations. We have 464 associations in goods+ industries that have supported or opposed climate action, and we consider whether those that have opposed represent more carbon-intensive industries than those that have supported. Naturally, we do not have the covariates for associations that we do for firms, so we only control for one-digit sector fixed effects in our analysis of trade associations.

Finally, to follow up on Hypothesis 2, we examine lobbying activities for firms. For this analysis, we define Lobbied_f as equal to 1 if a firm lobbied on climate issues according to our keyword and bill-based queries of the lobby data. These models are identical to the main models among the complete sample of politically active and randomly sampled Orbis firms; however, we substitute Lobbied_f for Oppose_f as our main outcome variable.

Results

Supply Chains Linkages and Public Opposition to Climate Action

We first examine whether firms linked to the carbon economy are more likely to join coalitions that publicly oppose climate action. These models are presented in Table 2. Before presenting the results, one note is warranted: Political activity is rare among all firms and effect sizes are small in absolute terms. For this reason, we multiply our dichotomous outcome variables in most tables by 100 to avoid coefficient estimates that require fourth or fifth decimal places. Coefficients are then interpretable as changing the percentage chance of opposition, rather than the probability.

We describe in detail our results from Model 1—which reexamines existing claims on the role of direct emissions using our new data—to contextualize our findings in Models 2–4, which represent our most original contribution. We find that firms that directly emit more carbon are more likely to join coalitions that oppose climate action. Interpreting the effect sizes from Model 1, moving *CO_2 intensity* from its median to its 75th percentile increases the percentage chance a large or very large firm opposes climate change by .06%, a relative increase of 57%.

We then see very similar patterns when we look at *Inputs CO_2 intensity* and *Downstream CO_2 intensity* in Models 2 and 3. Among large firms, an increase in *Inputs CO_2 intensity* from its 50th to its 75th percentile is predicted to increase the percentage chance of opposing climate action by .05. Likewise, among large firms, a similar increase in downstream carbon intensity increases the chance of support by .03. These are relative increases of 29% and 15%, respectively. These relative effects are large, and we highlight that a lot of the action in political activity occurs in the top tail of the distribution. Increasing *Inputs CO_2 intensity* from its 50th to its 95th percentile more than doubles the probability a large firm joins an opposing coalition. The same increase for *Downstream CO_2 intensity* increases the probability by 81%. The sign and significance of the findings are similar in Model 4, and the substantive effects are only somewhat attenuated. We also examine our main findings using public firms and a continuous measure of firm size (the demeaned logged *Revenue*) in the top third of Table 4, finding quite similar results (with the exception of *Inputs CO_2 intensity* in Model 4).

Our models in Table 2 use as an outcome variable whether a firm joined at least one anti–climate action coalition. We show similar results in Table 3 using alternative outcome variables that capture the intensity of activity. The second column reports estimates from models analogous to Models 1–3 of Table 2, but using only membership in coalitions that "strongly opposed" climate action. The outcome in column 3 is whether a firm was a member of a coalition exclusively focused on opposing climate action. The final three columns examine the number of opposing coalitions joined, the number of coalition-years (e.g., when a coalition lasts over many years), and the summed proportion of coalition-years (where each coalition has a maximum of 1). All three facets of carbon intensity remain positively correlated with opposition to climate action.

Supply Chains Linkages Among Active Firms and Associations

In this section, we consider a different question that generates a distinct empirical implication of our theory: Among firms that are politically active on climate issues, does carbon intensity predict opposition to climate action? We examine this question in the middle third of Table 4. Note that the models include the same controls as above, which we suppress to preserve space. We find that carbon intensity, whether via direct emission, input consumption, or downstream sales, is associated with opposing climate action among firms that are politically active on climate change. By way of illustration, increasing CO_2 intensity by 100% increases the percentage chance a firm has opposed rather than supported climate action by around 26%. Increasing input and downstream intensities by 100% have even larger predicted effects: 32% and 39%, respectively.

We are able to extend this analysis to trade associations, which provides an additional independent test of our theory. To do so, we construct analogous measures of carbon intensity using our own hand codings of six-digit NAICS industries of the trade associations that join public coalitions. The results of these models are reported in the bottom half of Table 4. We see in those models that *CO_2 intensity* and *Inputs CO_2 intensity* are positively associated with opposing climate action among politically active trade associations. *Downstream CO_2 intensity* is not, and is in fact negatively linked with opposition in Model 4. This latter relationship is not consistent with

TABLE 4 Carbon Intensity among Public Firms, and among Firms and Associations That Have Joined Coalitions

	Oppose			
	(1)	**(2)**	**(3)**	**(4)**
Models examining only publicly traded firms				
CO_2 intensity	2.88*			2.48*
	(0.71)			(0.92)
CO_2 intensity × Revenue	2.26*			1.48*
	(0.35)			(0.52)
Inputs CO_2 intensity		2.58*		−1.12
		(1.21)		(1.49)
Inputs CO_2 intensity × Revenue		2.72*		−0.04
		(0.75)		(0.90)
Downstream CO_2 intensity			5.36*	3.76*
			(1.33)	(1.49)
Downstream CO_2 intensity × Revenue			4.58*	2.76*
			(0.68)	(0.89)
Revenue	3.10*	3.96*	3.81*	3.84*
	(0.29)	(0.64)	(0.36)	(0.68)
Intercept	4.02	4.59	5.03*	4.86*
	(2.24)	(2.34)	(2.27)	(2.35)
Firm-level controls	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Models examining all firms active on climate issues				
CO_2 intensity	0.26*			0.18*
	(0.02)			(0.03)
Inputs CO_2 intensity		0.32*		0.09
		(0.05)		(0.06)
Downstream CO_2 intensity			0.39*	0.26*
			(0.04)	(0.04)
Intercept	0.33*	0.32*	0.31*	0.45*
	(0.06)	(0.07)	(0.06)	(0.07)
Firm-level controls	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes
Models examining all trade associations active on climate issues				
CO_2 intensity	0.18*			0.28*
	(0.04)			(0.05)
Inputs CO_2 intensity		0.42*		0.21
		(0.10)		(0.11)
Downstream CO_2 intensity			−0.03	−0.17*
			(0.03)	(0.04)
Intercept	0.97*	1.12*	0.81*	1.06*
	(0.07)	(0.09)	(0.07)	(0.09)
Sector fixed effects	Yes	Yes	Yes	Yes

Note: All models are weighted least squares (WLS). Among public firms, the sample size is 2,847. Among politically active firms N = 2,007; among associations, N = 464. Models of firms include unreported controls for size (four-level measure), multinational status, publicly listed/delisted, and subsidiary status.
*$p<0.05$.

TABLE 5 Carbon Intensity Drives Lobbying on Climate Issues

	Lobby			
	(1)	(2)	(3)	(4)
CO_2 intensity	0.01*			0.01*
	(0.00)			(0.00)
CO_2 intensity × Large	0.57*			0.51*
	(0.03)			(0.03)
Inputs CO_2 intensity		0.01		−0.00
		(0.01)		(0.01)
Inputs CO_2 intensity × Large		0.58*		0.35*
		(0.06)		(0.06)
Downstream CO_2 intensity			0.00	0.00
			(0.01)	(0.01)
Downstream CO_2 intensity × Large			0.36*	0.17*
			(0.05)	(0.05)
Large	0.46*	0.49*	0.23*	0.76*
	(0.03)	(0.05)	(0.03)	(0.05)
Δ CO_2 intensity	−0.00*	−0.00	−0.00	−0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
Multinational	5.54*	5.54*	5.54*	5.55*
	(0.07)	(0.07)	(0.07)	(0.07)
Delisted	0.98*	1.01*	0.98*	1.00*
	(0.06)	(0.06)	(0.06)	(0.06)
Listed	2.70*	2.78*	2.73*	2.72*
	(0.06)	(0.06)	(0.06)	(0.06)
Sub. of U.S. parent	0.07*	0.07*	0.07*	0.07*
	(0.02)	(0.02)	(0.02)	(0.02)
Sub. of foreign parent	0.04*	0.04*	0.04*	0.04*
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.00	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Sector fixed effects	Yes	Yes	Yes	Yes

Note: All models are weighted least squares (WLS). Unweighted sample size is 2,296 politically active firms and 396,013 randomly sampled firms; hence, N = 398,309. Sample sizes reflect deleted observations due to missingness. Sector fixed effects are at the two-digit NAICS level. $^*p<0.05$.

our theory, but overall the findings support the idea that carbon intensity through the supply chain is linked to producers' preferences over climate issues.

Lobbying on Climate Issues

Are producers' decisions to lobby on climate issues also driven by carbon intensity through the supply chain? We begin by replicating our empirical strategy from Table 2 but examining instead lobbying on climate issues as the outcome in Table 5. We see substantively very similar effects for all forms of carbon intensity on the choice of whether to lobby. Apparently, carbon intensity is driving firms to Washington to express their preferences about climate policy. These concerns are likely to come in the form of opposition to significant action to curtail carbon emissions.

To provide an alternative gloss on the findings in Table 5, we look at aggregated lobby spending on climate-related issues. We first examine the extent to which lobby spending on climate-related issues is shaped by carbon-intensive firms. To do so, we examined the percentage of lobbying expenditures by firms that are accounted for by firms that lie above the 90th percentile on at least one of our three measures of carbon intensity. Within goods+ industries, we find that 53.2% of lobbying on climate issues is conducted by these firms. If we relax our

Table 6 Public Positions of Firms Lobbying on Climate Issues

	Participation in Ad Hoc Coalitions			
	None	Oppose Only	Opp. and Favor	Favor Only
All actors	16.91	35.53	30.61	16.95
Firms	13.19	9.28	48.31	29.22
Trade associations	28.34	16.94	45.00	9.72
Peak associations	2.42	95.41	1.92	0.25
Labor unions	46.76	5.91	24.16	23.17

Note: Lobby data are from the Center for Responsive Politics. Climate lobbying was determined using keyword search of lobby report specific issues field and search for lobbying on particular bills. Figures are percentages of lobby expenditures accounted for by groups, conditional on their activity in ad hoc coalitions that support or oppose climate action.

threshold to the 75th percentile, then 79.9% of lobbying is conducted by firms that either directly emit or source or supply direct emitters.

We then look at the extent to which lobbying on climate issues is conducted by firms (and other actors) that have publicly opposed climate action. These results are in Table 6. The headline figure is that 66.1% of lobbying expenditures on climate change have been carried out by firms, associations, unions, or other groups that have joined coalitions that oppose climate action; and 35.5% by groups that have joined *only* coalitions opposed to climate action. Among firms only, 57.6% of lobbying has been done by firms that have opposed climate action, although a large amount of lobbying (48.3%) has been done by firms that have both opposed and supported climate action.[22] Among associations, the figures are especially striking: 9.7% and 0.2% of climate lobbying has been done by a trade and peak association, respectively, that has only supported climate action, whereas 16.9% and 95.4%, respectively, has been done by associations that have only publicly opposed climate action. We conclude that firms and industries that are significantly exposed to carbon pricing are much more likely to engage in outside lobbying opposed to climate action, are much more likely to lobby on climate policy, and account for the majority of lobbying expenditures on climate policy.

Conclusion

Firms and industries that intensively emit carbon dioxide are more likely to join public efforts to oppose climate action. We find that this opposition extends to their suppliers and to their customers, both of whom face costs from climate action that are transmitted through the supply chain. As a result, the set of producers negatively affected by efforts to limit GHG emissions extends far beyond direct emitters and electricity consumers and into areas of industry that may appear, at first glance, to face few negative consequences from decarbonization. The collective efforts in the public sphere of this "extended carbon coalition" are significant, and they are matched by significant activity in lobbying. We conclude with three primary implications for the political economy of climate change mitigation policy, as well as the special interest politics of regulation more generally.

First, our findings highlight the importance of taking a broader view of the effects of major regulatory changes like decarbonization. As in other areas, climate change politics is often viewed as a manifestation of a "narrow" interest group politics in which a small group of carbon-intensive actors have an easier time engaging in collective action than larger groups with more dispersed interests. This point is reinforced inasmuch as carbon-intensive industries employ relatively small numbers of workers. Our research challenges this view, implying that the group of actors benefiting from the status quo of unregulated carbon emissions, and consequently resisting efforts to mitigate climate change, may be much more widely distributed than previously believed. Through this large and geographically ubiquitous constituency (both in terms of firms and workers), the failure of federal climate policy could be attributable to a more broadly "pluralistic" process across producers. Our focus on the breadth of opposition to climate change action, and on the spread of climate action's costs through the supply chain, should inform new work on the endogenous determination of climate policy. Our focus on supply chain links can also be applied by analogy to many other regulatory areas that appear at first blush to be narrowly targeted.

A second implication concerns the design of policies intended to build support for dramatic policy changes.

[22]We investigate these "hedgers" in the supporting information (pp. 101–2) and find that they are disproportionately public, multinationals, and/or foreign.

Instead of addressing only the concerns of directly regulated firms, policy makers may need to target a broader and more diverse set of actors that extends across the supply chain because those supply chain linkages are conduits for the transmission of complex policy impacts. For example, economic adjustment policies intended to mitigate the shock of reduced demand for coal would need to help not only unemployed coal miners, but also the firms and workers who use coal further down the supply chain and the firms and workers who supply the coal extraction industry. Similarly, if resistance to policy change has a more pluralistic character, efforts to enact policy changes may be more successful not by using narrow, technical arguments that revolve around distributional benefits, but by expanding the scope of conflict through the invocation of ideological or other broad socializing discursive frames.

Finally, policy makers should take variation in the structure of industry supply chains into account when designing regulatory policy. In our case, regulations on carbon emissions impose costs on directly regulated firms that vary in their ability to pass costs down the supply chain. The distributive politics of climate mitigation policy must consider how to allocate scarce political resources, such as money and regulatory intensity, with an eye on supply chains. As an example, if concentrated opposition is impeding climate action, funds to defray adjustment costs (or regulatory slack) might be optimally targeted at direct emitters who cannot pass costs up and down the supply chain. If the breadth of opposition is more problematic, pro-climate politicians might target broader sets of industries sharing the same fate through supply chain linkages and then consider spreading resources for adjustment up and down the supply chain.

Firms' engagement in climate politics depends on their reliance on carbon-intensive industries. The political extent and organization of this "extended carbon coalition" means that a broader segment of the economy has the motive and means to oppose action to mitigate climate change than is generally acknowledged.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix A: Ad hoc coalitions and lobbying
Appendix B: Additional models