Doing it for the firms? National advantage and climate change regulation

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Abstract

Over the last twenty years, countries worldwide have intensified their efforts to combat climate change, placing increased demands on individuals and businesses. This surge is evident in the remarkable eight-fold increase in the number of policies specifically addressing climate change since 2000. However, the factors driving the recent proliferation and uneven adoption of climate policies across nations remain unclear. In our research, we shed light on this issue by highlighting the influential role of incumbent firms in shaping climate policy-setting. Through an analysis of cross-country panel data on climate policy adoption, we provide empirical evidence supporting our claim. We leverage exogenous variations stemming from natural advantages in renewable energy and changes in the cost of renewable technology. Our findings also reveal that within the European Union's international policy-setting context, the most carbon-intensive firms, along with those originating from countries with more lenient regulations, seek to exert the greatest influence through lobbying for climate-related matters. Taken together we suggest that historical and natural advantages in a country's climate efficiency significantly impact how national climate policies are formulated, often diverging from the preferences of the general public. However, given the asymmetric lobbying by firms, business influence at the international level is unlikely to result in the adoption of more stringent climate policies.

1 Introduction

At a 2014 meeting of heads of government, the European Union set an aggressive set of carbon emission cuts and binding renewable energy targets in 2014. A the time, the president of the European Commission declared "this package is very good news for our fight against climate change." What explained the particular shape that that agreement had? Soon after, journalists unearthed the role that certain oil companies had had in influencing the position of the European Union and in making it a lot less ambitious than it might have been, for example by not setting renewable targets by country (Carrington, 2015). This paper tries to explain the role of business in climate policy-setting in two stages. First, through taking national policies as a starting point and quantifying the role that the average carbon intensity of a countries' economy can have in determining the policy landscape. And second, through considering the influence firms seek to have in setting international climate policies, and how it depends on their individual and country-given comparative advantages. We provide empirical evidence cross-nationally using a panel model and an instrumental variable approach that changes in national policies track the average emissions in the country, and their levels can be predicted by their potential for renewable energy. At the international level, we provide observational evidence within the European Union that lobbying activity is concentrated among companies that we may expect to oppose increases in international policy demandingness.

The weight that governments attach to the public interest, relative to economic, or business interests when making decisions about the level of demandingness of regulation is an open question (Thornton, Kagan and Gunningham, 2008). In the case of climate change policies, there is a clear long-term public interest in the policies for demanding drastic policy measures, but costs of business compliance may be high, as they require large capital investments to transition to renewable energy sources.

We provide empirical support to the view that for climate policies, governments and business engage in a "dance" whereby governments gradually increase their demands of companies over time, as companies develop the capacity to comply with ever stricter policies. This view provides a more nuanced perspective than others that explain regulatory levels as largely driven by business or economic interests (Stigler et al., 1971), or alternatively, as driven by public interest defended by policy entrepreneurs (Levine, 2007; Thornton, Kagan and Gunningham, 2008). In effect, governments adopt the regulation that is feasible under firms' collective capacity constraints. The regulation set is dynamic and ultimately demands of companies more and more over time. By acting tn this way, governments that are not captured by any interest group end up rationally taking into account the interests of existing businesses when developing regulatory policies.

In our theoretical contribution, we suggest how national governments set regulation at levels that track levels of "climate efficiency" in the country, the greenhouse gas equivalent emission per unit of economic output. Additionally, as more policy-setting becomes international, companies will have to decide what regulatory strategy to adopt with respect to international regulation. They will base it on whether they stand to win or lose from more demanding international policies. This will depend on their own domestic policy environment and on their individual climate efficiency. They may be subject to high levels of national regulation that put them at a comparative advantage over others if international regulation were to rise or, conversely, they may be subject to lesser regulation and they would be at a disadvantage if international regulation were to start.

Empirically, we provide systematic evidence for the tracking of national policies to levels of national climate efficiency, beyond the abundant case studies in this literature that are not obviously generalizable (Bernauer et al., 2013). We use a novel panel dataset to test this, alongside plausibly exogenous sources of variation in levels of climate efficiency, and in its changes over time.

At the international level, we assess quantitatively the importance the significance of alternative regulatory strategies. In particular, we are interested in the types of firms and how many of them engage in lobbying of a key international institution in charge of regulating climate policy. We find that it is companies with highest emissions and from countries with looser existing regulations –who presumably stand to lose the most from increased regulation. Although in theory there ought to be a range of corporate voices represented in the policy debate (Meckling, 2015), the companies that oppose more demanding policies (like the oil companies in our example) are the ones that are most vocal. And we see little evidence of companies that would support increases in regulation there being active in lobbying.

We contribute to our empirical understanding of the regulation of climate change and its relation with business influence in two ways. First, we are able to isolate the effect of the stage of climate efficiency a country is in on the amount of climate regulation that is actually in place. Climate regulation in certain countries is associated, in part, with determinants such as the state of climate efficiency of businesses and the natural potential for mitigating climate policies, beyond questions of what the public wants and the specific political institutions in the country. Second, we also find that in the international setting, where there is even less direct connection to a particular "public" and where we would expect corporate voices to be more diverse, the most carbon-intensive companies are the ones that have been subject to the loosest national and environmental regulations are the only ones that engage in lobbying. This suggests an asymmetry in the voice exercised by existing companies in that the ones that would stand to benefit from greater regulation are not advocating for it. A key questions for future research will be to explain such "missing" lobbying, which if made available would contribute to bringing about more demanding climate regulations and better climate outcomes.

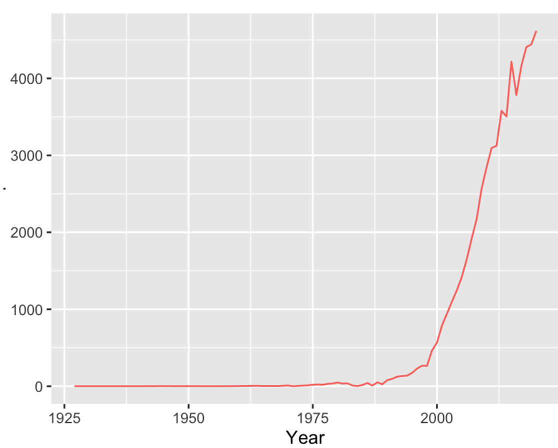
2 The evolution of climate policy: theory

We start from the observation that national environmental regulation cannot easily be explained by command-and-control approaches, where the public interest in climate change drives regulatory decisions. First, this would be at odds with how gradual the adoption of new policies has been: some of the first solid information about the relation between carbon emissions with climate change can be dated to the first Intergovernmental Panel on Climate Change (IPCC) report from 1990. The earliest international policy action commitments can be dated back to the Earth Summit in 1992, in Rio de Janeiro, or alternatively to 1997, with the Kyoto protocol. None of these discrete dates are apparent when we plot on the onset of environmental policies in Figure 2a, which are much more gradual. Information on the impact of climate change has also not been gradually unleashed. And every delay with limited climate effort would seem to be counter-productive in that the same goal would require more effort at a later date.[1]

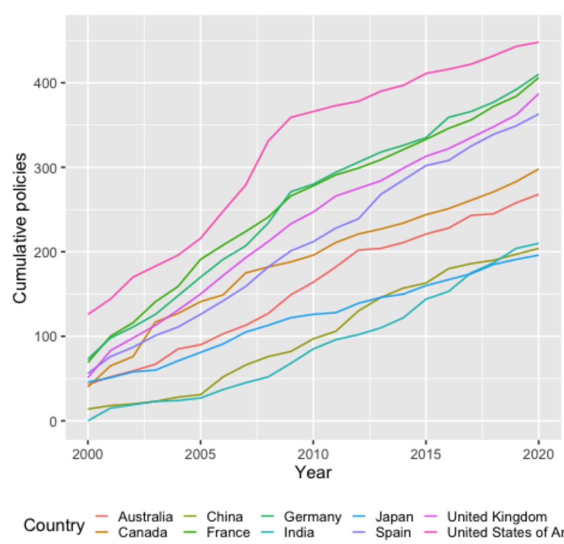
Second, differing regulatory efforts by country seem inconsistent with a view of the climate as a a global public good. These differences in regulations across countries are, moreover, not obviously aligned with the preferences of the different national publics.

Figure 1: Evolution in the number of climate-related policies, 1927-2020

(a) All countries



(b) Policies by country for top ten countries by emissions, since 2000



Source: Climate policy database.

[1]This may be the case even though technological costs of emissions reduction are reduced over time, as one cannot undo emissions today and forecasts are of severe effects on the basis of current emissions, even if emissions were to be completely halted in the future.

But these facts about regulatory policies are also not compatible with what a captured regulator would do. To a first approximation, we should expect stalling and inaction on regulation that would generate large adaptation costs on powerful large incumbents. We do see a long period of inaction followed by gradual increases in policy activity since 2000. Why would *some* policy activity, even if gradual, occur?

We suggest that a view that better explains these dynamics than either extreme is that there is an adoption of stringent policies that tracks the environmental strategies that are feasible for businesses at different points. Setting increasingly more demanding policies can be partly justified by a desire to be responsive to the public or to act like a policy entrepreneur through binding regulatory action that will have consequences in the mitigation of the negative impact of climate change. This is done, however, alongside *progressively* imposing higher requirements on incumbents in a way that allows them to adapt. Rather than set optimal public policies with cost X today, regulators deploy policies with a cost at a level below X and, in subsequent years they reach X or higher, as the cost of adaptation decreases.

The stringency of national policies is thus conditional on the potential for complying with it that businesses in that country, collectively have. In the case of climate adaptation, in turn, these will be at least partly due to historical trajectories or nature-given potential for reducing emissions.

We posit a "dance" between regulator and business interests that balance the demand for additional regulation with limits to the disruption businesses can endure, but makes those demands more gradual than is optimal from the point of view of the public. Capture of the regulator by firms (Stigler et al., 1971) that would condition its behavior fully does not need to occur under our theory. Similar results could happen if we follow a similar logic to Carpenter (2004), where a regulator that focuses on incumbent firms look like they are being favored by regulators due to their higher reliability or better expected outcomes. Behavior that favors incumbent firms' interests may occur if optimal public policy would imply regulations that are so stringent that many would exit, or go out of business –with negative welfare effects.[2]

These phased policy introductions may be the natural compromise resulting from extensive and influential input given by existing businesses to a regulator, as has been shown to occur in the US context by Yackee and Yackee (2006); Ban and You (2019). However, unlike alternative theories where regulators are captured, here the regulator is determined to increase how binding policies are throughout the economy, and does so. If the determination were less strong, the outcome would be immobility or a more subtle form of capture by incumbents such as vintage-differentiated regulations (Stavins, 2006).

The paths that countries follow would therefore be given in part by natural conditions for mitigating climate change and the historical path-dependency advantages as determinants of regulatory levels. We thus complement studies of other such determinants by explaining why they may have found limited empirical evidence for the importance of structural political factors (unions, green parties, inter-jurisdictional competition) on emissions (Bernauer and Koubi, 2009; Spilker, 2012), and on policies (Bättig and Bernauer, 2009; Von Stein, 2008) –although the latter are somewhat more robust. It also provides a set of explanations for climate policy adoption, for instance *within* democracies.

Our national theory puts at the center of the determinants of policies static and dynamic climate efficiency conditions manifested through the interests of businesses. The role of other interest groups, such as public opinion or environmental activists (Mildenberger, 2019), is thus bracketed, although we may expect it feeds the common interest for increasing the demandingness of regulation and, to an extent, that of businesses in demand for clientele (Bernauer and Caduff, 2004).

[2]There are at least three reasons for this. First, governments rely on incumbent companies to provide important services (energy, infrastructure, transport). Second, they are also typically big providers of employment. And, third, they play an informational role on what is possible to achieve or not with technology. Potential but non-existent or sub-scale firms that would, through technological innovation, be able to comply with stricter regulations are not reflected in those regulations. They do not have a voice if they do not exist and if they did, their views may be heavily discounted (as they would be typically subscale).

2.1 Lobbying at the international level

International climate action has increased in importance in recent years, from the United Nation's Framework Convention on Climate Change to other regional agreements such as the Asia-Pacific Adaptation Network, the Caribbean Community Climate Change Centre, Africa Renewable Energy Initiative and the African Adaptation Initiative. We will study the case of the to the European Union. Its executive branch, the European commission has declared its goal to be a leader in emissions reductions, by committing to reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. It is also "striving to be the first climate-neutral continent", which it aims to be by 2050 (European Commission, 2019). It has indeed a sprawling policy framework, including the European Green Deal, the EU Emissions Trading System the Effort Sharing Regulation.

A key question given the evolving nature of policymaking is about how national policies are associated with international-level policy-setting. How do firms, who have a home market that binds perhaps its core business relate to its activities when they are going to be increasingly bound by an international regulator (such as the European Union)?

For national policies, we have taken a (simplified) view that emissions efficiency levels or nature-given renewable potential are more or less homogeneous at the country level and are therefore good candidates for using unified national-level interests (measured via country averages) as predictors of policy-setting. At the international stage, we posit that heterogeneity within sectors becomes more important: firms of a similar sector may behave differently depending on the national policies they have been exposed to in their domestic markets, compared to others, and may have had very different levels of climate efficiency, compared to their counterparts in other countries. We would expect the variation of interests to be more pronounced for international than domestic lobbying, given the range of starting points in national climate policies and histories.[3]

Firms can adopt different stances as to what role to play with respect to new interna-

[3] This has been shown by Foster (2012) to have happened sectorally in the case of more fuel efficient airlines lobbying for more demanding emissions regulations for airlines.

tional regulations. To use the typology of Meckling (2015) companies can oppose, "hedge" or try to minimize compliance costs through shifting policies; support, or abstain altogether from making their views heard to regulators. New environmental policies are typically ones that impose costs such as of increasing renewable energy consumption, insulating buildings, etc. For example, a salient policy in the European Union has been whether to introduce binding renewable energy share commitments and reductions in emissions with implications for many industries. The influence that businesses will seek to have on these international agreements becomes more complex as a wider range of interests that are less organized and less homogeneous along sectoral lines emerges. In particular, companies within a sector such as energy may be at different stages of climate efficiency because of the legacy of national policies and natural conditions that they have been subject to in their domestic markets. In turn, this will affect how companies choose to lobby for these international regulations. Ambitious regulatory change resulting in a reduction of carbon emissions at the international level can be arrived at through "levelling-up", i.e. the internationalization of more demanding domestic regulation. If companies care as much about being subject to additional regulation as they would about using greater regulation to obtain a comparative advantage, we would see two types of companies engaging in more lobbying of international regulators. Companies with the lowest emission levels or from countries with the strongest policies nationally would be the ones that will lobby most strongly in support for more demanding of international regulations. Having confronted most demanding national regulations, it would be to these businesses' advantage to set up more (less) demanding regulations at the international level. Analogously, companies that have had a lax regulatory environment would oppose the imposition of additional international regulation.

2.2 Hypotheses

We thus draw two main hypotheses:

First, countries with greater "climate efficiency" levels, that is, with less climate impact per unit of economic output will have a a more demanding policy framework.

H1 *Countries with "climate efficiency" advantages will have a more demanding climate policy framework.*

Second, at the international level, and in particular at the European level, we focus on two proxy measures of the competitive position the firm may be in with respect to regulation, one that focuses on the domestic market's environment of policy demandingness and average emissions, while the other measures a firm's own emissions. Firms from countries with stricter regulations will lobby for stricter policies at the international level and firms from countries with less strict regulations will lobby for less strict regulations at the international level. Similarly, there may be be even more demand from companies that are themselves leaders or laggards in their own carbon emission profiles.

H2a *Companies headquartered in countries with high or low levels of national policies show more lobbying activity with the European Commission.*

H2b *Companies with high or low emissions levels show more lobbying with the European Commission.*

We now turn to empirically testing these hypotheses in turn.

3 National policies and domestic climate efficiency

3.1 Data

3.1.1 Dependent variables: climate policy intensity

The main national-level dependent variable we use is a simple count of the number of climate-related policies that countries have. This comes from the "Climate Policy Database" produced by the think-tank New Climate Institute (New Climate Institute, 2021). This source compiles and unifies 26 different sources, including the policy database of the International Energy Agency. It includes 5,783 policies and provides the name, sector, and assigns one or several types to a policy. It aims to include any policy in the broad sense of government action, from laws limiting emission levels or setting targets, to subsidies for the use of certain emissions, or regulations of permitted activities. This measure is useful because it has a wide range across countries and has a panel structure dating to 1927.[4] It has of course downsides in that it reduces how demandingness of a policy-set to a count of how many distinct policies there are. (In future work we will exploit the textual content of the policy typologies to get a less crude sense of the demandingness of the policy environment.)

3.1.2 Independent variables: measures of climate efficiency

We use two main independent variables to measure the climate efficiency of the national economy, that is, how carbon-intensive its economy is. The first is the share of renewable energy as a total share of all installed capacity in the country. Energy generation is the largest driver of carbon emissions. Globally, it is estimated that about three quarters of emissions are due to electricity generation, so the role that renewable (zero or low-emission) generation has dwarfs any other potential levers.[5] We use publicly available information on installed energy capacity by source and country, from IRENA, the International Renewable Energy Agency.

The second variable is forward-looking and measures the potential for reducing emissions. First, we do so through the potential for development of solar and wind energy in the country given the natural conditions in those countries.[6] We use data on the physical capacity "given by nature" for solar and wind energy obtained, respectively, from the Global Photovoltaic Power Potential Study of the World Bank, and the Global Wind Atlas, the result of a collaboration between the Department of Wind Energy at the Technical University of Denmark (DTU Wind Energy) and the World Bank Group. For wind energy, this is mean wind speed and wind power density (the annual wind power per square meter, adjusted by

[4] In our main specification, we attribute the policies of the European Union as additional policies each country has.

[5] 73%, to be precise, according to International Energy Agency estimates (in December 2022, available here). This includes non-renewable electric power generation, as well as energy for buildings and industry.

[6] This approach is the cross-country analogous of Stokes (2016), used for explaining cross-sectional levels. The Bartik-like instrument in our third strategy combines this with changes in the price of renewable energy.

height). For solar energy, it is the calculated average practical potential of solar energy, in KWh per square meter and day. These measures are determined by natural conditions, from hours of sunlight, to surface inclination in the case of sun, to natural wind currents and wind speed and air density (related to elevation and temperature).

In a second dynamic strategy, we construct a change-variable that exploits changes in the cost structure of different technologies using information from IRENA. We use the average observed costs across countries of generating energy through installed capacity, for each of the different renewable technologies (offshore wind, onshore wind, solar photovoltaic, concentrating solar power, and hydropower), and weight it by installed capacity at the beginning of the period. This information is available yearly 2010-2020, and so we use two periods, the growth 2010-15 and 2015-2020 (see below).

3.2 Empirical setup

We use three strategies to test our hypothesis H1. In all of them the main dependent variable is country-level climate-change related policies. In the first strategy, we use a panel of installed renewable capacity in the country since 2000. With it, we test the relation between lagged renewable capacity and national levels of regulation, which we operationalize as the number of climate policies, essentially those to reduce carbon emissions. We fit models of the form:

$$Policies_{iy} = ShRenewable_{i(y-l)} + \mathbf{X}_{i(y-l)} + C_i + Y_y \tag{1}$$

Where *Policies* are the cumulative number of climate policies at time y in country i, *ShRenewable* is the share of renewable energy in the country, C are country fixed effects and Y are year fixed-effects. $\mathbf{X}$ is a vector of country- and year-dependent control variables. Throughout, l is a lag in years.

In the second strategy, we use an exogenous source of variation on "climate efficiency" to measure solar and wind potential and relate them to the latest cross-section of number policies available (2020). Solar and wind potential is as-random variation in the climate efficiency of businesses in those countries.

$$Policies_i = SolarPotential_i + WindPotential_i + \mathbf{X}_i \tag{2}$$

Here, solar potential and wind potential enter alternatively and then concurrently in this 2020 cross-sectional equation.

In the third strategy, we combine the panel structure of our data with the exogenous source of variation in changes to the cost-efficiency of each energy source. In particular, we combine the share of each type of renewable energy at the beginning of each of the two periods (2010-15 and 2015-20) with the changes in the costs over time of different technologies. Changes in installation costs for the particular technology worldwide (weighted by the share at the beginning of the period for each technology in the country) are used to predict the changes in renewable share of energy in the same period. Then we regress changes in the number of climate policies on these predicted changes in renewable share. These allow us to relate changes in policies to changes in the renewable potential in the country.[7]

We implement this as follows:

$$ShRenewable_{iy} = \sum_{j=1}^{6}(ShRenewable_{ij(y-5)} \times \triangle GlobalCostRed_{jy}) \tag{3}$$

Here, $RenewableCostRed$ is the weighted reduction in the cost of renewables in country i between the periods of $y-5$ and y, and is a calculated as the product of the share of renewable energy from each technology j at the beginning of the period (at $y-5$) combined with the global cost reduction of installed capacity of the technology in the period from $y-5$ to y.[8] IRENA provides both the capacity-by-country and cost-by-year data.

We then use the predicted value from this equation to calculate a predicted growth in

[7] There are different ways of predicting how costs will affect the predicted renewable share, in effect, what we do is assume that the rate of expected growth of each technology will be directly proportional to the reductions in cost of that technology.

[8] The six renewable technologies we consider are solar photovoltaic, solar thermal energy, offshore wind energy, onshore wind energy, mixed hydro plants, and renewable hydropower, in accordance to the IRENA taxonomy.

renewable share over a 5-year period, by taking:

$$\triangle ShRenewable_{i[y-(y-5)]} = Sh\widehat{Renewable}_{iy} / ShRenewable_{i(y-5)} \tag{4}$$

Finally, we take this predicted value of the change in renewable share and regress the change in the number of policies in a five year period on it.

$$\triangle Policies_{i[y-(y-5)]} = \triangle Sh\widehat{Renewable}_{i[y-(y-5)]} + \mathbf{X}_{i(y-l)} + Y_y \tag{5}$$

3.3 Results

We present the relation between climate efficiency and the number of climate policies using the three complementary approaches described above. We do so in Table 1.

In the first specification (which we use as baseline), we relate the share of renewables and the number of climate policies in the country in 2020. Columnn 1 shows this single-year cross-section, with very small estimates but in a positive direction. Column 2 shows our main panel model with lagged dependent variable, and with country and year fixed effects. Its coefficients imply that a 10 percentage point increase in the share of renewable energy is associated with having 8 additional country environmental policies being in place. This effect is highly statistically significant. In the alternative model 3, when we include EU-wide policies and impute them to every country, the effect of policies is such that it leads to an increase of 3 policies per 10 percentage points increase in renewable share. Both cross-sectionally, and in the panel setup with one-year lag, there is a strong positive relation between the strength of renewable energy capacity and the amount of regulation endure. This is consistent with H1.

In Table 2, we regress the number of climate policies on the country's potential for solar and wind power in the country. When we regress number of policies in the 2020 cross-section on solar practical potential on column 1, we find a positive but statistically insignificant relation. In column 2, for wind potential, we find a positive relation between the wind speed

Table 1: Number of policies and share of total electricity coming from renewable sources

	(1) 2020 Cross-section	(2) Panel	(3) Panel including EU policies
Share renewable energy	0.250	80.148***	33.726***
	(36.972)	(11.131)	(11.131)
Constant	61.387***	−106.387***	−41.017***
	(18.885)	(12.053)	(12.053)
Country FE		X	X
Year FE		X	X
Observations	67	1428	1428

Note: Models implement cross-sectional (1) and lagged panel (2 and 3) models, with the number of climate policies in the country-year as a dependent variable. The independent variable captures the share of renewable energy in the previous year.

*p<0.1; **p<0.05; ***p<0.01

average in the country and the number of policies in the country, and this is statistically significant at conventional levels. When we combine both solar and wind potential into the model in column 3, the same results hold. The significant relation of wind potential in the country with the number of climate policies is consistent with H1, whereby country climate efficiency as a result of natural advantages is associated with a more demanding environmental policy environment.

Lastly, in our third strategy we try to get at the dynamic relation between changes in the number of policies and the predicted increases in renewable share of energy (predicted due to the reduction in renewable costs per unit of energy generated over five years). We present these in Table 3. Column 1 shows a 2020 cross-section, considering only reductions in cost in the previous 5 years (2015-2020). We find that, in that model, there is a marginally significant positive relation between the predicted increase in renewable energy (due to cost reductions) and growth in the number of policies. In columns 2 and 3 we stack the increase in renewable share in two periods 2010-2015 and 2015-2020, without (column 2) and with

Table 2: Number of Policies and Country Renewable Potential

	(1) Solar	(2) Wind	(3) Wind and solar
Solar practical potential	30.242		36.649
	(25.487)		(24.798)
Wind power density		-0.164^{**}	-0.180^{**}
		(0.073)	(0.074)
Wind speed		40.377^{**}	42.179^{***}
		(15.737)	(15.637)
HDI	83.896	−51.685	34.174
	(167.225)	(165.664)	(174.084)
GDP per capita	0.003^{***}	0.004^{***}	0.004^{***}
	(0.001)	(0.001)	(0.001)
Constant	−61.397	−66.199	−283.523
	(177.106)	(123.046)	(190.996)
Observations	67	67	67
R^2	0.350	0.399	0.420

Note: Models implement cross-sectional models, with the number of climate policies in 2020. The independent variables capture the potential for wind and solar energy.
*p<0.1; **p<0.05; ***p<0.01

(column 3) country controls. In both stacked models, we find a positive and statistically significant relation between the predicted growth in renewable share and the growth in the number of policies in the country. In each case, the magnitudes are significant: a growth of about 10% in predicted renewable share is associated with 7.5% growth (model 2) or 9.3% (model 3) in the number of policies. This provides additional support to H1, this time dynamically.

4 International climate policy-setting

4.1 Empirical strategy and data

We relate meetings with the European Commission, a key measure of lobbying activity in the European Union with two measures of the relative comparative positive of firms: the national policy environment in their domestic markets (H2a) and the carbon-intensity of

Table 3: Growth in number of policies and predicted change in renewable share

	(1) 2020 cross-section	(2) Stacked	(3) Stacked incl. controls
Predicted change in renewable share	1.254	0.750^{**}	0.928^{**}
	(0.777)	(0.358)	(0.371)
HDI			1.699
			(1.120)
GDP per capita			-0.00002^{***}
			(0.00001)
Country FE			
Year FE		X	X
Observations	62	133	127
R^2	0.058	0.024	0.067

Note: Models implement cross-sectional (1) and two stacked cross-sections (2 and 3) models, with the number of climate policies in the country-year as a dependent variable, in 5 year periods. The independent variable captures the predicted change in the share of renewable energy over the period due to the reduction in the cost of installed energy (see text).

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

the firms themselves (H2b). We are interested in ascertaining if there is a binomial relation between the two, with firms who both support and oppose further regulation engaging in lobbying activity.

We use as our main dependent variable the number of meetings with high-level European Commission officials over the Junker and Van der Leyen presidencies (from November 2014 to October 2022), focusing on the relevant divisions ("Directorate Generals") of Energy, Environment, and Climate Change. The Commission is the executive branch of the European Union and has powers of legislative initiative (including budget), and of implementation of the law. Climate-related policy is a very active area of the Commission's policymaking and this is reflected in companies' lobbying activity. Indeed, energy has been identified as the single largest lobbying policy domain before the European Commission, constituting eleven percent of all Commission meetings (Johnson, 2023). Meetings, along with identifying information have been reported on the EU official Transparency Register since November 2014. We use the database compiled and parsed by the nonprofit Transparency International (Integrity Watch Europe, 2022). We have in the database a total of 628 meetings, of 311 unique organizations. 473 of those meetings are of "companies and groups", while the rest are of trade associations, non-profits, and think-tanks.

We combine this with two types of independent variables that serve as proxies for the regulatory preferences of companies, and whether we would expect them to oppose (or hedge), or to support more regulation. The first is the carbon-intensity of firms. For it, we use the universe of firms participating in the Carbon Disclosures Project (CDP), a 23-year-old not-for-profit charity through which firms disclose their carbon emissions in a standardized way. Companies disclose their emissions and other environmental data via the CDP as a minimal signal of commitment towards tackling climate change. In the 2021 CDP data we use, 6,474 companies disclose their carbon emissions.[9] The other measures capture the climate intensity of the country, with the number of policies in the country (from the Climate policy database,

[9]Documentation for the CDP greenhouse-gas emissions dataset is here).

as above) and the emissions per capita on aggregate in the country (as reported by the World Bank). Of the 473 meetings of companies and groups we are able to link 377 to organizations that make CDP disclosures.

We fit models where we relate linearly (using OLS and Poisson models) the number of meetings held by CDP-reporting companies to the emissions intensity of companies, and to the aggregate emissions intensity in the headquartered country and the demandingness in the policy environment.

For all of these relations, establishing causality is a challenge. For example, our descriptive models may be partly capturing the fact that some larger emittors are larger, older firms, with more developed public policy teams, or whose businesses are more complex and require more engagement. These relations are interesting descriptively, however, as they still capture biases in the types of firms represented in lobbying: to the extent that characteristics such as size are related with being a firm with an *interest* in making climate policy less demanding, the result is that companies with such interests exert an asymmetric influence of those particular firms –even if the relations with emissions levels are not wholly causal. Nevertheless, in all our models we do control for the size of firms (a subset of employee number, profits and revenue), as well as 15 industry fixed effects.

The dependent variable provides an important but partial measure of the lobbying activity of company. Complementary measures would involve using meetings with Members of European Parliament, the Union's 705-member legislative body, and on the activities of registered lobbyists before the European Union. The role of industry associations and trade bodies, as well as think-tanks (as opposed to direct lobbying by companies) would also have to be explored. The textual description of the meeting may also shed light on its intention, although these tend to be short, e.g. "Energy policy priorities in the context of the Green Deal."

4.2 Results

4.2.1 Lobbying and country policies and emissions

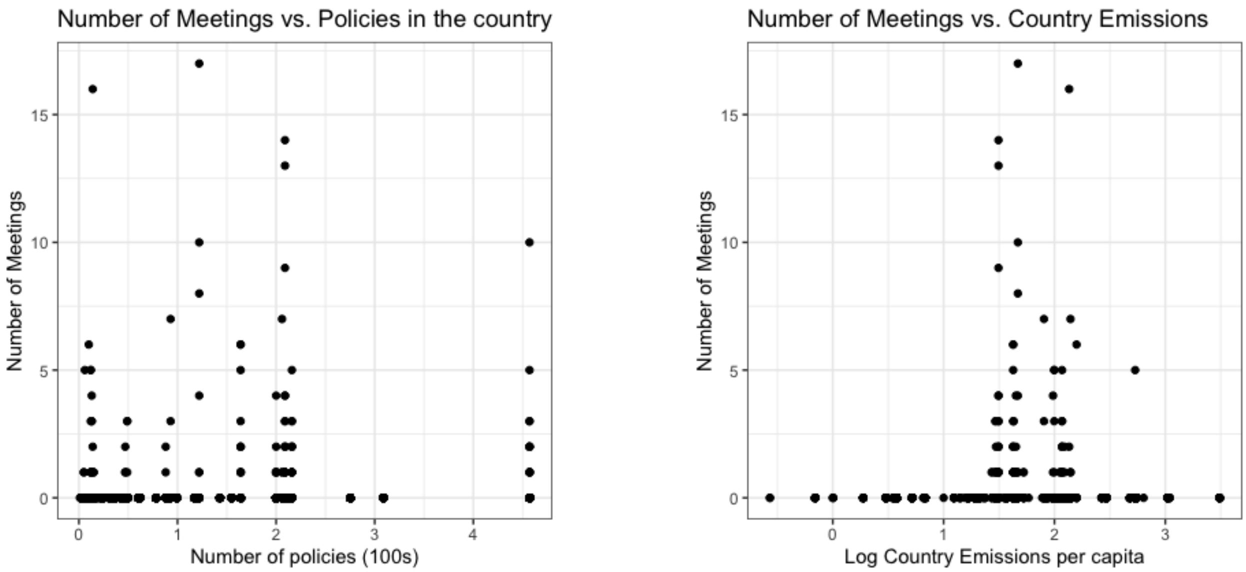
We plot the raw relations between the number of meetings companies hold, their national policy environment as well as national emissions in Figure 2. We find that there is, in fact, a relation between emissions intensity and national policy demandingness but that it is linear (Panel A): companies exposed to the lowest levels of policy demandingness domestically are the ones that hold the highest number of lobbying meetings. These relations are confirmed in the OLS (Panel A) and Poisson models (Panel B) presented in Table 4, at conventional significance levels, for all companies but not for the smaller sample of European companies. The relation with the country's average emisssions intensity of the economy is noisier and no clear relation emerges in Panel B of Figure 2 (and Table 5). We find thus only partial support for H2a, since companies from countries with low national policies and high emissions levels do more lobbying, but there is no evidence that companies at high levels of national policy demandingness or with low emissions levels do.

Additionally (H2b) we look at the relation with companies' own emissions levels. We find a similar pattern: it is firms with the highest emissions levels that lobby the European Commission the most. The raw relation without controls can be seen in Figure 3, for all companies and restricted to European ones. We show this pattern more formally via OLS models and Poisson models in Table 6 (All companies).[10] In each case, we relate scope 1 emissions reported (those directly controlled by companies) and Scope 1 and 2 emissions (including emissions associated with energy purchased, reported and estimated), the latter with and without company controls. Our results are similar throguhout: it is the companies that stand to lose the most that engage in the most lobbying, and others who would benefit from more demanding international policies are missing from lobbying activity.

[10] Appendix Table A.1 shows the results for European companies, which are similar but larger in magnitude.

Figure 2: Number of meetings with the European Commission (2014-2022), demandingness of country's climate policies, and country's emission intensity

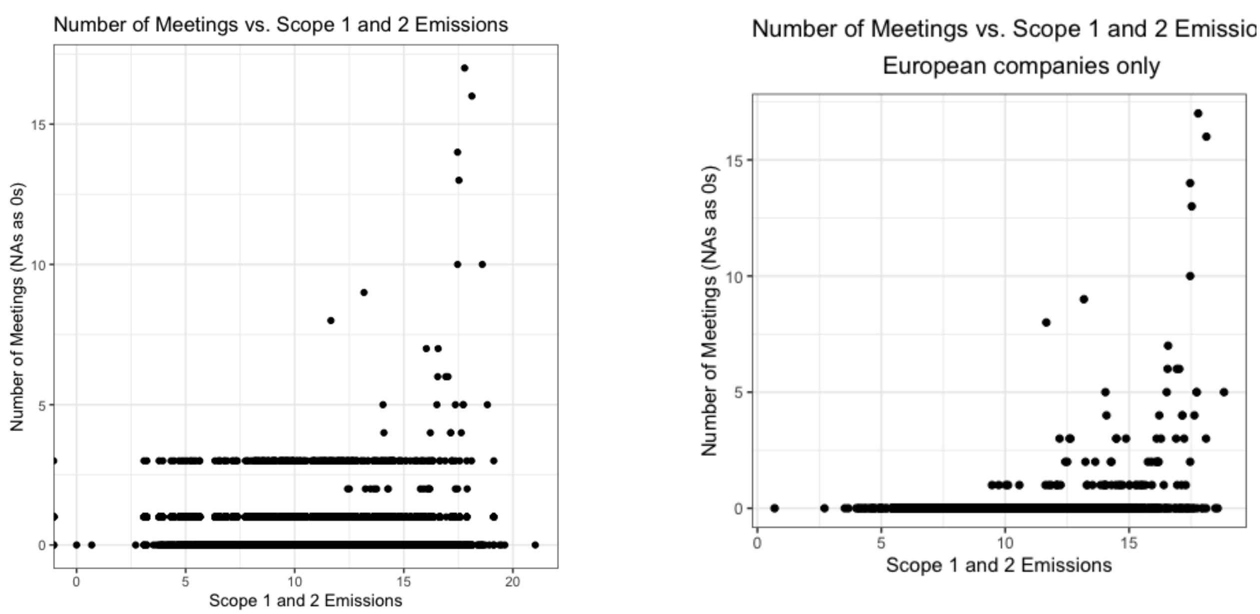
(a) Policy demandingness (b) Country's emission intensity



Source: European Commission, Climate policy database, World Bank.

Figure 3: Company meetings with the European Commission, 2014-2022, and companies' individual emissions intensity

(a) All companies (b) European companies



Source: Emissions are any scope 1, 2 emissions (reported or estimated), logged. Source: European Commission, CDP.

Table 4: Total number of meetings with the European Commission and number of policies in the country of the company's headquarters

	(1) All Companies	(2) European Companies
	Panel A: OLS models	
No. of policies	−0.010*	0.010
	(0.005)	(0.029)
Observations	5,988	1,784
	Panel B: Poisson models	
No. of policies	−0.228***	0.069
	(0.047)	(0.081)
Observations	5,988	1,784

Note: Hundreds of policies in the headquarters of the country, cumulative 1944-2021. All models include company controls and industry fixed effects. Source: Climate Policy Database, European Commission.
*p<0.1; **p<0.05; ***p<0.01

Table 5: Total number of meetings with the European Commission and emissions per capita in the country of the company's headquarters

	(1) All Companies	(2) European Companies
	Panel A: OLS models	
Emissions per capita	−0.003	0.004
	(0.002)	(0.012)
Observations	4,572	1,689
	Panel B: Poisson models	
Emissions per capita	−0.074***	0.025
	(0.019)	(0.031)
Observations	4,572	1,689

Note: Hundreds of policies in the headquarters of the country, by 2019. All models include company controls and industry fixed effects. Source: World Bank, European Commission. *p<0.1; **p<0.05; ***p<0.01

Table 6: Total number of meetings and individual company emissions, all companies

	Panel A: Regression models		
	(1)	(2)	(3)
Reported Scope 1	5.530***		
	(0.771)		
Any Scope 1 or 2		2.543***	54.618***
		(0.411)	(14.105)
Company controls			X
R^2	0.008	0.185	0.171
Adjusted R^2	0.008	0.164	0.138

	Panel B: Poisson models		
	(1)	(2)	(3)
Reported Scope 1	5.724***		
	(0.723)		
Any Scope 1 or 2		1.950***	11.381***
		(0.302)	(1.922)
Company controls			X
Observations	6,237	6,237	3,145

Note: "Any Scope 1 or 2" emissions include reported and estimated, Scope 1 or 2. All Billions tCO2-equivalent 2021. Companies with no meetings recorded as having 0 meetings. Company controls include number of employees, profits, and industry fixed effects. Source: CDP, European Commission. *p<0.1; **p<0.05; ***p<0.01

5 Conclusion

We provide empirical evidence for how firms' influence national climate policies and how they seek to influence policymaking. At the national level, we focused on how the evolution of actual emission levels in a country over time seem to be important determinants of the level of demandingness of policy, and that this is also conditioned by the natural propensity of each country to achieve greater climate efficiency. We foudn evidence that the change in how demanding national policies is causally related with changes in the climate efficiency of its economy. At the same time, cross-sectionally, the levels of policy demandingness are predicted by country's potential for the use of alternative energy.

At the international level, we have found observational evidence that the companies that seek to influence the European Commission (through lobbying meetings) are those who stand to lose from increasing regulation, even if we have not fully established that there is causal path running from having high emissions to more lobbying activity. We see little evidence of potential supporters of more demandig international regulation which would contribute to reducing climate change) trying to influence policymaking in Brussels.

Taken together, this reflects a view of how regulatory policies gets made that reflects a compromise between incumbent industry and public interests. At the national level, this compromise is mostly expressed in the gradual nature of the introduction of the more demanding climate policies. More policies are adopted in countries with greater climate efficiency at a given time, as signified by its renewable energy share or by their nature-given potential for that efficiency. Internationally, we observe directly that businesses who stand to lose given their individual emissions profile or the national policies they have been subject to are the ones whose interests are represented. We have therefore suggestive evidence of a policy process that is unlikely to lead to be ahead of the preferences of incumbent businesses.

This evidence complements extant theories and evidence of different factors that matter for the determination of climate change policies: business interests, interests of the public, and other political factors. It provides a view on how the observed gradual introductions of policies is the result of compromise and how it evolves over time, as conditions evolve. The scope conditions for this phenomenon as well as a more detailed understanding of how the mechanisms of policy development work at a national level would be fruitful avenues for future research.

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A Appendix Table

Table A.1: Total number of meetings and individual company emissions, European companies

	Panel A: Regression models		
	(1)	(2)	(3)
Reported Scope 1	58.326***		
	(3.584)		
Any Scope 1 or 2		53.863***	55.414***
		(2.547)	(14.014)
Company controls			X
Adjusted R^2	0.193	0.197	0.163

	Panel B: Poisson models		
	(1)	(2)	(3)
Reported Scope 1	34.776***		
	(1.369)		
Any Scope 1 or 2		36.584***	11.691***
		(1.235)	(1.953)
Company controls			X
Observations	1,101	1,782	1,250

Note: "Any Scope 1 or 2" emissions include reported and estimated, Scope 1 or 2. All Billions tCO2-equivalent 2021. Companies with no meetings recorded as having 0 meetings. Company controls include number of employees, profits, and industry fixed effects. *p<0.1; **p<0.05; ***p<0.01