The Effect of Party Polarization on Environmental Policy Evidence from Textual Data

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Abstract

Consensus in the scientific community about the effect of human activity on Earth's climate is almost unanimous. At the same time, climate change has become one of the most polarizing topics in the political arena. In this paper, I use textual data from the United States legislatures to measure the environmental position of states. I estimate the effect of party polarization on climate policies by exploiting regional variation in responses to aggregate trends in the US Congress. I find that party polarization reduces the amount of climate-related bills and moderates the positions of both Republican and Democratic legislators. The results are only significant when the seat distribution between the two parties is tight. To rationalize these findings, I develop a simple model of the legislature incorporating party seat distribution. When polarization between parties is high, the legislature can either enter a period of gridlock or approve extremist policies depending on the seat distribution. To understand the long run implications of polarization on climate change, I embed the legislative bargaining into a neoclassic growth model with a climate externality and show that the effects of polarization are mitigated by the exposure of the economy to climate change.

JEL Codes: D72 Political Processes, E60 Macroeconomic Policy, O44 Environment and Growth

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1 Introduction

The scientific community has long established that human activity is affecting Earth's climate (Oreskes, 2004, 2018). Experts may face uncertainty about certain aspects of climate change, such as the most likely emissions scenario (IPCC, 2014) or the potential economic damages (Burke et al., 2018). Nonetheless, scientific consensus is clear and governments have recognized in many occasions the need to cut CO_2 emissions. Environmental policies are key to address climate change. Instruments such as Pigouvian schemes taxing the social cost of CO_2 emissions have been proposed multiple times (Oates & Portney, 2003; Stern, 2006). However, effective policies against climate change are not prevalent in developed economies. For instance, the United States has no landmark climate policy at the federal level, and leaves most of environmental policy at the states' discretion (Klyza & Sousa, 2008). The European Union does have a CO_2 emissions market, but it is widely regarded as not ambitious enough.[1]

In this context, it remains an open question why climate change has not been addressed in the United States. According to Layman et al. (2006), "parties have grown increasingly divided on all the major policy dimensions in American politics", and climate change policy is not an exception. In fact, climate change is one of the exemplifying areas affected by this division (Gallup, 2008; Pew, 2016). In democratic countries, the actions taken by policy makers will necessarily reflect disagreement in public opinion; and the effects of this increase in disagreement on the trends of environmental policy making are visible to any casual observer. The bipartisan alliances that lead to the "golden age" of environmental lawmaking mid 20$^{\text{th}}$ century broke down in the 80s to such an extent that currently both parties have very antagonistic views on environmental protection.[2]

This paper studies the effect of disagreement on policies addressing climate change. To do so, I focus on party polarization. Party polarization is a form of disagreement that consists in a profound division on a certain topic between two distinct groups. In principle, party polarization could affect environmental policy in two opposite ways. It could result in policy switches, i.e. the approval of different policies by parties alternating in power; or it could lead to gridlock, i.e. to a paralysis in the process of policy-making. Notable examples of policy switches in the area of climate change include the withdrawal and posterior rejoining of the US to the Paris Climate Accords;[3] and the Keystone XL pipeline project, an infrastructure destined to connect the oil sands of Alberta, Canada, to Nebraska.[4] On the other hand, party polarization is also responsible in the delay of the approval of the Inflation Reduction Act (IRA), a landmark climate policy proposal by President Joe Biden (Economist, 2022a). However, anecdotal evidence aside, it is unclear which of these two effects is the empirically relevant one.

To evaluate the effect of party polarization on environmental policy, I first apply textual analysis techniques to measure the ideological content of bills related to climate change proposed in state chambers between 2009 and 2018. Specifically, I use Wordfish, an algorithm that estimates policy positions of documents based on their word frequencies developed by Slapin and Proksch (2008). The ideological dimension captured by

[1] The EU Emissions Trading Scheme (ETS) covers 50% of EU carbon emissions, and is estimated to have cut emissions by 4% (Bayer & Aklin, 2020).

[2] Most of the major environmental laws (such as the Clean Air Act, the Clean Water Act, and the Endangered Species Act) were approved during the 60s and the 70s; and the Environmental Protection Agency (EPA) was created by a Republican President, Richard Nixon (Rosenbaum, 2016).

[3] The Paris Climate Accords, an international treaty on climate change adopted in 2015 was initially ratified by the US, under the Obama administration. In 2020 the US withdrew from the agreement, under the Trump administration. President Joe Biden signed an executive order on his first day in office to re-admit the United States.

[4] The Obama administration never granted permits for the project. In their first day in office, Presidents Donald Trump and Joe Biden issued executive orders to grant and cancel permits, respectively (BBC, 2021).

Wordfish corresponds to the climate position of the proposed bills. Perhaps unsurprisingly (Grumbach, 2018; Kim & Urpelainen, 2017), bills proposed by Democratic legislators are more environmentally friendly, and state legislatures controlled by the Democratic Party are more environmentally friendly.

The key contribution of this paper is to use textual analysis techniques to measure environmental policy of the US state legislatures. Measurement of environmental policies is not trivial. Unlike the federal funds rate for monetary policy, there is no single indicator that summarizes the environmental stance of a governing body. State legislatures are very active in environmental policy-making (Grumbach, 2018; Rosenbaum, 2016), and each of them partakes in environmental policy in different ways (see Klyza & Sousa, 2008, ch. 7). Among other tools, states in the US can support environmental protection through the creation of cap-and-trade markets (e.g. the Regional Greenhouse Gas Initiative in northeastern US or the Western Climate Initiative in California), environmental spending (List & Sturm, 2006), or enforcement actions by regional EPAs (Fredriksson & Wang, 2020). By applying Wordfish to bills, I am able to measure the environmental policy stance of legislatures with very heterogeneous policies.

Using textual analysis to measure environmental policy is preferable to previously used measures in two key aspects. First, it allows me to exploit the intensive margin of policies. Alternative measures using count data as a proxy (such as the number of green initiatives approved; see CleanTech, n.d.; Grossmann et al., 2021) are likely to overestimate the scale of policy. This is especially specially true for policies addressing climate change, which is fundamentally a coordination problem.[5] Second, this measure focuses exclusively on climate policies. Alternative measures of environmental policy include aspects that are not necessarily related to climate change, such conservation of natural resources, or waste management. These aspects have been regulated at the federal level for decades,[6] and give the legislature less range of action.[7]

I then provide evidence that political polarization has a significant impact on environmental policy. Despite the vast literature studying the effects of party polarization, the actual evidence on economic outcomes is scarce and mixed (Potrafke, 2018). Regressing the policy stance of bills related to climate change on measures of party polarization developed by Poole and Rosenthal (2001), I establish the following four facts. First, the effect of polarization on environmental policy depends on the seat distribution of the legislature. Second, polarization moderates the environmental policy proposals by both parties when the seat distribution of the legislature is tight. Third, polarized legislatures are less likely to pass environmental legislation when the seat distribution of the legislature is tight. Fourth, parties reverse legislation when taking over a chamber; and the magnitude of this switch is greater the more extreme is the status quo environmental policy.

One concern is that polarization is endogenous to the environmental stance of a bill. Measures of disagreement at the state level might be mechanically correlated to the environmental position of a bill. However, measures of polarization capture disagreement in all topics, which might dilute this problem. Omitted variables might another potential concern. Several factors explain the recent surge in party polarization.[8] If any of these factors has a state-specific trend, endogeneity might arise. To address this concern, I employ an identification strategy based on the sensitivity analysis followed by Nakamura and Steinsson (2014). This strategy exploits the heterogeneity in the response to aggregate trends in polarization In particular, I instrument polarization

[5] Through this lens, a series of small initiatives tackling climate change are going to be less effective than combining the effort in a single policy action.

[6] See footnote 2.

[7] For instance, Azzimonti et al. (2022) note that most federal spending is mandatory, i.e. governed by criteria set by law.

[8] Scholars in the political science literature have come up with several candidates to explain the trends in polarization. The most prominent are redistricting or *gerrymandering*, the Southern Realignment, and increasing inequality and immigration. See McCarty et al. (2016) for a review on the topic.

at the state level using polarization at the US Congress interacted with state dummies. The identifying assumption is that states' response to aggregate trends in polarization are not correlated to bill-specific (trends) in environmental policy. In addition, the results of the empirical section are robust to a series of alternative specifications including different measures of polarization, focusing the analysis on different chambers (i.e. House vs. Senate) and samples restricting the analysis to bills that are either (a) proposed by the majority party; or (b) decided by a narrow margin.

A second contribution of this paper is to develop a framework in which climate policies are endogenously to ideological differences. This framework can be used to analyze the economic impact of party polarization. Even though party polarization is a recurrent concern in the public debate, its economic impact is underexplored. The economic impact of disagreement in environmental policies is sizable. For example, the Keystone XL pipeline had secured $8 billion (Reuters, 2021), while the withdrawal from the Paris Agreement entailed the termination of $3 billion for the Green Climate fund (Zhang et al., 2017). On the other hand, the expected increase in spending in the IRA falls $2 trillion short from the proposals in previous drafts (Economist, 2022b). Previous literature has linked different measures of political instability to lower growth rates at the country level (see Aisen & Veiga, 2013; Barro, 1991), and a similar pattern can be observed within the United States (see Table A1). Although the general consensus is that polarization is harmful for growth, the underlying mechanisms are not clear.

In the theoretical part of the paper, I develop a simple model of the legislature that shows how accounting for the party seat distribution of the legislature can explain two opposite views of the effect of polarization on policy. First, the prevalent view that polarization leads to policy switches (Alesina, 1988; Fiorina, 1996; Hare & Poole, 2014; Polborn & Snyder, 2017). Second, the alternate view that polarization leads to gridlock and policy moderation (for a review in the political science literature see Lee, 2015). To my knowledge, this is the first paper to provide a mechanism that rationalizes these two phenomena with one single explanation, i.e. party seat distribution. In the model, legislators facing political pressures à la Grossman and Helpman (1995) have to decide on a distortionary transfer between two sectors. Legislators are grouped in two parties with polarized preferences. Parties also differ in their seat distribution, i.e. they control a different share of the legislature's seats. The tax is decided by bargaining in a model in the spirit of Baron and Ferejohn (1989), playing a one-round negotiation game in which an agenda-setter makes a proposal, and the rest of legislators can either accept it or reject it.

Incorporating the seat distribution of the legislature, I find that polarization has a non-monotonic effect on policy. When polarization between parties is low, the preferences between both parties are overlapping and reaching an agreement is easy. On the other hand, the effect of high party polarization depends on the degree of control of the legislature. When the majority party's margin of votes is very narrow, bargaining between the two parties becomes too burdensome and a period of gridlock follows. Instead, when the majority party has a sufficient margin of control of the legislature, the response of policy will be towards extremism.

I then characterize the equilibrium behavior of the agenda-setter and derive two results detailing the impact on policy of an increase in polarization. In equilibrium, the action set of the agenda-setter is divided in three regions. The equilibrium proposal will depend on the seat distribution of the legislature, which amounts to the bargaining power of the agenda-setter. If the agenda-setter controls the legislature by a wide margin, then the agenda-setter will have free rein to propose their ideal (i.e. unconstrained) policy. If control of the legislature is intermediate, the resulting proposal will be the result of bargaining with members from the other party. Finally, if control of the legislature is low, gridlock will ensue.

The effect of an increase in polarization is characterized by two seemingly opposite results. First, higher polarization increases the distance between the ideal (unconstrained) policies of the two parties' agenda-setters. Second, higher polarization increases the region of gridlock and forces policy convergence when bargaining takes place. In line with the results from the empirical section, the effect that dominates will depend on the seat distribution of the legislature. These results are true under broad parameter combinations ensuring that (a) the output of the two sectors is substitutable; and (b) legislators' political motives dominate over welfare concerns. Finally, in line with the empirical results, the model also gives a prominent role to the status quo policy. The status quo is a key factor in determining the outcome of the bargaining process and the size of the gridlock regions. Intuitively, the status quo is a source of bargaining power for the minority party. Moderate values of the status quo prevents the majority party from reaching an agreement with the minority party's moderates.

To understand the long run implications of polarization on climate change, I embed the legislative bargaining into a simplified version of the dynamic stochastic general-equilibrium (DSGE) model with a climate externality developed by Golosov et al. (2014). I show that the effects of polarization are mitigated by the exposure of the economy to climate change. In particular, an increase in exposure to climate change (i.e. an increase in the parameter that links emissions to economic damages) reverts the results of an increase of polarization. That is, it brings the ideal policies of the two parties closer and reduces the region of gridlock. The framework is based on a multi-sector neoclassic growth model that incorporates output damages due to CO_2 emissions. In the model, the final good can be produced with two energy inputs, a clean and a dirty one. Production of the dirty input generates emissions that decrease productivity. Each period, the government taxes the sale of these two inputs. Taxes have a distortionary effect on production, but they can also be used to address the climate externality. The economic impact of polarization depends on which of the two effects of polarization prevails. If polarization leads to policy divergence, switches in climate policy can lower output to a suboptimal level. On the other hand, if policy stalemate prevails, delays in addressing the climate externality might generate important welfare losses.[9]

Finally, the static nature of the one-period model ignores potential concerns regarding to whether the equilibrium behavior extends to a dynamic setting. Taxation is an intertemporal decision that propagates to the future through an endogenous status quo. This endogeneity opens the door for the agenda-setter to manipulate the outcome of tomorrow's bargaining process. Similarly, legislators might be willing to accept proposals that they would not in a static setting. To this effect, I extend and solve computationally a two-period version of the model in which legislators have to bargain over taxes every period. Legislators and the agenda-setter are forward-looking. In this dynamic setting, I show that the two main results of the model are preserved.

Literature Review

By focusing on environmental policies this paper contributes to two branches of environmental economics. First, the relatively new macro-environmental literature (Hassler et al., 2016), and in particular the applications of models of Directed Technical Change (DTC) with environmental constraints (Acemoglu et al., 2012). This literature focuses on the development of growth models that incorporate a climate module, in order to determine the optimal carbon tax (see Barrage, 2020; Golosov et al., 2014; Nordhaus, 2018). Second, the

[9] Battaglini et al. (2014) show that in settings dynamic free riding with irreversibility, welfare losses might occur due to slow convergence, even though the optimum is attainable.

political economy of environmental policy (for an early review see Oates & Portney, 2003). This literature highlights the interactions between environmental policy and political constraints. For instance, there is ample evidence that politicians' decisions over secondary policy issues (such as environmental policies) are affected by electoral motives (see, for example, Bouton et al., 2021; Fredriksson & Wang, 2020; Fredriksson et al., 2011; List & Sturm, 2006). The effect of polarization on environmental policy is relatively understudied. Fisher et al. (2013) use NPL to determine the source of the political divide in the climate debate in the US Congress. Austen-Smith et al. (2019) develop a model to explain how inefficient policy instruments can be used to overcome gridlock when polarization is high. In this paper, I endogenize environmental policy through party polarization, and close the gap between the political and macroeconomic branches of the literature.

Another main contribution is to study the effects of political conflict on government policy (see Alesina & Drazen, 1989; Alesina & Tabellini, 1990; Azzimonti, 2011; Persson & Svensson, 1989), and in particular of party polarization. The literature studying the economic consequences of polarization is scarce and is based on the interaction between two factors: policy uncertainty and fiscal policy. The leading example in this area is Azzimonti (2011). Drawing from Alesina and Tabellini (1990), Azzimonti shows that polarization can induce governments to overspend in order to increase the probability of reelection. Because spending must be financed with distorsionary taxes, polarization depresses investment and thus growth. Azzimonti and Talbert (2014) show that this mechanism can also be extended to the business cycle. Azzimonti (2021) adds an additional channel by which polarization also increases the tail risk associated to the occurrence of an institutional crisis.

This paper also contributes to the large theoretical literature in political economy studying models of voting. Ever since the traditional median voter results (Downs, 1957), the literature has sought to explain the apparent policy divergence observed since the second half of the 20$^{\text{th}}$ century (Fiorina, 1996). Explanations include politically-motivated politicians (Alesina, 1988), strategic motives (Kalai & Kalai, 2001), voter turnout (Glaeser et al., 2005) and, more recently, behavioral biases (Callander & Carbajal, 2022). The seminal paper by Alesina (1988) sparked the wide belief that polarization in preferences translates to platform polarization (see Fiorina, 1996; Hare & Poole, 2014; Levy & Razin, 2015; Polborn & Snyder, 2017, footnote 3). However, this is not necessarily the case. Levy and Razin (2015) show that in the presence of correlation neglect, polarization in opinions can induce lower levels of policy polarization when the electoral system is not too competitive. In this paper, I provide empirical evidence supporting the view that party polarization does not necessarily translate to policy polarization; and develop a mechanism that can explain this phenomenon without behavioral biases. In my case, party moderation takes place because of the need to reach a coalition between agents with polarized preferences.

This paper also contributes to the legislative bargaining literature that originated from Baron and Ferejohn (1989). There are several applications of legislative bargaining in macroeconomic settings. For example, Battaglini and Coate (2007, 2008) develop a model in which legislative bargaining crowds out productive investment in a public good at the expense of pork-barrel spending. Battaglini et al. (2012, 2014) study the provision of irreversible investments in public goods under different legislative bargaining rules. Similarly, Bowen et al. (2014) study the relative efficiency between mandatory and discretionary spending rules in a model with two parties. In modeling terms, Azzimonti et al. (2022) is the closest paper to this one. Relative to this literature, I develop a procedure that bargains over the size of the public good rather than the distribution of a public good with fixed size.

There is a large political science literature that explores the causes of gridlock in the United States in particular. Legislative gridlock in the United States has been increasing since the last decades of the 20$^{\text{th}}$ century, and this literature has focused on finding the root cause of this phenomenon. The standard partisan explanation is the divided government hypothesis (Fiorina, 1996), whose empirical support has been mixed at best (Mayhew, 1991). Alternative theories also highlight the role of the bicameral system (see Binder, 2004). Scholars have also explored non-partisan explanations for gridlock (Brady & Volden, 2005; Krehbiel, 1996, 1998). In particular, Krehbiel (1996, 1998) highlights that in legislatures that require supermajorities, the key agent ("pivotal player") is not the one that gives a bill a simple majority, but the vote that allows its supporters to stop the filibuster. However, most of these theories focus on institutional features that are very specific to the US setting. Instead, I propose a theory in which gridlock is the product of the interaction between two factors: party polarization and party seat distribution. Some scholars have tested the validity of this theory (Hicks, 2015; Jones, 2001) but to my knowledge, this is the first paper to formalize this argument.

2 Empirical Evidence

In this section, I introduce the main results that motivate the model. The analysis focuses on a cross-section of bills proposed at the state level. I first measure the ideological direction of climate change policies using bills proposed in the state legislatures.[10] I then relate the environmental stance of the state legislatures with measures of polarization.

My findings are the following: First, the effect of polarization on environmental policy depends on the seat distribution of the legislature. Second, polarization moderates the environmental policy proposals by both parties when the seat distribution of the legislature is tight. Third, polarized legislatures are less likely to pass environmental legislation when the seat distribution of the legislature is tight. Fourth, parties reverse legislation when taking over a chamber; and the magnitude of this switch is greater the more extreme is the status quo environmental policy.

2.1 Data & Methodology

In order to determine the impact of polarization on climate policy, I need a measure of climate policy. To my knowledge, there is no comprehensive database suited for that purpose.[11] For this reason, I turn to bills proposed in state legislatures related to climate change. In the United States, states take an active role in environmental policy through enforcement (Fredriksson et al., 2011) and through other state-level initiatives (e.g. regional cap-and-trade programs; see Rosenbaum, 2016). However, environmental policy materializes in a series of policies that are not necessarily harmonized across states the same way other policies are (e.g. fiscal policy).[12] Bills provide a unique access to a policy that is not harmonized across states. In addition, exploiting cross-section and time-series variation of environmental policy is a better setup to isolate the effect of polarization on policy from other institutional factors (Besley & Case, 2003).

[10] Locating policy in real line is common in the political science literature (see Clinton, 2017, for a comprehensive review on the topic).

[11] The Correlates of State Policy Database (Grossmann et al., 2021) is a notable candidate. However, the time span of the measures included is not complete, and most of the variables refer to other areas of environmental protection (e.g. local pollutants, waste management, etc.).

[12] See Grossmann et al. (2021).

Climate Change Policy

To obtain a measure of climate policy for states I use data from LegiScan. LegiScan is a nonpartisan organization that provides access to bills proposed in all US state legislatures since 2009. I apply to these bills a procedure called Wordfish, which allows me to extract the ideological component of the documents. Wordfish is an algorithm widely used in political science (see Proksch & Slapin, 2010; Slapin & Proksch, 2008). Briefly, Wordfish assumes that following functional form for the text

$$y_{ij} \sim Poisson(\lambda_{ij})$$
$$\lambda_{ij} = exp(\alpha_i + \psi_j + \beta_j \theta_i)$$

where y_{ij} is number of times the term j is used in bill i, α_i are document fixed-effects, ψ_j are word fixed-effects, β_j is the ideological direction of word j and θ_i is the ideological direction of bill i. The parameter λ_{ij} measures the rate at which a term j appears in a document i. In Wordfish's specification, this rate can increase for two reasons. First, λ_{ij} can be high if either document fixed effects α_i or word fixed effects ψ_j are high. For example, if the word count of document i is high, the probability that any term j appears will be higher relative to shorter documents. Similarly, in this setup focusing on climate policy, the term "climate" is more likely to appear in documents than the term "immigration". Second, λ_{ij} can be high if the policy positions of document i and term j are aligned. The terms β_j and θ_i indicate the policy loading of words and documents, respectively; positive values indicate a pro-environmental stance, and vice versa for negative values. Consider for example the term "carbon tax", which has a very positive loading. The probability that this term appears is higher in bills that are more environmentally friendly.

The parameter of interest in this case is θ_i, the environmental position of a bill. Implicit in the analysis is the assumption that text is determined by the actors' ideological leaning (the so-called ideological dominance assumption; Grimmer & Stewart, 2013). However, there are other sources of variation in word use that can mask ideological position (Lauderdale & Herzog, 2016). In this case, I want to ensure that the dimension captured by the algorithm is the ideological stance against climate change. For this purpose, I pre-select the bills proposed in the state legislatures to those bills that discuss environmental policy, and apply some standard text cleaning procedures.[13] In addition, I select the set of words that are diagnostic of the legislator's political party following Gentzkow and Shapiro (2010).

The results show that Wordfish seems to capture the environmental stance of the bills. Table 1 presents of the top and bottom most environmentally-friendly bills proposed in US state legislatures. Among the most pro-environmental bills, we can find symbolic statements recognizing the human impact on climate change (HCR24, 2013) as well as proposals requiring that legislation account for scientific evidence regarding climate change (A4606, 2018). On the other hand, anti-environmental proposals include downwards revision and delays (HB798, 2019; SB374, 2015) in the application of energetic standards.

Figure 1 depicts the average environmental policy at the state level between the years 2009 and 2018. Northeastern and Pacific states are the more environmentally friendly both at the extensive and intensive margin. That is, they propose more environmental policy, and the content of these proposals is more environmentally friendly. The least environmentally friendly states can be roughly categorized in two groups. States with a low environmental stance at the intensive margin (e.g. Midwestern state), and states with a low

[13] I select terms that mentioned at least one of the following terms: *climate change*, *global warming*, *greenhouse gases*, *carbon dioxide*, *fossil fuel*, *energy efficiency*, *renewable energy* and drop bills with a low relevance, as expressed by LegiScan.

Pro-environmental (high θ)			Anti-environmental (low θ)		
To recognize that human actions have contributed to he rise in global sea and atmospheric temperatures and the increase in concentration of greenhouse gases, and to declare that Ohio will actively participate in diminishing and minimizing future greenhouse gas emissions.	OH	2013	Delays certain provisions [...]; revises the energy law.	OH	2016
Requires State to use 20-year time horizon and most recent Intergovernmental Panel on Climate Change Assessment Report when calculating global warming potential to measure global warming impact of greenhouse gases.	NJ	2018	Revises provisions relating to energy.	NV	2015

Table 1: Bills proposed in US state legislatures with the highest and lowest θ_i according to Wordfish.

environmental stance at the extensive margin (e.g. Southern states). Figure 2 illustrates the environmental position of bills θ per state. The distribution of the ideological positions of the proposals clearly differs depending on the party controlling the legislature. These results at the state level are also in line with consistent with common wisdom and prior evidence (Grumbach, 2018; Kim & Urpelainen, 2017).

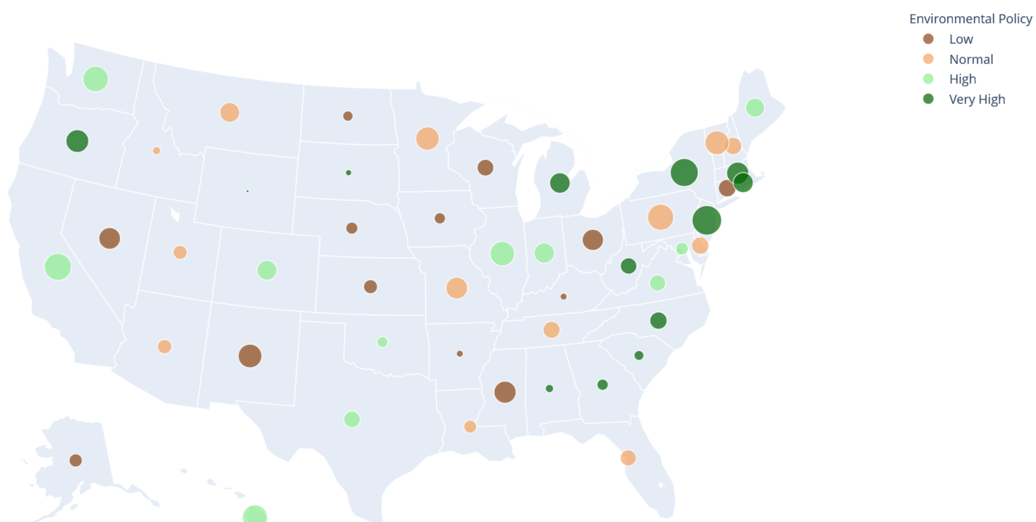

Figure 1: Environmental policy as denoted by mean θ by state. Size of the dot denotes the amount of environmental bills proposed.

To confirm in a more rigorous fashion that the dimension captured by Wordfish corresponds to the environmental position of bills, I present two additional validation exercises. In the first one I show that the environmental position of a particular document is lower for bills sponsored by more conservative legislators. I thus estimate the following equation

$$\theta_{ist} = \beta_0 + \beta_1 Conservativeness_{ist} + f_s + f_t + \varepsilon_{ist} \tag{1}$$

where θ_{ist} is the environmental stance of bill i, $Conservativeness_{ist}$ is a continuous variable measuring how conservative are the sponsors of bill i and f_s, f_t are state and year fixed effects, respectively.

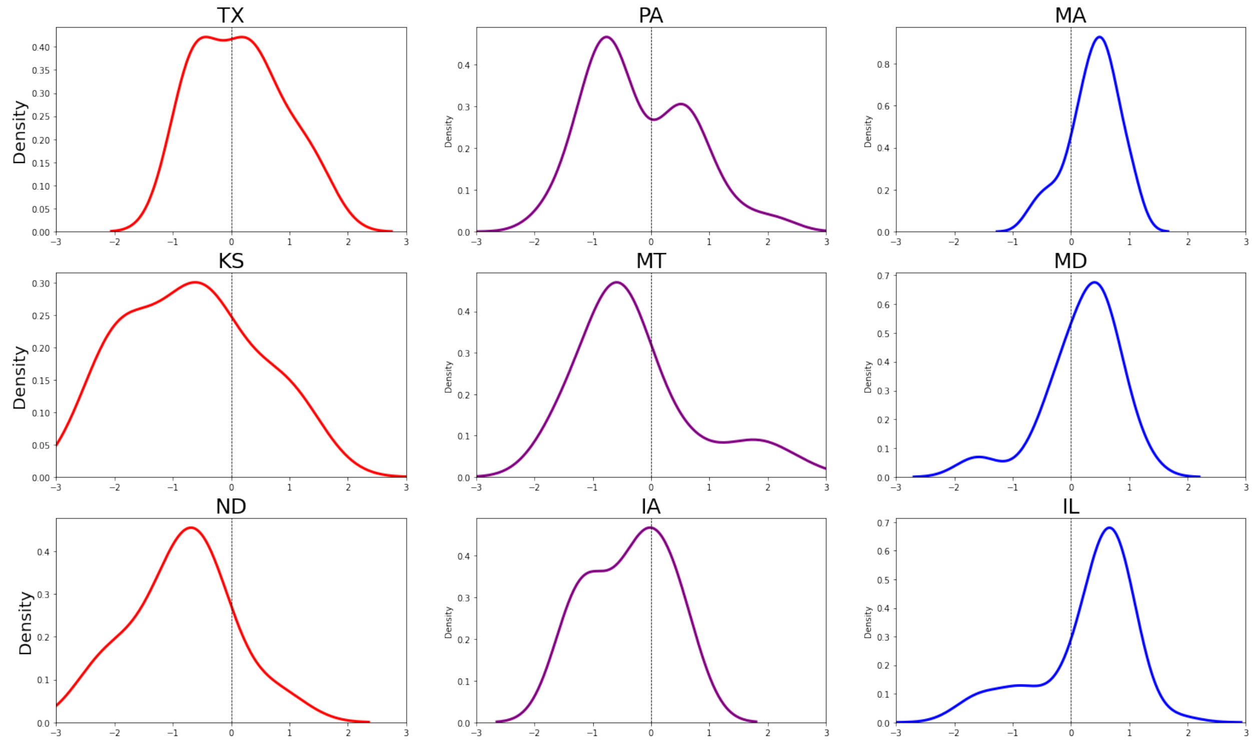

Figure 2: Density of policy proposals' θ for selected states. Color indicates whether the lower house was controlled by the Republicans (left columns), the Democrats (right columns) or by both parties (center columns) in the period 2009 - 2018.

$Conservativeness$ is constructed by averaging the ideal policy estimates of the sponsors of bill i.[14] Table 2 presents the results of estimating eq. (1). The negative and significant value of coefficient β_1 indicates that more conservative sponsors are linked to bills with a lower environmental stance.

Second, I show that the environmental position of bill is higher states in which the House of Representatives is controlled by the Democratic party. In this case I estimate

$$\theta_{ist} = \beta_0 + \beta_1 D_{st} + f_s + f_t + \varepsilon_{ist} \tag{2}$$

where D_{st} is a dummy equal to one if the chamber is controlled by the Democratic party. Table 3 presents the results of estimating eq. (2). Similarly, the positive and significant value of coefficient β_1 indicates that chamber controlled by the Democratic Party propose bills that are more environmentally-friendly.

Polarization Data

The data for polarization comes from Shor and McCarty (2011). The political science literature has a tradition of estimating politicians' ideal points using roll call data (Poole & Rosenthal, 2000). Intuitively, the procedure of these models is the following. Consider a chamber with only one legislator i voting on R roll calls. Let $x_i \in (-1, 1)$ be legislator i's coordinate on a unique ideological dimension. The points z_{rY} and z_{rN} are the outcome coordinates of voting Y or N, respectively, on a roll call r. The model uses the random

[14] The estimates by Shor and McCarty (2011) label positions greater (lower) than zero as conservative (liberal).

	(1) Environmental	(2) Environmental	(3) Environmental
Sponsor Conservativeness	-0.136**	-0.106***	-0.0968**
	(0.057)	(0.038)	(0.038)
Constant	4.653		
	(3.923)		
N	1090	1089	1089
State FE	No	Yes	Yes
Year FE	No	No	Yes
Adjusted R2	0.266	0.378	0.382

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 2: Results of estimating eq. (1) by OLS.

	(1) Environmental	(2) Environmental	(3) Environmental
Democratic House	0.303***	0.380**	0.274*
	(0.101)	(0.149)	(0.142)
Constant	3.921		
	(3.592)		
N	1337	1336	1336
State FE	No	Yes	Yes
Year FE	No	No	Yes
Adjusted R2	0.264	0.367	0.368

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 3: Results of estimating eq. (2) by OLS.

utility framework to determine a legislator's choices. That is, legislator i will vote Y with probability

$$Pr(U_{irY} > U_{irN}) = Pr(\varepsilon_{irN} - \varepsilon_{irY} < u_{irY} - u_{irN})$$

where the deterministic part of the utility, u, depends on some distance between the ideal point of the legislator, x_i, and the outcome of the roll call, z_{rY}, z_{rN}.

Different procedures are characterized by particular assumptions on both the deterministic and stochastic terms of the utility. Suppose error terms are normally distributed and $u_{iY} = (x_i - z_{rY})^2$. Then legislator i will vote Y with probability $\Phi(\beta_0 + \beta_1 x_i)$, where β_0, β_1 are both a function of z_{rY}, z_{rN}. The likelihood of the model is given by

$$L = \left[\Phi(\beta_0 + \beta_1 x_i)^{C_{irY}} (1 - \Phi(\beta_0 + \beta_1 x_i))^{C_{irN}}\right]$$

where $C_{irY} = 1$ if i votes Y on roll call r. Given this structure, the parameters of the model can recovered from the roll call data using an iterative procedure. Shor and McCarty (2011) apply a similar methodology to state legislators.[15]

Figure 3 illustrates the ideological estimates from Shor and McCarty (2011) for the legislatures of Washington state and Rhode Island, two states known for being among the most and least polarized in the US, respectively. Legislators in the two states are clearly divided along party lines. However, there are some key differences. For example, while the clusters of legislators are very close in ideological terms in Rhode Island, there is a substantial gap in the Washington legislature. In fact, an extreme legislator in the Rhode Island legislature from either party would be considered a moderate in Washington.

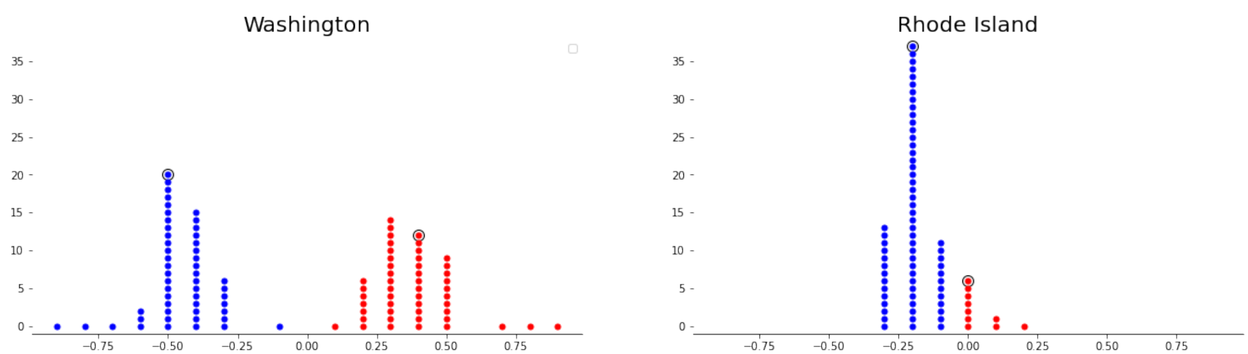

Figure 3: Distribution of ideological estimates in the 2017 legislatures. Marker indicates party median. Blue (red) indicates Democratic (Republican) legislators.

The usual measure of polarization is the difference between the estimate of the median Democratic and Republican legislator in each chamber (the circled points in Figure 3). For my results I will focus on this measure of polarization, but the results are robust to alternative measures of disagreement, such as the standard deviation of ideal points. Polarization data at the state level is available for all legislatures from 1993 to 2018.

[15]The dynamic component of Poole and Rosenthal (2000)'s DW-NOMINATE measure relies on legislators that served several legislatures. These legislators are used to "glue" different Congresses, in order to allow for comparison between the scores of congress-members that did not serve together. A similar procedure is not possible for state legislators at the cross-sectional level. Shor and McCarty (2011) use a procedure based on standardized surveys as a way to "glue" different states.

2.2 Results

To measure the impact of polarization on environmental policy proposals, I estimate the following equation

$$\theta_{ist} = \beta_0 + \beta_1 Polarization_{st} + \beta_2 D_{st} + \beta_3 Polarization_{st} \times D_{st} + \boldsymbol{\gamma X} + f_s + f_t + \varepsilon_{ist} \tag{3}$$

The dependent variable θ_{ist} is the environmental stance of a bill i proposed in state s in year t obtained using Wordfish. The main explanatory variables are the measure of polarization, and D_{st}, a dummy equal to one if a chamber (either the House/Assembly or the Senate) in state s is controlled by the Democrats.[16] To show the importance of the interaction between polarization and seat distribution, I will use two different explanatory variables. First, the estimates of Shor and McCarty (2011). Second, the interaction of this measure with a dummy equal to one when the seat distribution between the two parties is tight, i.e.

$$Margin_{st} = 1 \text{ if } \frac{|DemSeats_{st} - RepSeats_{st}|}{TotalSeats_s} < k \text{ for } k \in [0, 1]$$

where $Margin_{st}$ is normalized with respect to chamber size. In what follows, I will set $k = 5\%$ as a benchmark. However, the results are robust to variations in the threshold, and to a continuous equivalent.

The vector $\boldsymbol{X}$ includes a series of control variables ranging from bill characteristics (length, type) and legislature characteristics (party of the governor, legislative production) to state characteristics (population, industrial composition). Finally, f_s and f_t are state and year fixed effects, respectively.

Fact 1: The effect of polarization on environmental policy depends on the seat distribution of the legislature. Overall, Democratic chambers propose more environmentally friendly legislation, as indicated by the coefficient β_2 greater than zero and significant. The coefficient of interest is β_3, that is, the impact of an increase in polarization in a Democratic-controlled chamber. Table 4 shows the results of estimating eq. (3). The first three columns use only Shor and McCarty (2011)'s measure of polarization. In this specification, β_3 is not significant and very close to zero. One would be tempted to conclude that polarization has no effect on policy. However, measures of ideological distance like the ones computed by Shor and McCarty (2011) cannot explain by themselves movements in the environmental stance of a legislature. The reason is simple. Policy in a legislature in which the two main parties are very polarized is not necessarily going to be affected. Consider for instance the case of California. According to Shor and McCarty (2011), the legislature of California is the most polarized one across all US states. However, if the majority party has a wide margin consistently through the years (as it is the case in California), the ideological gap between the Republicans and Democrats will not have an effect on policy. This fact is consistent with previous evidence highlighting the role of seat distribution in legislative bargaining (Hicks, 2015; Jones, 2001).

Fact 2: Polarization moderates the environmental policy proposals when seat distribution between both parties is tight. The last three columns of Table 4 include the interaction with the dummy indicating whether the chamber is controlled by a narrow margin. When including state and time fixed effects, the main coefficient of interest β_3 is negative and significant. That is, in chambers controlled by the Democratic Party by a small margin, more polarization is linked to a lower environmental stance of the bills proposed. In terms of magnitudes, the results imply that increasing polarization in a narrowly

[16] In what follows, I use the state's House of Representatives (or equivalent) as the benchmark. Results are similar using the Senate (see Appendix B).

controlled chamber from a Rhode Island level (the least polarized state) to the level of California (the most polarized) is linked to a reduction of the environmental stance of policy of half a standard deviation. Despite these results, the coefficient β_2 are still positive, such that the overall effect of a chamber controlled by the Democratic Party on environmental policy is still positive, consistent with common wisdom and prior evidence (Grumbach, 2018; Kim & Urpelainen, 2017).

This fact puts in perspective median voter type of results by highlighting the importance of seat distribution. In the presence of a supermajority, agreement with the other party is not necessary. Policy convergence will arise when there is sufficient competition within the chamber. This fact also resonates with the results from Polborn and Snyder (2017) that policy divergence between parties arises when uncertainty about election outcomes is low. The model presented here features no uncertainty, but focuses instead on competition after the election.

This significance of these results occurs despite the fact that there are states that never switched parties between 2009 and 2018. For these states, the variable D_{st} and state fixed-effects will be completely correlated. These states constitute half of the states (see Figure 4) and also half of the observations. This loss of observations can explain the increase in standard errors.

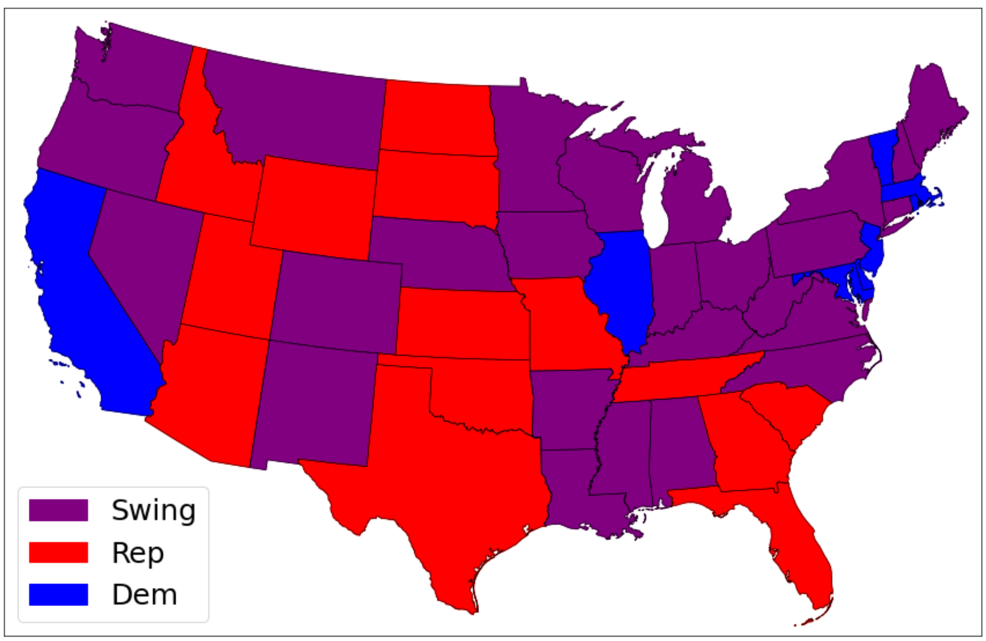

Figure 4: Party controlling the House (or equivalent) in each state during the period 2009 - 2018. Not shown: Alaska (Swing), and Hawaii (Dem).

To measure the impact of polarization on the probability of passing environmental law, I estimate the following equation

$$\begin{aligned} Enacted_{ist} = \beta_0 + \beta_1 Polarization_{st} + \beta_2 Margin_{st} + \beta_3 Polarization_{st} \times Margin_{st} \\ + \beta_4 D_{st} + \boldsymbol{\gamma X} + f_s + f_t + \varepsilon_{ist} \end{aligned} \tag{4}$$

where $Enacted_{ist}$ is a dummy indicating whether a bill was enacted into a law.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic House	0.284**	0.326**	0.337**	0.282**	0.301**	0.312**
	(0.131)	(0.150)	(0.141)	(0.129)	(0.148)	(0.141)
Polarization (Hou)	-0.0171	-0.110	-0.175	-0.0380	-0.114	-0.177
	(0.081)	(0.375)	(0.429)	(0.081)	(0.393)	(0.445)
Democratic House × Polarization (Hou)	0.0747	-0.0214	-0.0155	0.104	0.0631	0.0746
	(0.126)	(0.189)	(0.198)	(0.128)	(0.241)	(0.250)
Democratic House × Margin <5% × Polarization (Hou)				0.0693	-0.221**	-0.236*
				(0.146)	(0.106)	(0.117)
Constant	-0.651	11.23	12.81	-0.367	9.902	11.27
	(3.131)	(11.481)	(14.758)	(3.075)	(11.369)	(14.510)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.245	0.361	0.358	0.246	0.361	0.359

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 4: Results of estimating eq. (3) by OLS.

Fact 3: Polarized legislatures are less likely to pass environmental legislation when seat distribution between both parties is tight. Table 5 presents the results of estimating eq. (4). Overall, Democratic chambers are more likely to pass environmental legislation, as indicated by the coefficient β_4 greater than zero and significant. However, in chambers controlled by a narrow margin, the probability of enacting an environmental bill is reduced. In terms of magnitude, these results imply that losing a supermajority in the average state in terms of polarization[17] is linked to a 15% reduction in the probability of passing a environmental legislation. Ideological distance by itself does not seem to be related to the probability of enacting a bill. The results are qualitatively similar when including state and year fixed effects (see Section 2.3).

The result that polarization is linked to lower legislative productivity is not surprising (Lee, 2015). Although environmental policy was seen as a bipartisan issue during the 60s and the 70s, it soon became a very polarized issue (Rosenbaum, 2016). According to Klyza and Sousa (2008), pretenses of bipartisanship on the environment were abandoned around the 104$^{\text{th}}$ Congress.

However, environmental policy is not necessarily characterized by policy gridlock and moderation only. The results from Table 4 establish that environmental policy in chambers controlled by a narrow margin is tempered by polarization. Yet, policy switches could also arise from changes in control of the legislature.

To measure the impact on bill proposals of changes in the majority party controlling the chamber, I estimate the following equation

$$\begin{aligned}\theta_{ist} = \beta_0 &+ \beta_1 LegisTakeOver_{st} + \beta_2 Polarization_{st} \\ &+ \beta_3 LegisTakeOver_{st} \times Polarization_{st} \\ &+ \beta_4 LegisTakeOver_{st} \times Polarization_{st} \times EnvironmentalAvg_{st-1} \\ &+ \boldsymbol{\gamma X} + f_s + f_t + \varepsilon_{ist}\end{aligned} \tag{5}$$

where $LegisTakeOver_{st}$ is a dummy equal to one for chambers that switch from a Democratic to a Republican majority (or vice versa) in state s relative to $t-1$, and $EnvironmentalAvg_{st-1}$ is the average environmental stance of bills proposed in the previous legislature. That is, $\bar{\theta}_{st-1} \equiv \sum_i \frac{\theta_{ist-1}}{N_i}$.

[17] In the average state, polarization takes a value of 1.5.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Polarization (Hou)	-0.0123	-0.0512	-0.0398	-0.00795	-0.0161	-0.0165
	(0.025)	(0.154)	(0.087)	(0.024)	(0.145)	(0.082)
Democratic House	0.0821**	0.728**	0.382**	0.0789**	0.676**	0.362**
	(0.041)	(0.311)	(0.163)	(0.039)	(0.306)	(0.159)
Margin <5%				-0.0164	-0.309	-0.138
				(0.047)	(0.400)	(0.200)
Margin <5% × Polarization (Hou)				-0.100***	-0.807***	-0.442***
				(0.033)	(0.304)	(0.154)
Constant	-0.122	-0.822	-0.491	-0.229	-0.948	-0.603
	(0.955)	(6.725)	(3.603)	(0.940)	(6.646)	(3.535)
N	1268	1268	1268	1268	1268	1268
Model	LPM	Logit	Probit	LPM	Logit	Probit
Adjusted R2	0.0840			0.0879		

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 5: Results of estimating eq. (4) by OLS.

Fact 4: Parties reverse legislation when taking over a chamber. The magnitude of the change is greater the more extreme is the status quo environmental policy. Tables 6 and 7 present the estimates of this model for Republican and Democratic takeover, respectively. From the first three columns, it follows that the takeover of a chamber by the Republican Party is linked to a decrease in the environmental policy stance of the legislature, as indicated by $\beta_1, \beta_3 < 0$ (but not significant). Including the status quo policy left by the Democratic Party in the previous legislature strengthens this result, both in terms of magnitude and of significance. Consider a chamber taken over by the Republican Party with a status quo policy equivalent to the average Democratic state ($\bar{\theta}_{st-1} \approx 0.2$). In this case, increasing polarization from a Rhode Island level to a California level is linked to a reduction of the environmental stance of policy by one fourth of a standard deviation. The opposite results are true for chambers taken over by the Democratic Party.

This fact is consistent with the result theories of lawmaking that focus on pivotal player (Krehbiel, 1996, 1998) and with models of dynamic legislative bargaining (Eraslan et al., 2022), according to which gridlock is crucially dependent on the status quo policy.

2.3 Identification and Robustness

An important challenge to identifying the effect of polarization is the potential endogeneity since environmental policy is notoriously ideological. In addition, the identity of the party controlling a chamber is also potentially endogenous. To this effect, I estimate again eqs. (3) and (4) employing an identification strategy that combines the fixed-effect instrumental variable (FE-IV) approach from Murtazashvili and Wooldridge (2008) to control for polarization and the "sharp" RDD developed by Fredriksson et al. (2011) to control for the identity of the majority party.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Republican Capture	-0.0229	-0.107	-0.156	-0.0247	-0.103	-0.156
	(0.109)	(0.105)	(0.127)	(0.107)	(0.111)	(0.131)
Polarization (Hou)	-0.00606	-0.125	-0.157	-0.00472	-0.169	-0.213
	(0.073)	(0.320)	(0.378)	(0.073)	(0.313)	(0.375)
Republican Capture × Polarization (Hou)	-0.0290	-0.0795	-0.0788	-0.0860	0.0865	0.0804
	(0.119)	(0.127)	(0.132)	(0.155)	(0.141)	(0.141)
Republican Capture × Margin <5% × Polarization (Hou)				0.111	-0.302*	-0.289*
				(0.214)	(0.163)	(0.165)
Constant	1.586	12.08	12.75	1.702	11.34	11.89
	(2.803)	(11.617)	(14.993)	(2.835)	(11.618)	(15.185)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.235	0.358	0.356	0.234	0.359	0.357

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 6: Results of estimating eq. (5) by OLS for chambers taken over by the Republican Party.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Democratic Capture	0.209	0.269*	0.314**	0.218	0.277*	0.314**
	(0.157)	(0.143)	(0.122)	(0.163)	(0.141)	(0.121)
Polarization (Hou)	-0.0197	-0.155	-0.141	-0.0141	-0.193	-0.168
	(0.070)	(0.329)	(0.381)	(0.071)	(0.341)	(0.393)
Democratic Capture × Polarization (Hou)	0.0338	0.0679	0.0316	-0.0382	-0.00887	-0.0101
	(0.139)	(0.115)	(0.102)	(0.207)	(0.147)	(0.112)
Democratic Capture × Margin <5% × Polarization (Hou)				0.161	0.297	0.170
				(0.255)	(0.293)	(0.349)
Constant	1.624	15.15	13.17	1.788	14.91	13.42
	(2.823)	(11.913)	(14.950)	(2.886)	(11.967)	(14.976)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.237	0.360	0.357	0.237	0.360	0.357

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 7: Results of estimating eq. (5) by OLS for chambers taken over by the Democratic Party.

The application of the FE-IV approach (Murtazashvili & Wooldridge, 2008) in this setup follows from the observation that states are affected differently by trends of polarization in the US Congress. This approach consists in instrumenting for polarization at the state level using polarization in the US Congress interacted with a state dummy (see Nakamura & Steinsson, 2014). Consider the reduced model $\theta_{ist} = \beta Pol_{st} + \varepsilon_{ist}$ where Pol_{st} is our potentially endogenous independent variable, and the instrument $z_{st} = f_s Pol_t$, where Pol_t denotes polarization in the US Congress. In this setup, the moment conditions necessary for identification are

$$\mathbb{E}\left(f_s Pol_t \varepsilon_{ist}\right) = 0 \;\forall\; t$$

That is, state's sensitivity to polarization in the US Congress is exogenous to the unobserved factors affecting the environmental stance of a bill.

The sharp RDD method exploits the fact that the election outcome is a deterministic function of vote margin,

$$D_{st} = \mathbb{1}(m_{st} > 0)$$

where m_{st} is the vote margin. In eqs. (3) and (4) we might have that the moment condition with respect to D_{st} might not be satisfied, i.e. $\mathbb{E}\left[\varepsilon_{ist} \mid D_{st}\right] \neq 0$. However, conditional on the vote margin,

$$\mathbb{E}\left[\varepsilon_{ist} \mid D_{st}, m_{st}\right] = \mathbb{E}\left[\varepsilon_{ist} \mid m_{st}\right] = f(m_{st}) \tag{6}$$

Explicitly controlling for the function $f(m_{st})$ in the regression takes care of the endogeneity of D_{st}. I follow Fredriksson et al. (2011) in approximating f with polynomials of the fourth order.

One key difference with the approach employed in Fredriksson et al. (2011), is that the majority party of a legislature depends on the distribution of seats between both parties, which are decided at the district level. Therefore, I use instead the average vote margin at the district level. That is, for every state I calculate

$$m_{st} \equiv \sum_d \frac{1}{N_d} MoV_{dst}$$

where MoV_{dst} is the margin of votes of the Democratic party in a district d in state s, and N_d is the number of districts in state s. The district-level results of the legislative elections are available in Klarner (2018)'s State Legislative Election Returns dataset.

It is key for eq. (6) to hold that there is no strategic voting. This assumption could be violated in chambers that are renovated in a staggered process, and I therefore exclude them. I also exclude legislatures in which elections are not conducted using a winner-takes-it-all system (see Ballotpedia, n.d.).

Table 8 present the estimates of eqs. (3) and (4) instrumented and controlling for the margin of vote. The results from the IV regression are qualitatively similar to those of Tables 4 and 5. The coefficient of the preferred specification with state and year fixed effects is still negative and significant. In addition, when controlling for the margin of vote, the effect of polarization on the policy stance of legislatures controlled by the Democrats is stronger.

In addition, the results are robust to a series of alternative specifications. First, I restrict the sample to competitive bills. That is, bills that satisfy two conditions: (i) they have at least one roll call recorded; and (ii) the margin of votes of these roll calls is below a threshold (e.g. $\pm 50\%$). The idea under this pseudo RDD

	(1) Environmental	(2) Environmental	(3) Enacted	(4) Enacted
Democratic House	0.314**	0.198	0.0191	0.0226
	(0.134)	(0.164)	(0.069)	(0.097)
Polarization (Hou)	-0.0267	-0.273	-0.0857	-0.220
	(0.521)	(0.466)	(0.180)	(0.163)
Democratic House × Polarization	0.0499	-0.0341		
	(0.230)	(0.258)		
Democratic House × Polarization × Margin <5%	-0.270**	-0.473*		
	(0.136)	(0.257)		
Polarization × Margin <5%			-0.0205	-0.121*
			(0.052)	(0.064)
Constant	13.90	26.04	-7.236	-8.396
	(14.033)	(17.862)	(5.692)	(10.904)
N	1268	855	1268	855
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sharp RDD	No	Yes	No	Yes
Adjusted R2	0.360	0.388	0.159	0.143

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 8: Results of estimating eqs. (3) and (4) by 2SLS.

approach is that bills that have been approved or rejected by a small margin are comparable, regardless of the majority party. This procedure excludes from the analysis bills proposed by strategic motives, meant to be approved or rejected with an almost 100% chance. Tables A3, A5 and A6 present these results.

In Appendix B.3, I also restrict the sample to bills propose in states in which the control of the legislature changes hands at least once in the period covered by the data (see Figure 4). In Appendix B.4, I restrict the sample to bills proposed by the majority party. In Appendix B.5, I include in the regression the interaction terms that were not included in the main regressions because of potential colinearity between $Polarization_{st}$ and D_{st}.

Finally, in Appendices B.6 to B.8 I rerun the analysis using a party-free measure of polarization, and the measures of polarization in the state Senates. This party-free measure of polarization is computed as the average distance between the ideal points of any two members of a chamber, and is also available in Shor and McCarty (2011)'s data. Results in most specifications are both qualitatively and quantitatively similar.

3 Theoretical Model

In this section, I develop a simple model of the legislature that can explain the facts of Section 2 and highlights the importance of accounting for the degree of control of a legislature when considering the impact of polarization on policy. The inclusion of a second dimension (i.e. margin of control) is crucial for polarization to have a dual effect on policy. That is, polarization can either lead to policy extremism, or it can generate gridlock. I then embed this mechanism into a simplified version of the IAM developed by Golosov et al. (2014) and show the potential that polarization can have on long-run growth.[18]

[18]Integrated Assessment Models is an umbrella term that refers to models that study the feedback between economic production and climate change. The principal frameworks include the DICE (Nordhaus, 2018), the PAGE (Yumashev et al., 2019) and the FUND (Waldhoff et al., 2014) models.

The model has two sub-periods: a political stage and a production stage. The economy is populated by a continuum of economically identical agents. Agents in this model consume a final good and provide labor inelastically. The final good can be produced with two inputs, a clean and a dirty one. Production of both inputs requires labor. Production of the dirty energy input generates emissions. Damages from emissions materialize in the form of productivity losses.

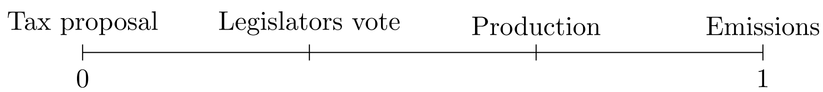

Figure 5: Timing of the model.

Before production happens takes place, the government can impose a tax to the production of energy inputs. This tax is effectively a transfer between the two energy sectors, and represents the concession of political favors. The tax has a distortinary effect, but at the same time can be used to address the climate externality. The governing body of this economy is a legislature modeled in the spirit of the bargaining model of Baron and Ferejohn (1989). The legislature is constituted by a subset of agents. Once in the legislature, agents receive political pressure to favor either energy sector (following Grossman & Helpman, 1995). Legislators are heterogeneous in the degree they are affected by political pressures. The tax schedule is determined by the legislators in a one-round bargaining process. Figure 5 presents the timing of the model.

3.1 The Economic Setup

In this section, I present a simplified version of the IAM developed by Golosov et al. (2014) to which I will embed a political process. The economy is populated by a representative household that maximizes the following utility function $U(C)$ where U is a standard concave utility function and, C is consumption.

Production of the final good is described by the following aggregate production function

$$Y = e^{-\gamma(S-\bar{S})} AE \tag{7}$$

where $S - \bar{S}$ denotes the excess of emissions with respect to a baseline level $\bar{S}$, the coefficient γ scales the impact on productivity of excess emissions, A denotes the usual productivity shifter and E is the amount of energy used in production.

Aggregate productivity is the product of two components, an exogenous and an endogenous one. The productivity shifter A is exogenous. The term $e^{-\gamma(S-\bar{S})}$ is endogenous, and denotes climate damages. Productiviy losses follow from excess emissions of carbon, S, with respect to its pre-industrial stock, $\bar{S}$. Damages are scaled by the parameter γ. The inclusion of climate damages into the production function is the basis of all IAMs. It is a reduced-form approximation to the idea that increases in the stock of CO_2 emissions have a negative impact on productivity, a fact long established by the climate-economy literature (Dell et al., 2014; Waldinger, 2022). This expression in particular bypasses the carbon cycle present in climate models (Rosenbaum, 2016).[19] Total energy is aggregated from two energy sources

$$E = \left(E_d^{\frac{\varepsilon-1}{\varepsilon}} + E_c^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{8}$$

[19]In its most reduced form, carbon progressively abandons the atmosphere and flows towards the reservoirs in the ocean (see Hassler & Krusell, 2018, p. 365), with the latter progressively absorbing the stock of carbon in the atmosphere.

where E_c, E_d are the product of the clean and the dirty energy sectors, respectively. The parameter $\varepsilon \in (0, \infty)$ determines the elasticity of substitution between the two energy sources.

In this model, contribution to the stock of emissions in the atmosphere is driven only by production in the dirty sector

$$S - \bar{S} = \rho E_d \tag{9}$$

where $\rho \in [0, 1]$. The term ρ denotes the amount of carbon that stays in the atmosphere. I follow Golosov et al. (2014) in using

$$\rho = \phi_L + (1 - \phi_L)\phi_0$$

where ϕ_L denotes the share of emissions that will stay permanently in the atmosphere, and $(1 - \phi_L)\phi_0$ the share of emissions that will exit the atmosphere in one period. Note the delay in the impact of emissions on output.

The production technology of the energy sectors is given by

$$E_i = N_i^{\alpha} \text{ for } i = \{c, d\} \tag{10}$$

where N_c and N_d denote the amount of labor allocated to each sector. Production in the energy sectors exhibit decreasing returns to scale. Positive profits are an essential ingredient for the political bloc. In what follows, I normalize the amount of labor to one

$$N_c + N_d = 1 \tag{11}$$

Finally, the budget constraint of the economy is given by

$$C = w + \Pi_Y + \Pi_d + \Pi_c + T \tag{12}$$

where Π_Y, Π_d, Π_c denote profits from the final good, the dirty, and the clean sector, respectively; and T denotes transfers from the government. The price of the final good is normalized to 1, resulting in the following relation

$$\left[p_d^{1-\varepsilon} + p_c^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} = 1 \tag{13}$$

3.2 The Political Game

In this section, I develop a simple model of the legislature that accounts for the margin of control of the chamber. The legislative bargaining process described here will determine how the tax of the production stage is set. The legislature consists of a measure one of legislators. Legislators can belong to one of two parties, $\{D, R\}$, which are heterogeneous in their preferences. The role of the legislature is to decide the tax level for the following periods.

The tax level is decided in a two-step bargaining game (Baron & Ferejohn, 1989). First, an agenda-setter offers a proposal to the rest of legislators. Legislators can then approve or reject the proposal. If the proposal is approved, the tax level is implemented and the economy moves to the production stage. If the proposal is rejected, the economy moves to the production stage with the status quo tax level.

Legislators have preferences based on Grossman and Helpman (1995). Each legislator cares for the representative agents, but also has vested interests towards the energy sectors. In particular, I assume the following preferences for legislators

$$V(\tau, \bar{S}, \omega_\ell) \equiv U(C) + \omega_\ell \Pi_d + (1 - \omega_\ell)\Pi_c \tag{14}$$

with $\omega_\ell \in [0, 1]$. The term ω_ℓ denotes the relative weight of the dirty sector in legislator's ℓ political motives.[20] Two remarks regarding legislators' preferences are on point. First, this functional form is consistent with legislators caring about the representative agent while at the same time facing political pressures to cater to the energy sectors. This interpretation implicitly assumes that legislators are drawn from the pool of representative agents. Second, this assumption is not the only one that can generate the results presented in this section. For example, assuming that parties represent agents with different discount factors could achieve similar results in a dynamic version of the model. However, the preferences presented here are more empirically relevant.[21]

Legislators are heterogeneous in their political motives both between and within parties. Their relative weight are drawn from the following distribution

$$\omega_\ell \sim \begin{cases} Beta\,(k, \psi_D) & \text{for } \ell \leq \mu \\ Beta\,(\psi_R, k) & \text{for } \ell > \mu \end{cases} \tag{15}$$

where $\mu \in [0, 1]$ denotes the fraction of legislators affiliated to party D, the parameters $\psi_D, \psi_R > 0$ affect the shape of polarization between the two parties and $k > 0$ is a constant term. For now I will assume that μ follows an exogenous process. This assumption does not necessarily state that the control over a legislature is random, but rather that it is independent from the environmental policy.[22] The choice of beta distributed ideal points, ω_ℓ is natural in this context, as it is bounded between $[0, 1]$.

The agenda-setter is selected from the pool of legislators in the majority party.[23] I abstract from uncertainty and assume that the agenda-setter from each party corresponds to the average legislator. That is,

$$\omega_{AD} = \frac{k}{k + \psi_D} \qquad\qquad \omega_{AR} = \frac{\psi_R}{k + \psi_R} \tag{16}$$

where ω_{AD}, ω_{AR} denotes the agenda-setter of party D and R, respectively. Setting the parameter $k^2 < \psi_D \psi_R$ ensures that the average R legislator caters more to the pressures of dirty sector compared to the average D legislator, i.e. $\omega_{AD} < \omega_{AR}$. In this setup, an increase in the parameters ψ_D, ψ_R corresponds to an increase in party polarization (see Figure 6).[24]

[20] Grossman and Helpman (1995) posit that the government's preferences take the form $\sum_{i \in L} C_i + aW$ where the first term is the contribution of lobbies and the second represent weighted welfare. The preferences eq. (14) correspond to the special case in which $a = 1$ and $C_d = \omega_\ell \Pi_d, C_c = (1 - \omega_\ell)\Pi_c$.

[21] For instance, contribution from environmental groups to Democratic congressional candidates has systematically surpassed that of Republican candidates (Rosenbaum, 2016, fig. 2.2). On the other hand, there is no evidence or a priori reason to think that discount factors differ between voters of both parties.

[22] In the political economy literature, environmental issues are usually considered secondary (Bouton et al., 2021; List & Sturm, 2006). In addition, climate change does not rank as a top priority for the US voters (Gallup, 2022; Pew, 2022).

[23] There is a general consensus in the political science literature that the majority party has a prominent role in controlling the agenda of the US Congress (Cox & McCubbins, 2005).

[24] Note that ω_{AD} is decreasing in ψ_D, and ω_{AR} is increasing in ψ_R. Therefore, an increase in either ψ_D, ψ_R increases the distance between the mean of both parties' ideal points.

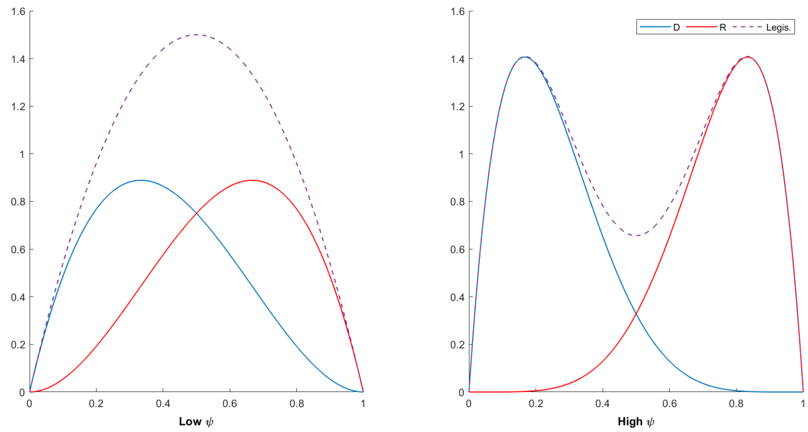

Figure 6: Distribution of the ideal points ω_ℓ for D legislators (blue line), R legislators (red line), and for the legislature (dashed line) for the parameter values $\psi_D = \psi_R = 3$ (left panel), $\psi_D = \psi_R = 6$ (right panel), $k = 2$ and $\mu = 0.5$.

3.3 Equilibrium

The equilibrium can be characterized in two steps. First, we can solve for the equilibrium of production. The political stage can then be solved using the solution of the second stage as an input.

Production Stage

The representative firm in the final good sector solves the following problem

$$\max_{E_c, E_d} Y - \sum_{i=c,d} p_i E_i$$

subject to eqs. (8) to (13). Maximization yields two first-order conditions for the price of each energy input

$$p_i = \left(\frac{Y}{E_i}\right)^{\frac{1}{\varepsilon}} \text{ for } i = \{c, d\} \tag{17}$$

Taking the ratio between both expressions, we obtain the relative prices of inputs

$$\frac{p_d}{p_c} = \left(\frac{E_c}{E_d}\right)^{\frac{1}{\varepsilon}} \tag{18}$$

That is, the relative prices of the energy inputs are inversely proportional to the relative supply of energy. The intensity of this relation is determined by the elasticity of substitution between the inputs, ε. Similarly, the representative firms in the two energy sectors face the following problem

$$\max_{N_i} p_i(1 - \tau_i)N_i^\alpha - wN_i$$

where τ_i is a value-added tax charged to the energy producers, and w denotes wages. In what follows, I will focus on the symmetric case $\tau_d = \tau \in (-1, 1)$ and $\tau_c = -\tau$. That is, politicians influence the energy sector by transferring resources from one input sector to the other. The first-order conditions of this problem gives the demand for labor

$$N_i = \left[\frac{\alpha(1 \pm \tau)p_i}{w}\right]^{\frac{1}{1-\alpha}}$$

Taking the ratio between the labor demand of the two sectors gives the relative demand of labor

$$\frac{N_d}{N_c} = \left[\frac{(1-\tau)}{(1+\tau)}\frac{p_d}{p_c}\right]^{\frac{1}{1-\alpha}} \tag{19}$$

That is, relative labor demand is proportional to relative prices. Compared to the *laissez-faire* case, the equilibrium allocation of labor is distorted whenever the government sets any tax different from zero.

The effect of policy on consumption in this model is twofold, and it is illustrated in Figure 7. Unsurprisingly, taxation has a distortionary effect on the labor market decisions of firms, which extends downstream to the final good sector. Note that in the decentralized equilibrium agents do not internalize the damage that production of the dirty input cause on output through eq. (9). Therefore, an increase in clean energy is not privately optimal. Further allowing the model to exhibit endogenous growth would extend this logic to the growth rate of the economy.[25]

On the other hand, the presence of a tax can help correct the climate externality given by eq. (9). It can be easily shown that, in this setup, the externality damage (i.e. the social cost of carbon) can be expressed as follows (see Golosov et al., 2014)

$$SCC \equiv d\gamma Y \tag{20}$$

which is strictly greater than zero. The social cost of carbon is proportional to output and increasing in two key parameters of the model: (i) the amount of carbon emitted that stays in the atmosphere; and (ii) the degree to which excess emissions impact ouptut. A social planner could easily reach the social optimum by setting $\tau_d = \frac{SCC}{p_d}$ and $\tau_c = 0$ (see Golosov et al., 2014, p. 57). For sufficiently small values of either parameter (specified in Lemma 1), the distortionay effect will dominate with respect to this last effect.

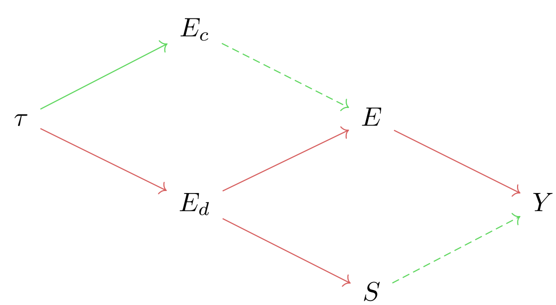

Figure 7: Diagram of the effects of taxation on the economy. Green and red lines indicate positive and negative effects, respectively; dashed lines indicated that effects are of second-order.

[25]For example, allowing productivity in sectors $i = \{c, d\}$ to follow a process $A_{i,t+1} = G(A_{it}, N_{it})$ where G is differentiable, convex function increasing in both arguments.

Political Stage

Consider the problem faced by a legislator ℓ who is proposed a tax level $\hat{\tau}$. The legislator can either accept or reject the proposal

$$\max_{Y,N}\left\{V_\ell\left(\hat{\tau},\bar{S}\right),V_\ell\left(\bar{\tau},\bar{S}\right)\right\}$$

where $\bar{\tau}$ denote the status quo tax level, which is determined exogenously. Clearly, ℓ will vote in favor of the proposal if it exceeds the value of the status quo policy. That is, ℓ will vote Y if

$$V_\ell\left(\hat{\tau},\bar{S}\right)\geq V_\ell\left(\bar{\tau},\bar{S}\right)\Leftrightarrow\omega_\ell\leq\bar{\omega}\left(\hat{\tau},\bar{\tau},\bar{S}\right)$$

where

$$\bar{\omega}\left(\hat{\tau},\bar{\tau},\bar{S}\right)\equiv\frac{U(C)-U(\bar{C})+\Pi_c-\bar{\Pi}_c}{\Pi_c-\bar{\Pi}_c-(\Pi_d-\bar{\Pi}_d)}$$

identifies the marginal legislator, i.e. the legislator that is indifferent between voting in favor or against the proposal $\hat{\tau}$. The upper bar, $\bar{\cdot}$, denotes the value of variables under the status quo tax level $\bar{\tau}$.

Under the assumption of the ideal points' distribution (eq. 15), the fraction of supporters for a given policy proposal $\hat{\tau}$ is given by

$$\mu Pr\left(\omega_\ell\leq\bar{\omega}\left(\hat{\tau},\bar{\tau},\bar{S}\right)\mid\ell\leq\mu\right)+(1-\mu)Pr\left(\omega_\ell\leq\bar{\omega}\left(\hat{\tau},\bar{\tau},\bar{S}\right)\mid\ell>\mu\right)\tag{21}$$

The agenda-setter's objective is to pass legislation catering to her own political pressures. The problem of the agenda-setter is given by

$$\max_{\hat{\tau}}V_{AD}\left(\hat{\tau},\bar{S}\right)$$

subject to eqs. (7) to (13), to the constraint $\hat{\tau}\in(-1,1)$ and to the coalition constraint (eq. 23). This last constraint states that the agenda-setter must assemble a simple majority in order to have her proposal approved. Note the absence of strategic considerations between parties (e.g. party discipline). Support to the proposal can come from both sides of the spectrum, as long as the ideal points are close enough.

The tax level resulting from this bargaining process will depend on the identity of the agenda-setter. Consider the case $\mu>\frac{1}{2}$ in which the agenda-setter is affiliated to D. The tax level proposal in equilibrium of the D agenda-setter is given by

$$\hat{\tau}_D=\begin{cases}\tau_D^u & \text{if } \mu>\overline{\mu}_D(\bar{\tau})\\ \tau_D^b & \text{if } \mu\in\left[\underline{\mu}_D(\bar{\tau}),\overline{\mu}_D(\bar{\tau})\right]\\ \bar{\tau} & \text{if } \mu<\underline{\mu}_D(\bar{\tau})\end{cases}\tag{22}$$

where τ_D^b, the tax level that makes the constraint binding, solves

$$\mu Pr\left(\omega_\ell\leq\bar{\omega}\left(\hat{\tau},\bar{\tau},\bar{S}\right)\mid\ell\leq\mu\right)+(1-\mu)Pr\left(\omega_\ell\leq\bar{\omega}\left(\hat{\tau},\bar{\tau},\bar{S}\right)\mid\ell>\mu\right)=\frac{1}{2}\tag{23}$$

and τ_D^u, the ideal tax level for the D agenda-setter, solves

$$-U_C'\frac{\partial C}{\partial\tau}=\omega_{AD}\frac{\partial\Pi_d}{\partial\tau}+(1-\omega_{AD})\frac{\partial\Pi_c}{\partial\tau}\tag{24}$$

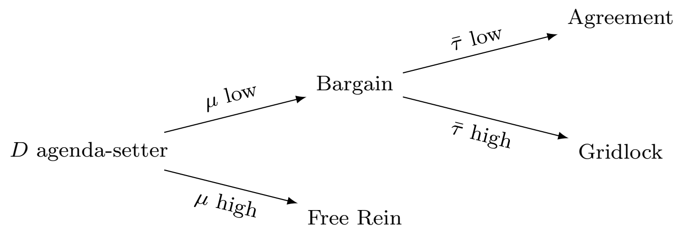

Figure 8: Diagram of the action space of a D agenda-setter.

That is, the ideal policy set by an unconstrained agenda-setter is the result of setting the marginal disutility due to the loss of consumption equal to the marginal utility gains obtained by catering to the political pressures.

The action set of both agenda-setters is divided in three regions, depending on the seat distribution of the legislature. The agenda-setters can either have free rein over the policy decision, in which case they set their ideal policy τ^u, or resort to bargain. In case of bargaining, the result of the negotiations process can either lead to an agreement, τ^b, or in gridlock, $\bar{\tau}$. The equilibrium proposal features the minimum winning coalitions principle, as is common in models of agenda-setting (Persson & Tabellini, 2002). Figure 8 illustrates this process for a D agenda-setter.

The limit of the three regions is determined by the threshold values $\overline{\mu}_D(\bar{\tau})$ and $\underline{\mu}_D(\bar{\tau})$. The first is the threshold level of within-party support that gives the agenda-setter free rein over the policy decision. Intuitively, if $\mu > \overline{\mu}_D(\bar{\tau})$ then the majority party controls the legislature with a wide margin. Because preferences between the two parties are polarized, a wider control over the chamber reduces the necessity to bargain with legislators whose preferences are further away. The object $\overline{\mu}_D(\bar{\tau})$ is defined as the μ that solves

$$\begin{aligned} &\overline{\mu}_D(\bar{\tau}) Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^u, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + \\ &(1-\overline{\mu}_D(\bar{\tau})) Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^u, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) = \frac{1}{2} \end{aligned} \tag{25}$$

That is, $\overline{\mu}_D(\bar{\tau})$ is the margin of control that allows the agenda-setter to propose her ideal policy and approve it with an exact simple majority.

Similarly, $\underline{\mu}_D(\hat{\tau})$ is the threshold level of support that makes the agenda-setter indifferent between bargaining or entering gridlock. In this case, $\underline{\mu}_D(\hat{\tau})$ is defined as the μ that solves

$$\begin{aligned} &\underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + \\ &(1-\underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) = \frac{1}{2} \end{aligned} \tag{26}$$

Let us now consider the case $\mu < \frac{1}{2}$ in which the agenda-setter is affiliated to R. The equilibrium tax level proposal of the R agenda-setter is then given by

$$\hat{\tau}_R = \begin{cases} \tau_R^u & \text{if } \mu < \overline{\mu}_R(\bar{\tau}) \\ \tau_R^b & \text{if } \mu \in [\overline{\mu}_R(\bar{\tau}), \underline{\mu}_R(\bar{\tau})] \\ \bar{\tau} & \text{if } \mu > \underline{\mu}_R(\bar{\tau}) \end{cases} \tag{27}$$

where τ_R^u, the ideal tax level for the D agenda-setter, solves

$$-U_C' \frac{\partial C}{\partial \tau} = \omega_{AR} \frac{\partial \Pi_d}{\partial \tau} + (1 - \omega_{AR}) \frac{\partial \Pi_c}{\partial \tau} \tag{28}$$

and τ_R^b, the tax level that makes the constraint binding is given by eq. (23). The objects $\overline{\mu}_R(\bar{\tau}), \underline{\mu}_R(\bar{\tau})$ are defined as in eqs. (25) and (26), respectively. Note that despite being defined similarly, the optimal behavior by a the agenda-setters of both parties will not necessarily be symmetric. The reason is that even though the two effects of taxes have opposite signs, they will not necessarily cancel each other. Figure 9 illustrates the tax level proposed by the R and the D agenda-setter in equilibrium.

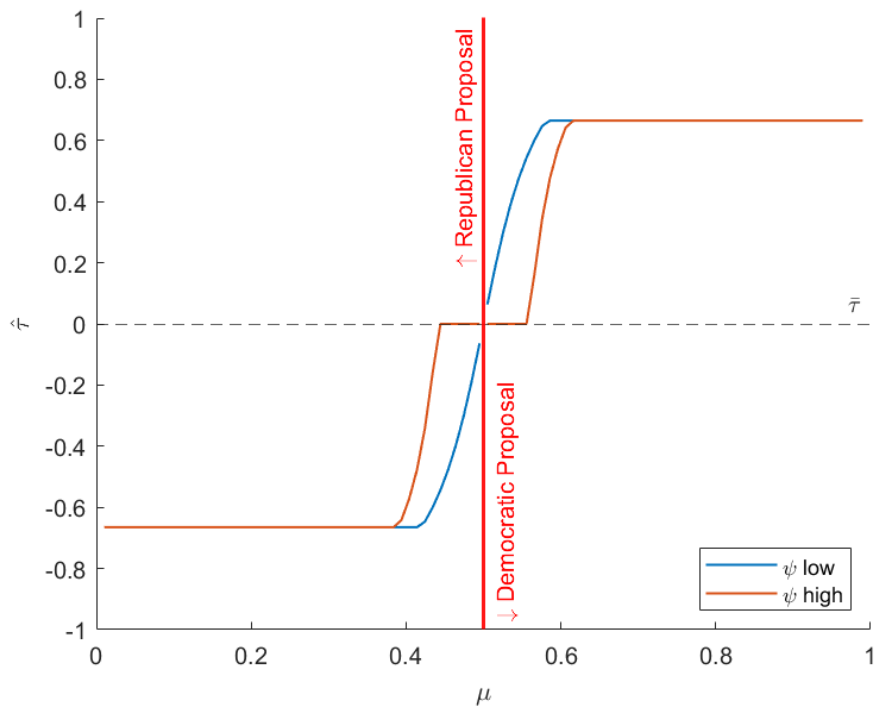

Figure 9: Equilibrium policy of the legislature for given levels of ideological distance. For $\mu < \frac{1}{2}$ the agenda-setter belongs to R, otherwise she belongs to D.

It is worth noting that proposals by the D party will be closer to the social optimum than those of the R party. The social cost of carbon implies a strictly positive optimal tax (eq. 20). Members of the D party will tend to cater to the clean sector, and thus set $\tau > 0$; and vice versa for members of the R party.

However, politicians are not driven by climate motives. Legislators represent agents and have political pressures, none of which internalize the impact of emissions. Therefore, legislators will not act the way a social planner would do. In addition, the specification of taxes as a transfer system ensures that the effect of taxes on consumption is symmetrical. The distortionary effect of taxes depends on the absolute values of the proposal, $|\tau|$, and not on the sign. Hence, even if D party is consistently closer to the socially optimal, voters would not have any reason to be electorally biased towards them.

3.4 The Impact of Polarization

In this section, I characterize the effects of ideological distance between parties under generally broad conditions. This model can encompass two opposite effects of polarization.The traditional view that polarization leads to more extremism is formalized in Theorem 1. The alternative view that polarization leads to gridlock is formalized in Theorem 2. In addition, the model also makes delivers predictions about the impact on policy of exposure to climate change. These are characterized in Corollaries 2 and 3.

Assumption 1. *Suppose that the following conditions hold:*

(i) $SCC < \left((1-\tau)^{-1} - (1+\tau)^{-1}\right) \frac{(1-\tau)^{\frac{\varepsilon(1-\alpha)}{1-\zeta}}\left((1+\tau)^{\frac{\varepsilon}{1-\zeta}}+(1-\tau)^{\frac{\varepsilon}{1-\zeta}}\right)^{\alpha}}{\left((1+\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}+(1-\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}\right)}$

(ii) $\varepsilon > \left(\frac{1}{1+\tau}\right) \frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}}+(1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}+(1-\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}}$

(iii) $\varepsilon > \left(\frac{1}{1-\tau}\right) \frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}}+(1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}+(1-\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}}$

Intuitively, the first condition states that the distortion generated by taxes is large relative to the climate externality. These conditions ensure that taxes will have a negative effect on output. The last two conditions of Assumption 1 ensure that the effect of taxes on the energy sectors is opposed. That is, if energy substitution is high enough, then the clean sector benefits from a tax to the dirty sector (within a limited range); and vice versa.

Theorem 1 presents the key results supporting the prevalent view in economics that more polarization leads to more polarized policy. In particular, it states that the distance between R and D agenda-setters' ideal tax, $\{\tau_R^u, \tau_D^u\}$ increases with polarization. Theorem 1 also defines the disagreement region as the set of status quo taxes, $\bar{\tau}$, for which both political parties will choose to change taxes in opposite directions.

Theorem 1. *For the set of status quo tax levels $\bar{\tau} \in [\tau_R^u, \tau_D^u]$, and if Assumption 1 holds, the D (R) agenda-setter proposes to increase (decrease) taxes. The length of this set is weakly increasing in both parameters ψ_D, ψ_R.*

Proof. Let us begin by showing what happens when $\bar{\tau} \notin [\tau_R^u, \tau_D^u]$. The definition of τ_D^u (eq. 24) and Lemma 1 (see Appendix C.2) imply that in the case $\bar{\tau} > \tau_D^u$, the marginal loss of consumption exceeds the marginal utility of catering to political pressures, i.e.

$$U_C' \frac{\partial C}{\partial \tau} + \omega_{AD} \frac{\partial \Pi_d}{\partial \tau} + (1-\omega_{AD}) \frac{\partial \Pi_c}{\partial \tau} < 0$$

Since $\omega_{AR} < \omega_{AD}$, this expression is also negative for agenda-setter R. Therefore, even though there is disagreement in the level of taxes, both agenda-setters agree in wanting to decrease them. The reverse argument applies to $\bar{\tau} < \tau_R^u$.

Because U, Π are continuous and monotonic, it follows that in the range $\tau \in [\tau_R^u, \tau_D^u]$, the first-order conditions of both agenda-setters differ in sign. Therefore, both parties disagree in the desired direction for the policy change.

Lastly, the limit of the disagreement region is defined by the first-order conditions, eqs. (24) and (28). The tax level τ_D^u is increasing in ω_{AD}, while τ_R^u is increasing in ω_{AR}. From eq. (16) we know that ω_{AD} is decreasing in ψ_R, and ω_{AR} is increasing in ψ_R. Therefore, an increase in either ψ_D or ψ_R widens the range of disagreement. □

Even though an increase in polarization leads to a greater distance in legislators' ideal tax, this increase does not necessarily translate into actual policy polarization. The reason is that even if agenda-setters' proposals depend on their ideal tax, their actual behavior will be distorted by the need to reach a coalition.

Consider an increase in the ideological distance between the two parties, reflected by an increase in the parameter ψ_{-i} of the party $-i$ who is currently not in power. Because ψ_i affects both the probability of members of the party i voting in favor of a proposal (eq. 21) and the ideal tax of the agenda-setter eqs. (24) and (28), the two effects are confounded. Instead, an increase in ψ_i alone isolates the effect of ideological distance. Figure 9 illustrates this phenomenon.

In line with the evidence presented in Equations (3) and (4), an increase in ideological distance affects the proposals of the political parties in two ways. First, it increases legislative inactivity in the sense that it takes a greater margin to pass a proposal. Second, when an agreement is reached, more concessions, in the form of a more moderate proposal, are needed for the legislation to be approved. Theorem 2 and Corollary 1 generalize these results under generally broad conditions.

Assumption 2. *Suppose that the following condition holds*

$$\left| U'_C \frac{\partial C}{\partial \tau} \right| < \left| \frac{\partial \Pi_c}{\partial \tau} \right| \ \forall\ \tau$$

Intuitively, Assumption 2 states that, for any tax level, the marginal losses of consumption have to be small relative to the gains of the clean sector. Since the clean sector is the only one favored by τ, this assumption ensures that there will be some degree of conflict between both parties. This assumption is only necessary for Corollary 3.

Theorem 2 states that an increase in ψ_R will lead to more gridlock in the sense that the D agenda-setter will require a higher control of the chamber in order for the bargaining to be more worth it than the status quo policy.[26]

Theorem 2. *For any given status quo tax level $\bar{\tau}$, and if Assumption 2 holds, the threshold $\underline{\mu}_D(\hat{\tau})$ is weakly increasing in ψ_R.*

Proof. See Appendix C.2 for the remainder of the proofs. □

Intuitively, an increase in ψ_R shifts the distribution of R legislators' ideal points away from the center. Thereby making bargaining less attractive for the agenda-setter (see Corollary 1). Note that the proof of Theorem 2 does not rely on the assumption that ideal points are beta distributed, as in eq. (15). In fact, any structure in which an increase in ψ_R decreases the probability of R legislators voting in favor while keeping the support from D legislators intact can achieve this result.[27]

[26] Having proved the statement for a D agenda-setter, it is straightforward to show that the opposite occurs for an R agenda-setter.

[27] Alternative assumptions could include a truncated normal or a continuous uniform distribution for ω_ℓ.

Corollary 1. *For any given status quo tax level $\bar{\tau}$, and if Assumption 2 holds, the bargaining tax level τ_D^b is weakly decreasing in ψ_R.*

Perhaps unsurprisingly, the effects of polarization can be less intense the more vulnerable is the economy to climate damages. Corollaries 2 and 3 show that an increase in the vulnerability of the economy to climate damages (i.e. decreases in $\bar{S}$) have the opposite effect as increases in ideological distance (i.e. in ψ_{-i}). Notice that in this model, a reduction in $\bar{S}$ is akin to more vulnerability to climate damages. From eq. (7), CO_2 accumulation hurts the economy insofar as it exceeds the pre-industrial stock of carbon, $\bar{S}$. The lower $\bar{S}$, the easier it is for the economy to suffer damages from emissions.

Corollary 2. *The unconstrained tax level τ_R^u (τ_D^u) is weakly increasing (decreasing) in $\bar{S}$.*

That is, whereas disagreement increases with polarization, it decreases the more prone is the economy to suffer damages from emissions.

Corollary 3. *If Assumption 2 holds, then the threshold $\underline{\mu}_D(\hat{\tau})$ weakly decreases with a lower $\bar{S}$.*

Similarly, Corollary 3 states that the threshold defining the gridlock region for party D is decreasing with sensitivity to climate damages.

Finally, the model also highlights the effects that the status quo tax has on the bargaining process, in line with the dynamic legislative bargaining literature (Eraslan et al., 2022). The following two corollaries extend the results from Theorem 2 and Corollary 1.

Corollary 4. *If $\left|U_C' \frac{\partial^2 C}{\partial \tau^2}\right| > \left|\frac{\partial^2 \Pi_c}{\partial \tau^2}\right| \; \forall \; \tau$, then the threshold $\underline{\mu}_D(\bar{\tau})$ is increasing in $\bar{\tau}$.*

Corollary 5. *If $\left|U_C' \frac{\partial^2 C}{\partial \tau^2}\right| > \left|\frac{\partial^2 \Pi_c}{\partial \tau^2}\right| \; \forall \; \tau$, then the bargaining tax level τ_D^b is weakly decreasing in $\bar{\tau}$.*

Intuitively, the assumption states that the slope of the marginal utility is greater in absolute value than that of the profits of the clean sector.

4 Two-period Taxation

The static nature of the model presented in Section 3 ignores a potential concern regarding to whether the equilibrium behavior extends to a dynamic setting. In this Section, I extend the model of Section 3 to a two-period model in which legislators have to bargain over taxes every period. Legislators and the agenda-setter are forward-looking, which makes the model intractable for the first period. I solve it computationally and show that the logic of policy stalemate is reinforced even under a dynamic setting.

There are two periods, $t = \{1, 2\}$. Absent any intertemporal economic decisions (i.e. capital decision), the economic structure of the model is the same as in the previous version of the model for both periods. Legislators, however, are forward looking. Their problem in the first period is given by

$$\max_{Y,N} \left\{ V_\ell\left(\hat{\tau}_1, S_0\right) + \beta \mathbb{E}_{\hat{\tau}_1}\left[V_\ell\left(\tau_2, S_1\right)\right], V_\ell\left(\tau_0, S_0\right) + \beta \mathbb{E}_{\tau_0}\left[V_\ell\left(\tau_2, S_1\right)\right] \right\}$$

where τ_0, S_0 are the status quo tax and the pre-industrial stock of carbon for the first period, respectively. As in the one-period case, the mass of legislators voting in favor of any proposal is given by eq. (21), with the difference that the marginal legislator is now defined by

$$\bar{\omega}\left(\hat{\tau}_1, \tau_0, S_0\right) \equiv \frac{U(C_1) - U(\bar{C}_1) + \Pi_{c1} - \bar{\Pi}_{c1} + \beta\left(\mathbb{E}_{\hat{\tau}_1} - \mathbb{E}_{\tau_0}\right)\left(U(C_2) + \Pi_{c2}\right)}{\Pi_{c1} - \bar{\Pi}_{c1} - \left(\Pi_{d1} - \bar{\Pi}_{d1}\right) + \beta\left(\mathbb{E}_{\hat{\tau}_1} - \mathbb{E}_{\tau_0}\right)\left(\Pi_{c2} - \Pi_{d2}\right)}$$

where $\left(\mathbb{E}_{\hat{\tau}_1} - \mathbb{E}_{\tau_0}\right)(x) \equiv \mathbb{E}_{\hat{\tau}_1}(x) - \mathbb{E}_{\tau_0}(x)$. That is, legislators take into account the fact that the tax set today will become the status quo tomorrow.

Similarly, the problem of the agenda-setter in the first period is given by

$$\max_{\hat{\tau}_1} V_A\left(\hat{\tau}_1, S_0\right) + \beta \mathbb{E}_{\hat{\tau}_1}\left(V_A\left(\tau_2, S_1\right)\right)$$

subject to eqs. (7) to (13), to the constraint $\hat{\tau}_1 \in (-1, 1)$ and to the coalition constraint (eq. 23).

In the two-period version of the model, taxation is an intertemporal decision that propagates to the future through an endogenous status quo. From Corollaries 4 and 5, we know that the presence of a status quo has effects on future policy. This endogeneity opens the door for the agenda-setter to manipulate the outcome of tomorrow's bargaining process. Similarly, legislators are willing to accept proposals that they would not in a static setting.

To see how the dynamic nature of the model affects the behavior of both legislators and the agenda-setter, we can rewrite the expression of the expected value splits as follows

$$\begin{aligned}
\mathbb{E}_{\hat{\tau}_1}\left(V_A\left(\tau_2, S_1\right)\right) = & Pr\left(\mu_2 > \overline{\mu}_D(\hat{\tau}_1)\right) V_A\left(\tau^u_{D2}, S_1\right) \\
& + Pr\left(\mu_2 \in \left[\underline{\mu}_D(\hat{\tau}_1), \overline{\mu}_D(\hat{\tau}_1)\right]\right) V_A\left(\tau^b_{D2}, S_1\right) \\
& + Pr\left(\mu_2 \in \left[\underline{\mu}_R(\hat{\tau}_1), \underline{\mu}_D(\hat{\tau}_1)\right]\right) V_A\left(\hat{\tau}_1, S_1\right) \\
& + Pr\left(\mu_2 \in \left[\overline{\mu}_R(\hat{\tau}_1), \underline{\mu}_R(\hat{\tau}_1)\right]\right) V_A\left(\tau^b_{R2}, S_1\right) \\
& + Pr\left(\mu_2 < \overline{\mu}_R(\hat{\tau}_1)\right) V_A\left(\tau^u_{R2}, S_1\right)
\end{aligned} \tag{29}$$

Figure 10 illustrates the limits of the different regions (i.e. free rein, bargain and gridlock) in the second period depending on the status quo. In general, extreme values of τ grant the agenda-setter a higher utility. However, they also make it easier for the other party to reach a coalition to revert the policy, were they to control the legislature in the future. In line with the results from Tables 6 and 7, the policy reversal resulting from a change in the majority party will be greater the more extreme is the status quo $\bar{\tau}$. On the other hand, moderate values of τ reduce overall probability of ending in gridlock, but this probability is more evenly distributed between both parties.

It is not obvious a priori which of the two motives will dominate in taking the decision. Figure 11 illustrates the equilibrium policy in a calibrated version of the two-period the model. Clearly, in this dynamic setting the policy stalemate motive dominates.

As in the previous Section, the effects of polarization can be less intense the more vulnerable is the economy to climate damages. Figure 12 illustrates the equilibrium policy in the two-version model when damages from emissions are high. In this case, both agenda-setter shift their proposals in the free rein case upwards.

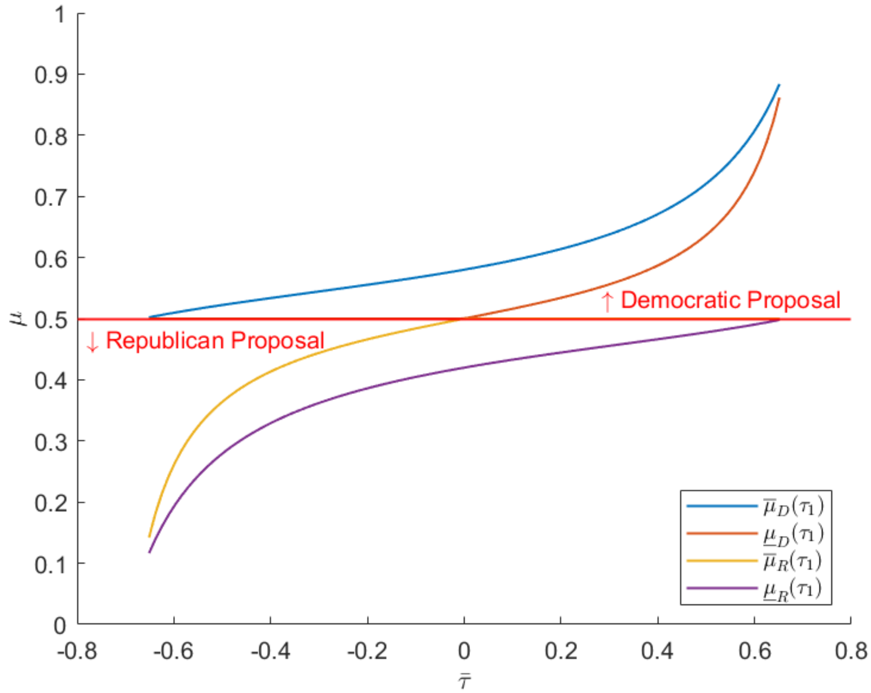

Figure 10: Thresholds defining the different action regions of agenda-setters for different values of μ and $\bar{\tau}$.

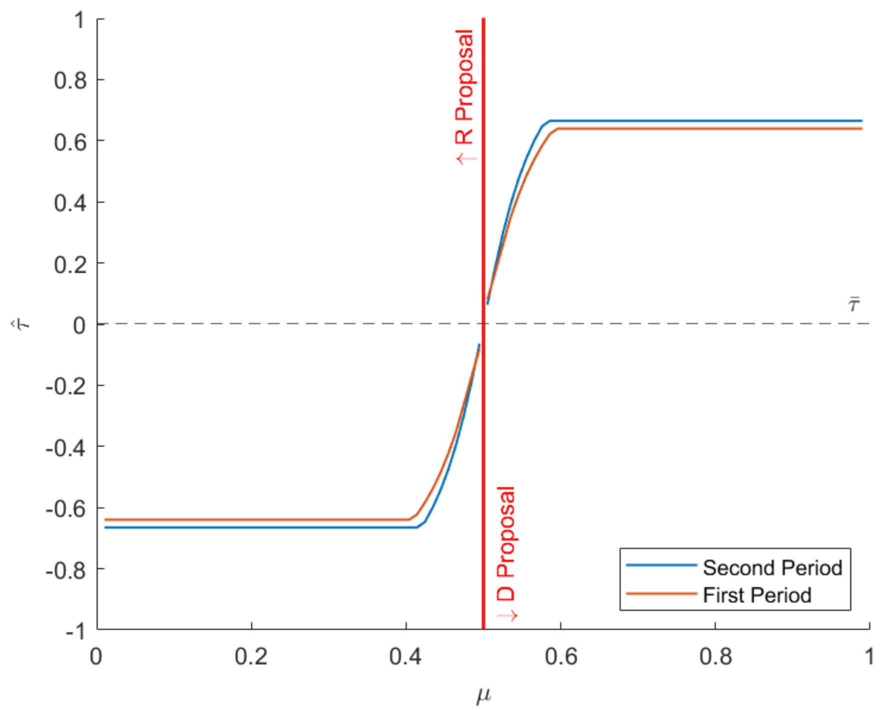

Figure 11: Equilibrium policy of the legislature in the two-period version.

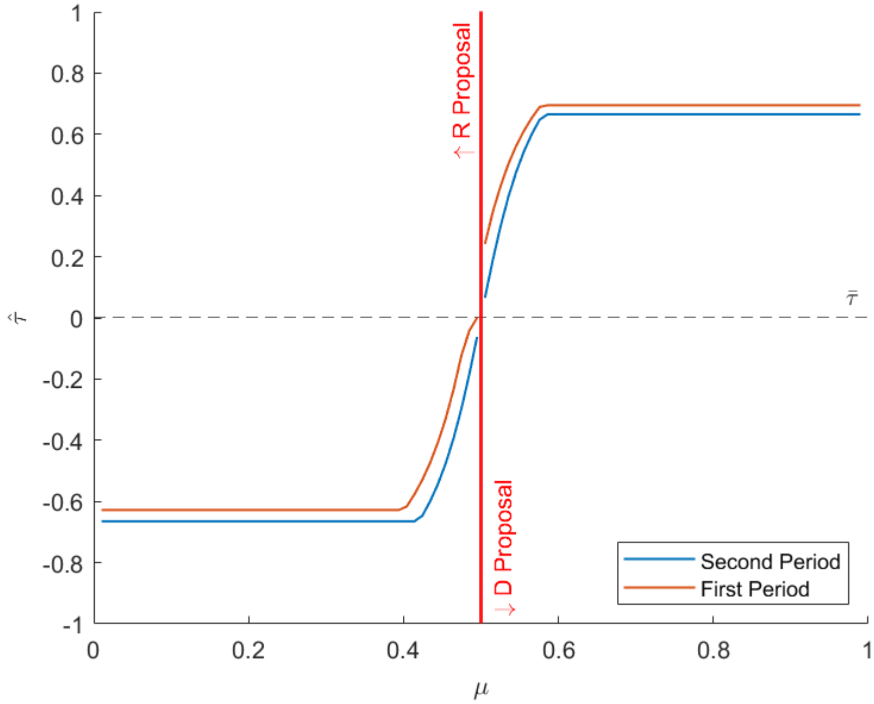

Figure 12: Equilibrium policy of the legislature in the two-period version when γ is high.

5 Conclusion

In this paper I study the effect of party polarization on climate policies. Despite consensus in the scientific community about the harmful effects of human activity on Earth's climate, advanced economies have failed to pass effective legislation addressed to cut CO_2 emissions. At the same time, Western democracies, in particular the United States, have recently experienced a surge in party polarization. Increasing ideological differences have affected many areas, especially climate change.

To address this question I use textual analysis to measure environmental policy of the US state legislatures. Measurement of environmental policies is not trivial. In particular, I apply Wordfish, an algorithm that estimates policy positions of documents based on their word frequencies, to environmental bills proposed between 2009 and 2018. The US has no landmark climate policy at the federal level, and leaves most of the policy-making at the states' discretion.

Party polarization affects environmental policy in four ways. First, the effect of polarization on environmental policy depends on the seat distribution of the legislature. Second, polarization moderates the environmental policy proposals by both parties when the seat distribution of the legislature is tight. Third, polarized legislatures are less likely to pass environmental legislation when the seat distribution of the legislature is tight. Fourth, parties reverse legislation when taking over a chamber; and the magnitude of this switch is greater the more extreme is the status quo environmental policy.

I rationalize these findings by developing a simple model of the legislature that incorporates the party distribution of seats. I find that polarization has a non-monotonic effect on policy. When polarization between parties is low, the preferences between both parties are overlapping and reaching an agreement is easy. On the other hand, the effect of high party polarization depends on the degree of control of the legislature. When the majority party's margin of votes is very narrow, bargaining between the two parties becomes too burdensome and a period of gridlock follows. Instead, when the majority party has a sufficient margin of control of the legislature, the response of policy will be towards extremism.

To understand the potential implications of party polarization in the long run, I embed this mechanism into a simplified version of the IAM developed by Golosov et al. (2014). I show that polarization can harm economic growth. At the same time, the effects of polarization are mitigated by the exposure of the economy to climate change.

The findings in this paper open up a few important questions for future research. In the model, gridlock prevents polarized parties to approve proposals that drive would drive the carbon tax away from the optimal. This does not take into account the role of institutional factors that can require supermajorities (e.g. the fillibuster in the US Senate). Supermajority requirements can also impede the approval of policies even when Pareto efficient. Similarly, the prevalence of gridlock in the legislature does not necessarily translate to policy stalemate. In fact, following gridlock in the US Congress, executive policy making has taken off. The implications of this shift in power are substantial, since executive policy making is more prone to changes. Future chiefs of the executive power and legislatures can easily override rules established through executive orders.

Finally, the framework provided in this paper can be used for quantitative evaluation. It would be interesting to study, for example, whether the implementation of a carbon tax with a gradual updating to climate risks would be easier to approve. Estimating growth models with a climate module is usual in the macro-environmental literature Hassler and Krusell, 2018; Hassler et al., 2016. Given its simplicity, incorporating the legislative bargaining game to standard models should be straightforward.

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A Additional Tables and Figures

Dependent Variable:	GDP Growth
Polarization	-3.157***
	(0.4091)
N	1001
State FE	Yes
Pseudo R^2	0.02893

Clustered (State) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A1: Results of regressing state's real GDP growth on a measure of polarization from 1997 to 2018, with state fixed effects and standard errors clustered at the state level.

B Robustness of the Empirical Results

B.1 Results with Probit and Logit

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Polarization (Hou)	-0.0123	-0.0512	-0.0398	-0.00795	-0.0161	-0.0165
	(0.025)	(0.154)	(0.087)	(0.024)	(0.145)	(0.082)
Democratic House	0.0821**	0.728**	0.382**	0.0789**	0.676**	0.362**
	(0.041)	(0.311)	(0.163)	(0.039)	(0.306)	(0.159)
Margin <5%				-0.0164	-0.309	-0.138
				(0.047)	(0.400)	(0.200)
Margin <5% × Polarization (Hou)				-0.100***	-0.807***	-0.442***
				(0.033)	(0.304)	(0.154)
Constant	-0.122	-0.822	-0.491	-0.229	-0.948	-0.603
	(0.955)	(6.725)	(3.603)	(0.940)	(6.646)	(3.535)
N	1268	1268	1268	1268	1268	1268
Model	LPM	Logit	Probit	LPM	Logit	Probit
Adjusted R2	0.0840			0.0879		

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A2: Results of estimating eq. (4) by OLS.

B.2 Restricting the Sample to Competitive Bills

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic House	0.386	0.187	0.560	0.314	0.0740	0.599
	(0.307)	(0.560)	(0.762)	(0.306)	(0.526)	(0.638)
Polarization (Hou)	-0.0567	-0.263	1.345	-0.224	-0.609	2.307
	(0.199)	(1.471)	(1.657)	(0.270)	(1.531)	(1.902)
Democratic House × Polarization (Hou)	0.683***	0.395	-0.0397	1.007**	-0.142	-2.505*
	(0.222)	(0.558)	(0.440)	(0.395)	(2.004)	(1.313)
Democratic House × Margin <5% × Polarization (Hou)				-0.278***	-0.590*	-0.604*
				(0.098)	(0.320)	(0.298)
Constant	8.608	35.72	68.60	9.647	-0.723	36.54
	(6.104)	(33.882)	(40.398)	(6.377)	(35.763)	(47.183)
N	161	161	154	161	161	154
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.355	0.484	0.455	0.358	0.487	0.461

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A3: Results of estimating eq. (3) restricting the sample to competitive bills.

	(1)	(2)	(3)	(4)	(5)	(6)
	Enacted	Enacted	Enacted	Enacted	Enacted	Enacted
Polarization (Hou)	0.00484	-0.356	-1.134*	0.00819	-0.317	-1.459*
	(0.089)	(0.765)	(0.639)	(0.089)	(0.923)	(0.752)
Democratic House	0.235*	0.662***	1.570***	0.227*	0.670***	1.542***
	(0.129)	(0.195)	(0.224)	(0.129)	(0.204)	(0.225)
Margin <5%				-0.0460	0.132	-0.206
				(0.184)	(0.470)	(0.315)
Margin <5% × Polarization (Hou)				-0.0437	-0.0582	-0.0347
				(0.127)	(0.325)	(0.253)
Constant	-2.214	-6.982	-6.246	-2.380	-4.679	-18.44
	(2.412)	(24.605)	(22.829)	(2.328)	(28.934)	(23.652)
N	161	161	154	161	161	154
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.173	0.287	0.343	0.164	0.273	0.335

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A4: Results of estimating eq. (4) restricting the sample to competitive bills.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Republican Capture	-0.0661	-0.207	-0.901**	0.419	-0.760	-1.452***
	(0.228)	(0.235)	(0.410)	(0.342)	(0.534)	(0.384)
Polarization (Hou)	0.169	-0.423	1.299	0.0390	0.606	2.767
	(0.221)	(1.159)	(1.128)	(0.225)	(1.601)	(1.691)
Republican Capture × Polarization (Hou)	-0.432***	-0.436	-0.0351	-0.881***	-0.395	0.132
	(0.144)	(0.310)	(0.313)	(0.218)	(0.416)	(0.432)
Republican Capture × Polarization (Hou) × EnvironmentalAvg				-0.132	-1.253*	-1.687**
				(0.399)	(0.737)	(0.799)
Constant	11.41*	10.21	63.66	2.986	7.512	98.24
	(6.659)	(40.292)	(42.006)	(7.681)	(102.491)	(126.764)
N	161	161	154	119	119	109
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.313	0.499	0.485	0.364	0.417	0.345

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A5: Results of estimating eq. (5) restricting the sample to competitive bills.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Democratic Capture	0.00721	-0.0324	0.0351	-0.105	1.040	1.106
	(0.329)	(0.382)	(0.707)	(0.804)	(1.342)	(3.169)
Polarization (Hou)	0.0596	0.424	1.550	-0.0718	1.023	1.242
	(0.234)	(1.346)	(1.304)	(0.266)	(1.258)	(1.633)
Democratic Capture × Polarization (Hou)	0.600*	0.751**	0.834	0.640	0.209	1.235
	(0.320)	(0.331)	(0.635)	(0.706)	(0.963)	(2.898)
Democratic Capture × Polarization (Hou) × EnvironmentalAvg				-0.407*	-0.676**	-0.210
				(0.225)	(0.263)	(0.492)
Constant	11.63*	62.47	92.21*	4.155	67.17	80.16
	(6.727)	(43.916)	(49.149)	(8.415)	(102.112)	(138.287)
N	161	161	154	119	119	109
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.304	0.488	0.463	0.324	0.417	0.348

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A6: Results of estimating eq. (5) restricting the sample to competitive bills.

B.3 Sample Restricted to Swing States

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic House	0.289**	0.330**	0.342**	0.172	0.497***	0.551***
	(0.127)	(0.144)	(0.135)	(0.208)	(0.150)	(0.169)
Polarization (Hou)	-0.0194	-0.133	-0.208	0.0492	0.583	0.990*
	(0.092)	(0.423)	(0.484)	(0.223)	(0.501)	(0.497)
Democratic House × Polarization (Hou)	0.0839	-0.0243	-0.0200	0.0912	-0.332	-0.398
	(0.142)	(0.214)	(0.223)	(0.217)	(0.228)	(0.245)
Constant	-0.650	11.22	13.12	-4.217	-14.18	-6.998
	(3.127)	(11.579)	(14.819)	(4.748)	(11.753)	(20.478)
N	1268	1268	1267	693	693	693
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.245	0.360	0.358	0.305	0.417	0.413

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A7: Results of estimating eq. (3) restricting the sample to bills produced in swing states.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Polarization (Hou)	-0.0138	-0.0486	0.0118	-0.0775*	-0.297**	-0.320*
	(0.028)	(0.102)	(0.119)	(0.042)	(0.135)	(0.174)
Democratic House	0.0821**	0.0527	0.0209	0.0332	0.0210	-0.0219
	(0.041)	(0.080)	(0.070)	(0.070)	(0.058)	(0.069)
Constant	-0.128	-9.551**	-7.446	0.201***	0.228***	0.251***
	(0.955)	(4.587)	(5.923)	(0.030)	(0.026)	(0.028)
N	1268	1268	1267	721	721	721
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.0839	0.155	0.160	0.0188	0.154	0.150

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A8: Results of estimating eq. (4) restricting the sample to bills produced in swing states.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Republican Capture	-0.0249	-0.112	-0.161	0.0845	-0.0705	0.0445
	(0.109)	(0.104)	(0.124)	(0.120)	(0.103)	(0.138)
Polarization (Hou)	-0.00704	-0.156	-0.198	0.0841	0.0412	0.390
	(0.083)	(0.360)	(0.424)	(0.133)	(0.557)	(0.712)
Republican Capture × Polarization (Hou)	-0.0325	-0.0920	-0.0904	-0.168	-0.0432	0.00412
	(0.134)	(0.143)	(0.148)	(0.166)	(0.149)	(0.164)
Constant	1.587	11.95	13.00	-0.138	-0.0988*	-0.166**
	(2.801)	(11.695)	(15.011)	(0.142)	(0.058)	(0.078)
N	1268	1268	1267	721	721	721
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.235	0.358	0.356	0.000183	0.272	0.270

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A9: Results of estimating eq. (5) restricting the sample to bills produced in swing states.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Democratic Capture	0.212	0.285**	0.324***	0.604***	0.218*	0.241
	(0.150)	(0.139)	(0.119)	(0.208)	(0.115)	(0.170)
Polarization (Hou)	-0.0225	-0.187	-0.179	0.0407	-0.0538	0.392
	(0.079)	(0.368)	(0.427)	(0.112)	(0.608)	(0.741)
Democratic Capture × Polarization (Hou)	0.0381	0.0604	0.0215	-0.270	0.0401	-0.0300
	(0.156)	(0.125)	(0.111)	(0.191)	(0.110)	(0.106)
Constant	1.622	14.99	13.37	-0.177	-0.140**	-0.182**
	(2.821)	(11.951)	(14.942)	(0.135)	(0.055)	(0.070)
N	1268	1268	1267	721	721	721
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.237	0.360	0.357	0.0226	0.275	0.273

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A10: Results of estimating eq. (5) restricting the sample to bills produced in swing states.

B.4 Sample Restricted to Proposals by the Majority Party

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic House	0.317*	0.395**	0.439**	0.327*	0.368**	0.402**
	(0.167)	(0.168)	(0.165)	(0.163)	(0.167)	(0.172)
Polarization (Hou)	-0.0930	-0.286	-0.522	-0.107	-0.240	-0.443
	(0.108)	(0.390)	(0.462)	(0.111)	(0.423)	(0.489)
Democratic House × Polarization (Hou)	0.116	-0.0812	-0.109	0.136	0.0710	0.0631
	(0.168)	(0.225)	(0.244)	(0.169)	(0.226)	(0.240)
Democratic House × Margin <5% × Polarization (Hou)				0.183	-0.344	-0.409
				(0.262)	(0.280)	(0.317)
Constant	-0.651	3.083	11.31	-0.494	3.127	11.42
	(3.726)	(15.313)	(20.629)	(3.633)	(15.391)	(20.536)
N	944	944	941	944	944	941
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.244	0.373	0.374	0.245	0.373	0.374

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A11: Results of estimating eq. (3) restricting the sample to bills proposed by the majority party.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Polarization (Hou)	0.0222	-0.0267	-0.0126	0.0207	0.0132	0.0587
	(0.035)	(0.126)	(0.152)	(0.035)	(0.130)	(0.160)
Democratic House	0.103	0.0263	0.000346	0.0948	-0.00988	-0.0551
	(0.064)	(0.103)	(0.101)	(0.063)	(0.092)	(0.090)
Margin <5%				-0.0962	-0.168***	-0.224***
				(0.076)	(0.059)	(0.070)
Margin <5% × Polarization (Hou)				-0.114*	-0.0851	-0.131
				(0.065)	(0.073)	(0.085)
Constant	-0.383	-8.106	-3.066	-0.513	-8.271	-4.536
	(1.414)	(6.306)	(8.823)	(1.389)	(5.983)	(8.986)
N	944	944	941	944	944	941
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.0840	0.169	0.170	0.0865	0.171	0.174

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A12: Results of estimating eq. (4) restricting the sample to bills proposed by the majority party.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Republican Capture	0.312	0.0852	0.0901	1.012	0.610	0.867
	(0.709)	(0.770)	(0.837)	(1.039)	(1.087)	(1.097)
Polarization (Hou)	-0.147	-0.706	-1.003	-0.0328	-0.845	-1.033
	(0.151)	(0.723)	(0.809)	(0.151)	(1.067)	(1.258)
Republican Capture × Polarization (Hou)	-0.0919	-0.0217	-0.0431	-0.440	-0.222	-0.386
	(0.427)	(0.454)	(0.478)	(0.587)	(0.641)	(0.635)
Republican Capture × Polarization (Hou) × EnvironmentalAvg				0.0252	-0.174	-0.178
				(0.168)	(0.120)	(0.106)
Constant	2.398	4.233	9.061	3.588	-3.225	16.01
	(3.042)	(15.290)	(20.881)	(3.286)	(16.329)	(21.864)
N	944	944	941	683	683	680
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.234	0.368	0.369	0.250	0.400	0.397

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A13: Results of estimating eq. (5) restricting the sample to bills proposed by the majority party.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic Capture	-0.0841	-0.118	-0.0491	-0.145	-2.010*	-1.838*
	(0.731)	(0.821)	(0.743)	(0.818)	(1.013)	(1.000)
Polarization (Hou)	-0.161	-0.857	-1.068	-0.0614	-1.508	-1.719
	(0.160)	(0.748)	(0.840)	(0.155)	(1.081)	(1.273)
Democratic Capture × Polarization (Hou)	0.174	0.240	0.195	0.231	1.219**	1.161**
	(0.369)	(0.447)	(0.409)	(0.413)	(0.594)	(0.545)
Democratic Capture × Polarization (Hou) × EnvironmentalAvg				-0.0666	-0.0626	-0.0955
				(0.092)	(0.128)	(0.103)
Constant	2.343	8.763	9.866	3.497	-3.725	4.971
	(3.139)	(15.630)	(20.936)	(3.556)	(17.392)	(21.313)
N	944	944	941	683	683	680
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.235	0.372	0.371	0.248	0.404	0.403

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A14: Results of estimating eq. (5) restricting the sample to bills proposed by the majority party.

B.5 Full Specification

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic House	0.289**	0.330**	0.342**	0.282**	0.258	0.265*
	(0.127)	(0.144)	(0.135)	(0.125)	(0.156)	(0.140)
Polarization (Hou)	-0.0194	-0.133	-0.208	-0.0531	-0.129	-0.212
	(0.092)	(0.423)	(0.484)	(0.096)	(0.436)	(0.495)
Democratic House × Polarization (Hou)	0.0839	-0.0243	-0.0200	0.121	0.0288	0.0365
	(0.142)	(0.214)	(0.223)	(0.143)	(0.262)	(0.273)
Margin <5%				-0.247	-0.211	-0.221
				(0.199)	(0.204)	(0.199)
Democratic House × Margin <5%				0.0219	0.142	0.142
				(0.234)	(0.320)	(0.326)
Margin <5% × Polarization (Hou)				0.388	0.0676	0.0618
				(0.255)	(0.261)	(0.279)
Democratic House × Margin <5% × Polarization (Hou)				-0.263	-0.299	-0.309
				(0.246)	(0.302)	(0.319)
Constant	-0.650	11.22	13.12	-0.511	9.735	10.84
	(3.127)	(11.579)	(14.819)	(3.111)	(11.703)	(15.206)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.245	0.360	0.358	0.248	0.361	0.358

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A15: Results of estimating eq. (3) under the full specification.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Polarization (Hou)	-0.0138	-0.0486	0.0118	-0.00884	-0.0387	0.0123
	(0.028)	(0.102)	(0.119)	(0.027)	(0.110)	(0.119)
Democratic House	0.0821**	0.0527	0.0209	0.0788**	0.0297	-0.00170
	(0.041)	(0.080)	(0.070)	(0.039)	(0.068)	(0.061)
Margin <5%				-0.0239	-0.127***	-0.129***
				(0.046)	(0.035)	(0.037)
Margin <5% × Polarization (Hou)				-0.113***	-0.0496	-0.0379
				(0.037)	(0.031)	(0.034)
Constant	-0.128	-9.551**	-7.446	-0.234	-9.679**	-7.994
	(0.955)	(4.587)	(5.923)	(0.940)	(4.613)	(6.117)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.0839	0.155	0.160	0.0879	0.158	0.163

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A16: Results of estimating eq. (4) under the full specification.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Republican Capture	-0.0249	-0.112	-0.161	0.0309	-0.0726	-0.134
	(0.109)	(0.104)	(0.124)	(0.096)	(0.114)	(0.144)
Polarization (Hou)	-0.00704	-0.156	-0.198	-0.0156	0.104	0.273
	(0.083)	(0.360)	(0.424)	(0.072)	(0.404)	(0.423)
Republican Capture × Polarization (Hou)	-0.0325	-0.0920	-0.0904	-0.263*	-0.327*	-0.378**
	(0.134)	(0.143)	(0.148)	(0.150)	(0.165)	(0.166)
EnvironmentalAvg				0.403***	-0.0312	-0.0469
				(0.099)	(0.062)	(0.053)
Republican Capture × EnvironmentalAvg				-0.250*	-0.177	-0.203**
				(0.135)	(0.108)	(0.099)
Polarization (Hou) × EnvironmentalAvg				-0.00425	0.0876*	0.0522
				(0.071)	(0.051)	(0.051)
Republican Capture × Polarization (Hou) × EnvironmentalAvg				-0.612***	-0.613***	-0.578***
				(0.190)	(0.146)	(0.139)
Constant	1.587	11.95	13.00	3.118	10.35	17.61
	(2.801)	(11.695)	(15.011)	(2.335)	(11.592)	(15.900)
N	1268	1268	1267	893	893	893
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.235	0.358	0.356	0.304	0.382	0.382

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A17: Results of estimating eq. (5) under the full specification.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic Capture	0.212	0.285**	0.324***	0.135	-0.420***	-0.237
	(0.150)	(0.139)	(0.119)	(0.212)	(0.156)	(0.190)
Polarization (Hou)	-0.0225	-0.187	-0.179	-0.00196	0.0949	0.301
	(0.079)	(0.368)	(0.427)	(0.062)	(0.475)	(0.474)
Democratic Capture × Polarization (Hou)	0.0381	0.0604	0.0215	0.172	0.637**	0.478*
	(0.156)	(0.125)	(0.111)	(0.190)	(0.257)	(0.258)
EnvironmentalAvg				0.395***	-0.0451	-0.0518
				(0.083)	(0.067)	(0.063)
Democratic Capture × EnvironmentalAvg				0.0344	0.540	0.423
				(0.262)	(0.350)	(0.347)
Polarization (Hou) × EnvironmentalAvg				-0.0193	0.0964	0.0701
				(0.066)	(0.057)	(0.058)
Democratic Capture × Polarization (Hou) × EnvironmentalAvg				-0.337	-0.562**	-0.531**
				(0.226)	(0.238)	(0.221)
Constant	1.622	14.99	13.37	2.816	9.594	17.53
	(2.821)	(11.951)	(14.942)	(2.357)	(14.395)	(18.432)
N	1268	1268	1267	893	893	893
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.237	0.360	0.357	0.298	0.378	0.376

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A18: Results of estimating eq. (5) under the full specification.

B.6 Using Polarization in the Senate

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic Senate	0.222	0.146	0.118	0.228	0.165	0.131
	(0.152)	(0.150)	(0.160)	(0.157)	(0.161)	(0.173)
Polarization (Sen)	0.0299	-0.102	-0.0855	0.0207	-0.130	-0.102
	(0.084)	(0.248)	(0.234)	(0.099)	(0.266)	(0.255)
Democratic Senate × Polarization (Sen)	-0.0196	0.00767	0.0407	-0.00889	0.0147	0.0397
	(0.136)	(0.139)	(0.144)	(0.158)	(0.193)	(0.189)
Democratic Senate × Margin <5% × Polarization (Sen)				0.0716	0.124	0.0857
				(0.164)	(0.129)	(0.116)
Constant	-1.008	15.47	12.99	-1.049	16.05	13.61
	(3.625)	(12.308)	(14.758)	(3.630)	(12.143)	(14.430)
N	1241	1241	1240	1241	1241	1240
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.228	0.343	0.341	0.227	0.342	0.340

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A19: Results of estimating eq. (3) using the measures of polarization in the senate.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Polarization (Sen)	-0.00734	-0.0473	-0.0248	-0.00438	-0.0244	-0.00414
	(0.030)	(0.100)	(0.094)	(0.031)	(0.108)	(0.105)
Democratic Senate	0.0840*	0.0462	0.0420	0.0803	0.0433	0.0286
	(0.046)	(0.046)	(0.042)	(0.049)	(0.049)	(0.044)
Margin <5%				0.0160	0.0465	0.0232
				(0.082)	(0.061)	(0.063)
Margin <5% × Polarization (Sen)				-0.0508	-0.0373	-0.0509
				(0.060)	(0.036)	(0.040)
Constant	-0.631	-10.43**	-5.704	-0.606	-10.77**	-6.339
	(1.100)	(4.652)	(5.669)	(1.092)	(4.640)	(5.809)
N	1241	1241	1240	1241	1241	1240
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.0887	0.162	0.167	0.0882	0.161	0.166

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A20: Results of estimating eq. (4) using the measures of polarization in the senate.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Republican Capture	-0.0278	-0.115	-0.140	0.0764	-0.0494	-0.125
	(0.111)	(0.103)	(0.126)	(0.150)	(0.130)	(0.141)
Polarization (Sen)	-0.00787	-0.0882	-0.0460	0.0652	0.0439	0.0595
	(0.066)	(0.257)	(0.245)	(0.072)	(0.386)	(0.359)
Republican Capture × Polarization (Sen)	-0.0499	-0.130	-0.154	-0.290*	-0.267*	-0.300*
	(0.127)	(0.102)	(0.101)	(0.158)	(0.144)	(0.150)
Republican Capture × Polarization (Sen) × EnvironmentalAvg				-0.341	-0.396*	-0.430**
				(0.258)	(0.198)	(0.198)
Constant	1.019	14.83	12.82	2.781	8.317	15.45
	(2.782)	(12.468)	(14.845)	(3.004)	(12.706)	(15.996)
N	1241	1241	1240	862	862	862
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.223	0.344	0.343	0.239	0.374	0.375

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A21: Results of estimating eq. (5) using the measures of polarization in the senate.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic Capture	0.204	0.342**	0.370***	0.117	-0.00202	0.164
	(0.150)	(0.151)	(0.131)	(0.194)	(0.102)	(0.120)
Polarization (Sen)	-0.0218	-0.103	-0.0453	0.0463	0.0448	0.0722
	(0.057)	(0.262)	(0.243)	(0.058)	(0.394)	(0.355)
Democratic Capture × Polarization (Sen)	-0.00647	-0.0480	-0.0855	0.198	0.121	-0.0293
	(0.203)	(0.242)	(0.239)	(0.171)	(0.173)	(0.159)
Democratic Capture × Polarization (Sen) × EnvironmentalAvg				-0.153	-0.221**	-0.279***
				(0.101)	(0.098)	(0.080)
Constant	1.150	18.71	13.70	3.215	9.141	13.72
	(2.799)	(12.558)	(14.715)	(2.972)	(14.629)	(18.011)
N	1241	1241	1240	862	862	862
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.225	0.346	0.344	0.236	0.371	0.369

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A22: Results of estimating eq. (5) using the measures of polarization in the senate.

B.7 Using a Party-Free Measure of Polarization

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic House	0.289**	0.375**	0.358**	0.288**	0.354**	0.342**
	(0.132)	(0.164)	(0.167)	(0.132)	(0.162)	(0.167)
Polariz (Hou, PF)	0.000713	0.607**	0.688***	-0.0190	0.611**	0.688***
	(0.093)	(0.247)	(0.237)	(0.096)	(0.256)	(0.242)
Democratic House × Polariz (Hou, PF)	0.0575	-0.159	-0.134	0.0836	-0.119	-0.0850
	(0.147)	(0.198)	(0.202)	(0.153)	(0.223)	(0.232)
Democratic House × Margin <5% × Polariz (Hou, PF)				0.0441	-0.246**	-0.263***
				(0.145)	(0.100)	(0.098)
Constant	-0.553	11.70	7.207	-0.280	10.23	5.633
	(3.260)	(10.177)	(13.352)	(3.253)	(10.040)	(13.115)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.245	0.365	0.363	0.245	0.366	0.365

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A23: Results of estimating eq. (3) using the party-free measure of polarization.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Democratic House	0.0831**	0.0519	0.0244	0.0811**	0.0318	0.00326
	(0.040)	(0.080)	(0.072)	(0.039)	(0.069)	(0.063)
Polariz (Hou, PF)	-0.0151	-0.134	-0.121	-0.0104	-0.108	-0.0896
	(0.024)	(0.092)	(0.084)	(0.023)	(0.097)	(0.088)
Margin <5%				-0.00190	-0.104***	-0.109***
				(0.048)	(0.036)	(0.039)
Margin <5% × Polariz (Hou, PF)				-0.110***	-0.0502*	-0.0413
				(0.038)	(0.030)	(0.033)
Constant	-0.132	-9.226*	-6.005	-0.259	-9.430*	-6.882
	(0.955)	(4.892)	(6.293)	(0.939)	(4.844)	(6.389)
N	1268	1268	1267	1268	1268	1267
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.0840	0.157	0.161	0.0877	0.159	0.163

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A24: Results of estimating eq. (4) using the party-free measure of polarization.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Republican Capture	-0.00855	-0.136	-0.185	0.0371	-0.0549	-0.101
	(0.111)	(0.102)	(0.121)	(0.130)	(0.107)	(0.123)
Polariz (Hou, PF)	0.0269	0.509**	0.663***	0.0477	0.765***	0.983***
	(0.075)	(0.206)	(0.207)	(0.076)	(0.255)	(0.248)
Republican Capture × Polariz (Hou, PF)	-0.120	-0.115	-0.112	-0.449***	-0.227*	-0.249**
	(0.102)	(0.109)	(0.110)	(0.118)	(0.130)	(0.122)
Republican Capture × Polariz (Hou, PF) × EnvironmentalAvg				-0.634***	-0.507***	-0.503***
				(0.175)	(0.169)	(0.159)
Constant	1.668	12.39	5.292	3.306	12.42	16.24
	(2.844)	(10.554)	(13.556)	(3.071)	(12.046)	(14.712)
N	1268	1268	1267	893	893	893
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.236	0.363	0.363	0.256	0.390	0.393

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A25: Results of estimating eq. (5) using the party-free measure of polarization.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental	Environmental	Environmental	Environmental	Environmental	Environmental
Democratic Capture	0.225	0.287*	0.347**	0.200	-0.0932	0.0556
	(0.168)	(0.150)	(0.140)	(0.211)	(0.118)	(0.123)
Polariz (Hou, PF)	0.000989	0.433**	0.602***	0.0239	0.822***	1.077***
	(0.072)	(0.214)	(0.223)	(0.072)	(0.270)	(0.264)
Democratic Capture × Polariz (Hou, PF)	-0.00692	-0.0368	-0.0736	0.0377	0.150	0.0832
	(0.161)	(0.144)	(0.116)	(0.161)	(0.137)	(0.110)
Democratic Capture × Polariz (Hou, PF) × EnvironmentalAvg				-0.0185	-0.154**	-0.207***
				(0.136)	(0.066)	(0.065)
Constant	1.665	15.70	6.478	2.985	10.51	12.56
	(2.817)	(10.928)	(13.735)	(3.148)	(12.988)	(16.101)
N	1268	1268	1267	893	893	893
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.237	0.363	0.362	0.240	0.385	0.389

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A26: Results of estimating eq. (5) using the party-free measure of polarization.

B.8 Using Polarization in the Senate and a Party-Free Measure of Polarization

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic Senate	0.216	0.224	0.184	0.223	0.210	0.165
	(0.151)	(0.164)	(0.178)	(0.155)	(0.167)	(0.182)
Polariz (Sen, PF)	0.0180	0.311	0.313	0.00713	0.336	0.355
	(0.077)	(0.264)	(0.257)	(0.093)	(0.300)	(0.294)
Democratic Senate × Polariz (Sen, PF)	-0.0474	-0.132	-0.0928	-0.0323	-0.168	-0.147
	(0.115)	(0.139)	(0.145)	(0.137)	(0.173)	(0.175)
Democratic Senate × Margin <5% × Polariz (Sen, PF)				0.126	0.0998	0.0860
				(0.205)	(0.148)	(0.121)
Constant	-0.945	17.52	14.02	-0.897	17.49	13.96
	(3.484)	(11.444)	(14.579)	(3.481)	(11.246)	(14.320)
N	1241	1241	1240	1241	1241	1240
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.228	0.344	0.342	0.227	0.343	0.342

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A27: Results of estimating eq. (3) using the party-free measure of polarization in the senate.

	(1) Enacted	(2) Enacted	(3) Enacted	(4) Enacted	(5) Enacted	(6) Enacted
Democratic Senate	0.0931**	0.0448	0.0383	0.0861*	0.0366	0.0222
	(0.045)	(0.045)	(0.040)	(0.048)	(0.048)	(0.041)
Polariz (Sen, PF)	0.0129	-0.111	-0.112	0.0151	-0.100	-0.102
	(0.025)	(0.088)	(0.078)	(0.025)	(0.088)	(0.080)
Margin <5%				0.0343	0.0685	0.0419
				(0.094)	(0.062)	(0.062)
Margin <5% × Polariz (Sen, PF)				-0.0723	-0.0578	-0.0647*
				(0.060)	(0.035)	(0.037)
Constant	-0.760	-10.86**	-5.701	-0.735	-11.38**	-6.493
	(1.058)	(4.718)	(5.704)	(1.049)	(4.736)	(5.863)
N	1241	1241	1240	1241	1241	1240
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
Adjusted R2	0.0890	0.163	0.168	0.0890	0.162	0.168

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A28: Results of estimating eq. (4) using the party-free measure of polarization in the senate.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Republican Capture	0.0144	-0.113	-0.139	0.112	-0.0440	-0.113
	(0.107)	(0.099)	(0.123)	(0.161)	(0.142)	(0.146)
Polariz (Sen, PF)	-0.0130	0.255	0.285	0.0453	0.0833	0.00705
	(0.067)	(0.259)	(0.247)	(0.074)	(0.297)	(0.283)
Republican Capture × Polariz (Sen, PF)	-0.154	-0.172*	-0.171*	-0.399***	-0.290**	-0.346***
	(0.105)	(0.086)	(0.087)	(0.145)	(0.124)	(0.117)
Republican Capture × Polariz (Sen, PF) × EnvironmentalAvg				-0.370	-0.394**	-0.464**
				(0.221)	(0.184)	(0.174)
Constant	1.086	16.52	13.71	2.984	8.825	20.09
	(2.794)	(11.522)	(14.528)	(3.088)	(12.581)	(16.226)
N	1241	1241	1240	862	862	862
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.225	0.346	0.345	0.245	0.376	0.377

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A29: Results of estimating eq. (5) using the party-free measure of polarization in the senate.

	(1) Environmental	(2) Environmental	(3) Environmental	(4) Environmental	(5) Environmental	(6) Environmental
Democratic Capture	0.221	0.353*	0.416**	0.121	0.0318	0.258*
	(0.196)	(0.199)	(0.180)	(0.233)	(0.113)	(0.143)
Polariz (Sen, PF)	-0.0435	0.147	0.204	0.00528	0.130	0.104
	(0.061)	(0.252)	(0.245)	(0.063)	(0.305)	(0.296)
Democratic Capture × Polariz (Sen, PF)	-0.00927	-0.0631	-0.149	0.139	0.0311	-0.134
	(0.208)	(0.226)	(0.224)	(0.170)	(0.161)	(0.156)
Democratic Capture × Polariz (Sen, PF) × EnvironmentalAvg				-0.159**	-0.200***	-0.244***
				(0.075)	(0.060)	(0.054)
Constant	1.198	20.04	13.60	3.224	10.08	13.53
	(2.793)	(11.953)	(14.784)	(3.054)	(14.368)	(18.129)
N	1241	1241	1240	862	862	862
State FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	Yes	No	Yes
Adjusted R2	0.225	0.346	0.344	0.235	0.370	0.369

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A30: Results of estimating eq. (5) using the party-free measure of polarization in the senate.

C Proofs & Derivations

C.1 Equilibrium Values

Substituting the normalization eqs. (11) and (18) into the relative labor demand, eq. (19), we obtain the equilibrium values of labor

$$N_d = \frac{(1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}} \tag{30}$$

$$N_c = \frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}} \tag{31}$$

where $\zeta \equiv (1-\varepsilon)(1-\alpha) < 0$ if $\varepsilon > 1$.

Substituting the equilibrium values of labor (eqs. (30) and (31)) and eq. (13) into eq. (18) gives the equilibrium values of prices

$$p_d = \frac{(1-\tau)^{\frac{\alpha}{\zeta-1}}}{\left[(1+\tau)^{\frac{\alpha(1-\varepsilon)}{\zeta-1}} + (1-\tau)^{\frac{\alpha(1-\varepsilon)}{\zeta-1}}\right]^{\frac{1}{1-\varepsilon}}} \tag{32}$$

$$p_c = \frac{(1+\tau)^{\frac{\alpha}{\zeta-1}}}{\left[(1+\tau)^{\frac{\alpha(1-\varepsilon)}{\zeta-1}} + (1-\tau)^{\frac{\alpha(1-\varepsilon)}{\zeta-1}}\right]^{\frac{1}{1-\varepsilon}}} \tag{33}$$

Substituting the equilibrium values of labor, eqs. (30) and (31), into eqs. (8) and (10) gives the equilibrium values of energy

$$E_d = \left(\frac{(1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}}\right)^{\alpha} \tag{34}$$

$$E_c = \left(\frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}}\right)^{\alpha} \tag{35}$$

$$E = \frac{\left((1+\tau)^{\frac{\alpha(1-\varepsilon)}{\zeta-1}} + (1-\tau)^{\frac{\alpha(1-\varepsilon)}{\zeta-1}}\right)^{\frac{\varepsilon}{\varepsilon-1}}}{\left((1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}\right)^{\alpha}} \tag{36}$$

C.2 Proofs

Lemma 1. *If Assumption 1 holds, then*

(i) Consumption decreases for any value $\tau \neq 0$.

In addition, $\exists\ \varepsilon > 1$ such that the following statements hold:

(ii) The profits of the clean sector are increasing in τ.

(iii) The profits of the dirty sector are decreasing in τ.

Proof. We want to show that the following expressions hold

(i) $\frac{\partial C}{\partial \tau} \lesseqgtr 0 \Leftrightarrow \tau \gtreqless 0$

(ii) $\frac{\partial \Pi_d}{\partial \tau} < 0$

(iii) $\frac{\partial \Pi_c}{\partial \tau} > 0$

The signs of the derivatives depend on the equilibrium values of labor, prices, energy and output, eqs. (30) to (36). The derivatives of labor in both periods take the following form

$$\frac{\partial N_d}{\partial \tau} = \frac{\varepsilon N_d N_c}{\zeta - 1}\left[\frac{1}{1-\tau} + \frac{1}{1+\tau}\right] < 0 \tag{37}$$

$$\frac{\partial N_c}{\partial \tau} = \frac{\varepsilon N_d N_c}{1 - \zeta}\left[\frac{1}{1-\tau} + \frac{1}{1+\tau}\right] > 0 \tag{38}$$

because $\zeta < 0$ if $\varepsilon > 1$. The derivative of total energy produced is given by

$$\begin{aligned}\frac{\partial E}{\partial \tau} &= \frac{\partial N_d}{\partial \tau}\left[\frac{\partial E}{\partial E_d}\frac{\partial E_d}{\partial N_d} - \frac{\partial E}{\partial E_c}\frac{\partial E_c}{\partial N_c}\right] \\ &= E^{\frac{1}{\varepsilon}}\frac{\partial N_d}{\partial \tau}\left(\frac{E_d^{\frac{\varepsilon-1}{\varepsilon}}}{N_d} - \frac{E_c^{\frac{\varepsilon-1}{\varepsilon}}}{N_c}\right) \lesseqgtr 0 \Leftrightarrow \tau \gtreqless 0\end{aligned} \tag{39}$$

where the first equality is implied by eq. (11)

$$\frac{\partial N_d}{\partial \tau} = -\frac{\partial N_c}{\partial \tau} \tag{40}$$

The sign of the derivative in eq. (39) is determined by the term in brackets

$$\begin{aligned}\frac{E_d^{\frac{\varepsilon-1}{\varepsilon}}}{N_d} - \frac{E_c^{\frac{\varepsilon-1}{\varepsilon}}}{N_c} &= \left(\frac{(1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}}\right)^{\frac{\zeta-1}{\varepsilon}} - \left(\frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}}\right)^{\frac{\zeta-1}{\varepsilon}} \\ &\propto (1-\tau)^{-1} - (1+\tau)^{-1} \gtreqless 0 \Leftrightarrow \tau \gtreqless 0\end{aligned} \tag{41}$$

The derivative of output is given by

$$\begin{aligned}\frac{\partial Y}{\partial \tau} &= Y\left[-\gamma\frac{\partial (S-\bar{S})}{\partial \tau} + \frac{1}{E}\frac{\partial E}{\partial \tau}\right] \\ &= \frac{\varepsilon N_d N_c Y}{\zeta - 1}\left(\frac{1}{1-\tau} + \frac{1}{1+\tau}\right)\left[E^{\frac{1}{\varepsilon}-1}\left(\frac{E_d^{\frac{\varepsilon-1}{\varepsilon}}}{N_d} - \frac{E_c^{\frac{\varepsilon-1}{\varepsilon}}}{N_c}\right) - \gamma\left(\phi_L + (1-\phi_L)\phi_0\right)\frac{E_d}{N_d}\right]\end{aligned}$$

where the second equality comes from

$$\begin{aligned}\frac{\partial (S-\bar{S})}{\partial \tau} &= d\frac{\partial E_d}{\partial \tau} \\ &= \alpha d\frac{E_d}{N_d}\frac{\partial N_d}{\partial \tau}\end{aligned}$$

From eq. (41), it follows that $\frac{\partial Y}{\partial \tau} > 0$ when $\tau < 0$. On the other hand, when $\tau > 0$,

$$\frac{\partial Y}{\partial \tau} < 0 \Leftrightarrow \left((1-\tau)^{-1} - (1+\tau)^{-1}\right) \frac{(1-\tau)^{\frac{\varepsilon(1-\alpha)}{1-\zeta}} \left((1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}\right)^{\alpha}}{\left((1+\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}} + (1-\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}\right)} > \gamma(\phi_L + (1-\phi_L)\phi_0)$$

Finally, it follows from the resource constraint $C = Y$ that

$$\frac{\partial C}{\partial \tau} = \frac{\partial Y}{\partial \tau}$$

which concludes the proof of the first part of the Lemma.

The last two statements of the proof require the derivatives of prices, which are given by

$$\begin{aligned}
\frac{\partial p_d}{\partial \tau} &= p_d p_c^{1-\varepsilon} \frac{\alpha}{1-\zeta} \left[\frac{1}{1-\tau} + \frac{1}{1+\tau}\right] > 0 \\
\frac{\partial p_c}{\partial \tau} &= p_c p_d^{1-\varepsilon} \frac{\alpha}{\zeta-1} \left[\frac{1}{1-\tau} + \frac{1}{1+\tau}\right] < 0
\end{aligned}$$

Substituting the FOCs of the energy sectors, we obtain the equilibrium values of profits

$$\begin{aligned}
\Pi_d &= (1-\alpha)(1-\tau) p_d E_d \\
\Pi_c &= (1-\alpha)(1+\tau) p_c E_c
\end{aligned}$$

These expressions can be used to obtain the sign of the derivatives of profits

$$\begin{aligned}
\frac{\partial \Pi_d}{\partial \tau} &= \left[(1-\alpha)(1-\tau)\left(N_d^{\alpha} \frac{\partial p_d}{\partial \tau} + \alpha p_d N_d^{\alpha-1} \frac{\partial N_d}{\partial \tau}\right) - (1-\alpha) p_d N_d^{\alpha}\right] \\
&= \Pi_d \left[\frac{\alpha}{\zeta-1}\left(\frac{1}{1-\tau} + \frac{1}{1+\tau}\right)\left(\varepsilon N_c - p_c^{1-\varepsilon}\right) - \frac{1}{1-\tau}\right]
\end{aligned}$$

will be negative if

$$\varepsilon > \left(\frac{1}{1+\tau}\right) \frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}} + (1-\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}} \tag{42}$$

Similarly,

$$\begin{aligned}
\frac{\partial \Pi_c}{\partial \tau} &= \left[(1-\alpha)(1+\tau)\left(N_c^{\alpha} \frac{\partial p_c}{\partial \tau} + \alpha p_c N_c^{\alpha-1} \frac{\partial N_c}{\partial \tau}\right) + (1-\alpha) p_c N_c^{\alpha}\right] \\
&= \Pi_c \left[\frac{\alpha}{1-\zeta}\left(\frac{1}{1-\tau} + \frac{1}{1+\tau}\right)\left(\varepsilon N_d - p_d^{1-\varepsilon}\right) + \frac{1}{1+\tau}\right]
\end{aligned}$$

will be positive if

$$\varepsilon > \left(\frac{1}{1-\tau}\right) \frac{(1+\tau)^{\frac{\varepsilon}{1-\zeta}} + (1-\tau)^{\frac{\varepsilon}{1-\zeta}}}{(1+\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}} + (1-\tau)^{\frac{\alpha(\varepsilon-1)}{1-\zeta}}} \tag{43}$$

Lemma 2. *If Assumption 2 holds, then the threshold $\bar{\omega}(\tau, \bar{\tau}, \bar{S})$ is decreasing in τ.*

Proof. Taking the derivative of $\bar{\omega}$ gives

$$\frac{\partial \bar{\omega}}{\partial \tau} \propto \left(U'_C \frac{\partial C}{\partial \tau} + \frac{\partial \Pi_c}{\partial \tau} \right) (\Pi_c - \bar{\Pi}_c - (\Pi_d - \bar{\Pi}_d)) - \left(\frac{\partial \Pi_c}{\partial \tau} - \frac{\partial \Pi_d}{\partial \tau} \right) (U(C) - U(\bar{C}) + \Pi_c - \bar{\Pi}_c)$$

We want to show that the sign of this derivative is negative,

$$\frac{\partial \bar{\omega}}{\partial \tau} < 0 \Leftrightarrow \frac{U'_C \frac{\partial C}{\partial \tau} + \frac{\partial \Pi_c}{\partial \tau}}{\frac{\partial \Pi_c}{\partial \tau} - \frac{\partial \Pi_d}{\partial \tau}} < \bar{\omega}$$

From Appendix C.2, we know that $\frac{\partial \Pi_d}{\partial \tau} < 0$ and $\frac{\partial \Pi_c}{\partial \tau} > 0$. Then, the denominator

$$\frac{\partial \Pi_c}{\partial \tau} - \frac{\partial \Pi_d}{\partial \tau}$$

is positive when the agenda setter is planning to increase taxes, i.e. $\tau > \bar{\tau}$.

Note that the numerator has to satisfy

$$U'_{C_1} \frac{\partial C}{\partial \tau} + \frac{\partial \Pi_c}{\partial \tau} \geq 0$$

Otherwise, the first-order condition of the agenda-setter in free rein case would be

$$U'_C \frac{\partial C}{\partial \tau} + \omega \frac{\partial \Pi_d}{\partial \tau} + (1 - \omega) \frac{\partial \Pi_c}{\partial \tau} < 0 \; \forall \; \omega \in [0, 1]$$

which would collapse to the case $\tau^u_D = \tau^u_R = -1$. □

Note that within the range $\tau \in (-1, 1)$, both eqs. (42) and (43) are well defined. Since acceptable values of ε lie in the set of positive real numbers, there will always exist a $\underline{\varepsilon}$ such that $\forall \; \varepsilon > \underline{\varepsilon}$, eqs. (42) and (43) will be satisfied. □

Lemma 3. *If* $\left| U'_C \frac{\partial^2 C}{\partial \tau^2} \right| > \left| \frac{\partial^2 \Pi_c}{\partial \tau^2} \right| \; \forall \; \tau$, *then* $\lim_{\tau^b_D \to \bar{\tau}} \bar{\omega}(\tau^b_D, \bar{\tau}, \bar{S})$ *is decreasing in* $\bar{\tau}$.

Proof. By L'Hôpital's rule,

$$\lim_{\tau^b_D \to \bar{\tau}} \bar{\omega}(\tau^b_D, \bar{\tau}, \bar{S}) = \lim_{\tau^b_D \to \bar{\tau}} \frac{U'_C \frac{\partial C}{\partial \tau} + \frac{\partial \Pi_c}{\partial \tau}}{\frac{\partial \Pi_c}{\partial \tau} - \frac{\partial \Pi_d}{\partial \tau}} = \left. \frac{U'_C \frac{\partial C}{\partial \tau} + \frac{\partial \Pi_c}{\partial \tau}}{\frac{\partial \Pi_c}{\partial \tau} - \frac{\partial \Pi_d}{\partial \tau}} \right|_{\tau = \bar{\tau}}$$

The derivative of this object will be proportional to

$$\left(U'_C \frac{\partial^2 C}{\partial \tau^2} + \frac{\partial^2 \Pi_c}{\partial \tau^2} \right) \left(\frac{\partial \Pi_c}{\partial \tau} - \frac{\partial \Pi_d}{\partial \tau} \right) - \left(\frac{\partial^2 \Pi_c}{\partial \tau^2} - \frac{\partial^2 \Pi_d}{\partial \tau^2} \right) \left(U'_C \frac{\partial C}{\partial \tau} + \frac{\partial \Pi_c}{\partial \tau} \right) < 0$$

will be negative if the assumption is satisfied. The statement follows from Lemma 1 and because C is concave, and Π_c, Π_d are convex in τ. □

Lemma 4. *If Assumption 1 and 2 hold, then the cross partial derivatives of* $U(C), \Pi_d, \Pi_c$ *have the same sign as the derivatives in Lemma 1.*

Proof. We need to show that the following expressions hold

$$\frac{\partial^2 U(C)}{\partial \bar{S}\partial \tau} < 0 \qquad \frac{\partial^2 \Pi_d}{\partial \bar{S}\partial \tau} \leq 0 \qquad \frac{\partial^2 \Pi_c}{\partial \bar{S}\partial \tau} \geq 0 \tag{44}$$

In order to obtain the cross partial derivatives, it is easier to start with the derivative with respect to $\bar{S}$. The derivative of the utility function is given by

$$\frac{\partial U(C)}{\partial \bar{S}} = U'_C \frac{\partial C}{\partial \bar{S}} \propto U'_C \frac{\partial Y}{\partial \bar{S}} = \gamma U'_C Y > 0$$

and the derivative of profits is given by

$$\frac{\partial \Pi_i}{\partial \bar{S}} = (1-\tau_i)(1-\alpha)E_{it}\frac{\partial p_i}{\partial \bar{S}} = 0 \text{ for } i = \{c, d\}$$

because

$$\frac{\partial p_i}{\partial \bar{S}} \propto \frac{\partial}{\partial \bar{S}}\left(\nu \frac{Y}{E}\right) = 0$$

The cross partial derivatives are then given by

$$\frac{\partial^2 U(C)}{\partial \bar{S}\partial \tau} \propto \frac{\partial}{\partial \tau}\left(\gamma U'_C \frac{\partial Y}{\partial \tau}\right) < 0 \qquad \frac{\partial^2 \Pi_i}{\partial \bar{S}\partial \tau} = 0 \text{ for } i = \{c, d\}$$

□

Theorem 2. *For any given status quo tax level $\bar{\tau}$, and if Assumption 2 holds, the threshold $\underline{\mu}_D(\hat{\tau})$ is weakly increasing in ψ_R.*

Proof. From eq. (26) and for $\psi'_R > \psi_R$, we have that

$$\begin{aligned}
\frac{1}{2} &= \underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) \\
&= \underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi_R\right) \\
&> \underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi'_R\right)
\end{aligned}$$

Since $\underline{\mu}_D$ is defined at the limit $\tau_D^b \to \bar{\tau}$, $\bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \perp \psi_R$. Finally, $\exists\ \underline{\mu}'_D > \underline{\mu}_D$ such that

$$\begin{aligned}
&\underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi'_R\right) < \\
&\underline{\mu}'_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1 - \underline{\mu}'_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid k, \psi'_R\right) = \frac{1}{2}
\end{aligned}$$

□

Corollary 1. *For any given status quo tax level $\bar{\tau}$, and if Assumption 2 holds, the bargaining tax level τ_D^b is weakly decreasing in ψ_R.*

Proof. For $\psi'_R > \psi_R$,

$$\begin{aligned}\frac{1}{2} &= \mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) \\ &= \mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid k, \psi_R\right) \\ &> \mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid k, \psi'_R\right)\end{aligned}$$

Furthermore, we have that $\forall\, \tilde{\omega}$ such that $\tilde{\omega} \geq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right)$

$$\begin{aligned}&\mu Pr\left(\omega_\ell \leq \tilde{\omega} \mid k, \psi_D\right) + (1-\mu) Pr\left(\omega_\ell \leq \tilde{\omega} \mid k, \psi'_R\right) \geq \\ &\mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \mid k, \psi'_R\right)\end{aligned}$$

Then, $\exists\, \bar{\omega}\left(\hat{\tau}(\psi'_R), \bar{\tau}, \bar{S}\right) > \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right)$ such that

$$\mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi'_R), \bar{\tau}, \bar{S}\right) \mid k, \psi_D\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}(\psi'_R), \bar{\tau}, \bar{S}\right) \mid k, \psi'_R\right) = \frac{1}{2}$$

From Lemma 2,

$$\bar{\omega}\left(\hat{\tau}(\psi'_R), \bar{\tau}, \bar{S}\right) > \bar{\omega}\left(\hat{\tau}(\psi_R), \bar{\tau}, \bar{S}\right) \Leftrightarrow \hat{\tau}(\psi'_R) < \hat{\tau}(\psi_R)$$

□

Corollary 2. *The unconstrained tax level τ_R^u (τ_D^u) is weakly increasing (decreasing) in $\bar{S}$.*

Proof. Consider two different pre-period levels of emissions, S^H, S^L with $S^H > S^L$. It then follows from Lemma 1 and the expressions in Lemma 4 that

$$\begin{aligned}&U'_C \frac{\partial C}{\partial \tau}\bigg|_{\bar{S}=S^H} + \omega_{AR} \frac{\partial \Pi_d}{\partial \tau}\bigg|_{\bar{S}=S^H} + (1-\omega_{AR}) \frac{\partial \Pi_c}{\partial \tau}\bigg|_{\bar{S}=S^H} \\ &< U'_C \frac{\partial C}{\partial \tau}\bigg|_{\bar{S}=S^L} + \omega_{AR} \frac{\partial \Pi_d}{\partial \tau}\bigg|_{\bar{S}=S^L} + (1-\omega_{AR}) \frac{\partial \Pi_c}{\partial \tau}\bigg|_{\bar{S}=S^L} \\ &< U'_C \frac{\partial C}{\partial \tau}\bigg|_{\bar{S}=S^L} + \omega_{AD} \frac{\partial \Pi_d}{\partial \tau}\bigg|_{\bar{S}=S^L} + (1-\omega_{AD}) \frac{\partial \Pi_c}{\partial \tau}\bigg|_{\bar{S}=S^L} \\ &< U'_C \frac{\partial C}{\partial \tau}\bigg|_{\bar{S}=S^H} + \omega_{AD} \frac{\partial \Pi_d}{\partial \tau}\bigg|_{\bar{S}=S^H} + (1-\omega_{AD}) \frac{\partial \Pi_c}{\partial \tau}\bigg|_{\bar{S}=S^H}\end{aligned}$$

which implies that $\tau_R^u(S^H) > \tau_R^u(S^L) > \tau_D^u(S^L) > \tau_D^u(S^H)$. □

Corollary 3. *If Assumption 2 holds, then the threshold $\underline{\mu}_D(\hat{\tau})$ weakly decreases with a lower $\bar{S}$.*

Proof. Taking the derivative of $\bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right)$ gives

$$\frac{\partial}{\partial \bar{S}}\left(\bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right)\right) \propto \gamma \frac{\partial}{\partial \tau}\left(\bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right)\right) \tag{45}$$

which, following Lemma 2, is negative if $\left|U'_C \frac{\partial C}{\partial \tau}\right| < \left|\frac{\partial \Pi_c}{\partial \tau}\right|$.

It then follows that for two different pre-period levels of emissions, S^H, S^L with $S^H > S^L$,

$$\begin{aligned}
\frac{1}{2} &= \underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^H\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^H\right) \mid \ell > \mu\right) \\
&< \underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^L\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^L\right) \mid \ell > \mu\right)
\end{aligned}$$

By the same logic as in Theorem 1, $\exists\ \underline{\mu}'_D < \underline{\mu}_D$ such that

$$\begin{aligned}
&\underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^L\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^L\right) \mid \ell > \mu\right) > \\
&\underline{\mu}'_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^L\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}'_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, S^L\right) \mid \ell > \mu\right) = \frac{1}{2}
\end{aligned}$$

□

Corollary 4. *If* $\left|U'_C \frac{\partial^2 C}{\partial \tau^2}\right| > \left|\frac{\partial^2 \Pi_c}{\partial \tau^2}\right|\ \forall\ \tau$, *then the threshold* $\underline{\mu}_D(\bar{\tau})$ *is increasing in* $\bar{\tau}$.

Proof. From eq. (26) and for $\bar{\tau}' > \bar{\tau}$, we have that

$$\begin{aligned}
\frac{1}{2} &= \underline{\mu}_D(\bar{\tau}) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) \lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) \\
&= \underline{\mu}_D(\bar{\tau}) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) \\
&> \underline{\mu}_D(\bar{\tau}) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}', \bar{S}\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}', \bar{S}\right) \mid \ell > \mu\right)
\end{aligned}$$

where the equality follows from

$$\begin{aligned}
\lim_{\tau_D^b \to \bar{\tau}} Pr\left(\omega_\ell \leq \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right)\right) &\equiv \lim_{\tau_D^b \to \bar{\tau}} \int_{-\infty}^{\bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right)} f_\omega(t) dt \\
&= \int_{-\infty}^{\lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right)} f_\omega(t) dt \equiv Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}, \bar{S}\right)\right)
\end{aligned}$$

and the inequality follows from Lemma 3.

By the same logic as in Theorem 1, $\exists\ \underline{\mu}'_D > \underline{\mu}_D$ such that

$$\begin{aligned}
&\underline{\mu}_D(\bar{\tau}) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}', \bar{S}\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}_D(\bar{\tau})) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}', \bar{S}\right) \mid \ell > \mu\right) < \\
&\underline{\mu}'_D(\bar{\tau}) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}', \bar{S}\right) \mid \ell \leq \mu\right) + (1 - \underline{\mu}'_D(\bar{\tau})) Pr\left(\omega_\ell \leq \lim_{\tau_D^b \to \bar{\tau}} \bar{\omega}\left(\tau_D^b, \bar{\tau}', \bar{S}\right) \mid \ell > \mu\right) = \frac{1}{2}
\end{aligned}$$

□

Corollary 5. *If* $\left|U'_C \frac{\partial^2 C}{\partial \tau^2}\right| > \left|\frac{\partial^2 \Pi_c}{\partial \tau^2}\right|\ \forall\ \tau$, *then the bargaining tax level* τ_D^b *is weakly decreasing in* $\bar{\tau}$.

Proof. For $\bar{\tau}' > \bar{\tau}$, and from Lemma 3,

$$\begin{aligned}\frac{1}{2} &= \mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) \\ &< \mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}, \bar{\tau}', \bar{S}\right) \mid \ell \leq \mu\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}, \bar{\tau}', \bar{S}\right) \mid \ell > \mu\right)\end{aligned}$$

Furthermore, we have that $\forall\ \tilde{\omega}$ such that $\tilde{\omega} \geq \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right)$

$$\begin{aligned}&\mu Pr\left(\omega_\ell \leq \tilde{\omega} \mid \ell \leq \mu\right) + (1-\mu) Pr\left(\omega_\ell \leq \tilde{\omega} \mid \ell > \mu\right) \geq \\ &\mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right)\end{aligned}$$

Finally, $\exists\ \bar{\omega}\left(\hat{\tau}', \bar{\tau}', \bar{S}\right) > \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right)$ such that

$$\mu Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}', \bar{\tau}, \bar{S}\right) \mid \ell \leq \mu\right) + (1-\mu) Pr\left(\omega_\ell \leq \bar{\omega}\left(\hat{\tau}', \bar{\tau}, \bar{S}\right) \mid \ell > \mu\right) = \frac{1}{2}$$

From Lemma 3,

$$\bar{\omega}\left(\hat{\tau}', \bar{\tau}', \bar{S}\right) > \bar{\omega}\left(\hat{\tau}, \bar{\tau}, \bar{S}\right) \Leftrightarrow \hat{\tau}' < \hat{\tau}$$

$\square$