Title

The Role of Political Ideology, Lobbying and Electoral Incentives in Decentralized U.S. State Support of the Environment

Authors

Pacca, Lucia
Rausser, Gordon C.
Olper, Alessandro

Publication Date

2017-12-01

Data Availability

The data associated with this publication are available upon request.

The Role of Political Ideology, Lobbying and Electoral Incentives in Decentralized U.S. State Support of the Environment

Lucia Pacca[1], Gordon Rausser[2], and Alessandro Olper[3]

[1] LASER Doctoral School - University of Milan, Italy

[2]University of California, Berkeley

[3]University of Milan, Italy

[3]LICOS – Centre for Institution and Economic Performance, KU Leuven, Belgium

December 1, 2017

Abstract

This article investigates the influence of lobbying, electoral incentives, and the ideology of U.S. state governors on environmental expenditures. A theoretical framework is presented, emphasizing that the potential impact of lobbying and messaging from interest groups on environmental policies depends on the ideology of governors. Implementing a Regression Discontinuity Design (RDD), we identify and estimate the causal effect of state governors on the level of environmental expenditures. We test whether governors tend to deviate from their own political ideology when facing pressures from polluting lobbies and electoral incentives from environmental organizations. The empirical results reveal that, when Democratic governors are in charge, environmental expenditures are, on average, higher. However, in oil-abundant states, Democratic politicians tend to allocate fewer resources to environmental preservation, suggesting that political pressure from lobbying groups matters.

1 Introduction

Given the withdrawal of the U.S. federal government from the Paris Climate Accord and the current governance structure of the federal Environmental Protection Agency, the role

of decentralized state governments' support of the environment has become increasingly important. Indeed, governors have a substantial degree of autonomy in deciding the portion of a state's budget allocated to the conservation of natural resources. Given their central role, governors are subject to political pressures from alternative, self-interested sources. On the one hand, they are subject to lobbying from corporate groups, which are usually interested in lowering the level of environmental regulations. On the other hand, the sensitivity of voters towards environmental issues has been increasing as a consequence of the intensification of the worldwide debate on climate change and the effect of emissions and other types of pollution (see, for example, Herrnstadt and Muehlegger (2014)). Generally, environmental organizations invest in organizing and expanding "green" voters, bringing environmental issues to the attention of politicians and acting largely through public persuasion and demonstrations.

The political economy determinants of environmental policies has been extensively studied by theoretical and empirical literature (see Oates and Portney (2003) for a survey). However, given the complexity of the policy formation process, most of the studies analyze single determinants of environmental regulations rather than considering how different factors interact with each other. Within the literature about the political economy of environmental policies, the paper by List and Sturm (2006) is of particular interest. Their work focuses on the impact of electoral incentives on state governments' environmental policies, showing that governors, when facing reelection, are conditioned by the preferences of their state's voters. More specifically, in "green" states (where citizens have higher sensitivity towards the environment), even a "brown" governor, whose ideology is closer to industrialists, could decide to implement environmentalist policies with the objective of attracting voters. The model by Yu (2005), in addition to analyzing effects of voter preferences, focuses also on the effects of lobbying from interest groups. Yu (2005) shows that governments set the optimal environmental policy in response to political pressures from interest groups - industrialists and environmentalists - as well as preferences of the median voter.

In our model, we integrate the seminal papers by List and Sturm (2006) and Yu (2005) and incorporate new data to examine U.S. states governors' support of the environment. As with earlier work, we draw a sharp distinction between electoral incentives versus lobbying incentives in the policy formation process orchestrated by the ideology of the "center" of the governance structure in each state. According to our framework, industrialist lobbies exert significant political pressure on governors with weaker environmental sensitivity, while the converse holds for environmentalist lobbies. In this paper, we assign ideology according to governors' party affiliation, hypothesizing that Democrats are more environmentally friendly than Republicans. Environmental support, or the results of the

policy formation process, is measured in terms of environmental expenditures.

Our analysis on environmental expenditures across the various U.S. states covers the sample period 1980-2014. In addition to investigating the impact of a governor's party on environmental expenditures, we test whether a governor's behavior is affected by political contributions from polluting industries or environmental groups, both of whom allocate resources to lobbying and/or persuasive messaging to voting citizens. This allows us to examine whether states' governors tend to deviate from their ideology when they are subjected to strong lobbying pressures, electoral incentives, or both. To address the endogeneity issue of governors' parties, we implement a Regression Discontinuity Design. This framework emphasizes elections where the margin of victory between Democratic and Republican candidates was very close to zero. Our modelling structure exploits quasi-random variation in winners and identifies a causal effect.

Based on the data utilized and on our theoretical political economic framework, the empirical results reveal that Democratic governors receive, on average, fewer contributions from polluting sectors than Republican governors. Moreover, we find that, when a state is governed by a Democratic candidate, the portion of the budget spent on the environment tends to be higher with respect to years when the governor is a Republican. However, the effect is highly heterogeneous across states. In particular, the larger the oil reserves of a given state, the more Democratic governors will deviate from their ideology, allocating fewer resources to the preservation of the environment and the enforcement of environmental regulations.

Our analysis integrates the major political economic forces of electoral incentives, self-interested lobbying, and ideology as the potential determinants of individual state environmental policies. Our presentation unfolds with a review of the critical literature related to our analysis in Section 2. In Section 3, we illustrate the theoretical framework of our political economic analysis of environmental policies. Section 4 presents the data employed. Our identification strategy and the empirical results are contained in Sections 5 and 6, respectively. In Section 7, we present robustness tests and an evaluation of our identification strategy. Finally, Section 8 provides some concluding remarks.

2 Relevant Literature

Two seminal papers inform our political economic theoretical framework. The first is the excellent paper by List and Sturm (2006) that examines the role of electoral incentives on U.S. environmental expenditures. The emphasis is on whether politicians, who are concerned about elections, tend to shape policies to attract the most possible votes. More specifically in "green" states, where citizens have high sensitivities to the environment,

will even a "brown" governor, whose ideology is more aligned with industrialists, decide to implement environmental policies with the objective of attracting voters? In essence, a "brown" governor, who may have a personal preference against environmental policies, may well implement a "green" policy when this improves the probability of being elected. List and Sturm (2006) discover evidence confirming their hypothesis, finding that the level of environmental expenditure differs between years in which a governor can be reelected and years in which a governor is term-limited. However, missing from the List and Sturm (2006) formulation are the lobbying efforts of self-interested polluting firms, which are structured to counter the actions of electoral incentives that are potentially influenced by environmental interest groups.

The second seminal paper incorporates the lobbying efforts of both industrialized and environmental interest groups. In this insightful theoretical framework by Yu (2005), not yet empirically tested, the governmental policy process in setting environmental expenditures is influenced by two types of interest groups: polluting industries and environmental organizations. While the first group acts mainly through direct lobbying such as monetary donations to politicians, the latter group is more efficient at carrying out indirect lobbying designed to influence electoral incentives that are linked to the preferences of the median voter. Yu (2005) structures his formulation in three stages: In the first stage, lobbyists act through indirect actions, sending messages to citizens to influence their preferences. Since political candidates take into account the policy preferred by the median voter, whose beliefs are influenced by messages, interest groups indirectly affect the decisions of the elected officials. Direct lobbying takes place in the second stage to directly influence government policy. Finally, in the third stage, the government chooses its preferred policy, taking into account both contributions from lobbying and the preferences of the median voter. Missing from the Yu (2005) formulation is the critical role of ideology.

Our proposed integration of the two seminal papers, List and Sturm (2006) and Yu (2005), in the context of environmental policies is very much aligned with the general conceptual framework advanced for governmental policies by Besley and Coate (2001). In this formulation, even though ideology is not highlighted, the authors argue that the citizen-candidate model of representative democracy must be combined with the menu-auction model of lobbying advanced by Grossman and Helpman (1994). In their formulation, Besley and Coate (2001) argue that interest group political pressure and electoral competition should be considered jointly whenever examining the governmental policy-making process. These two forces, in their formulation, interact to determine the actual policy-making process. Here too, however, the ideology of political leaders is not emphasized.

In the context of environmental policies, our work is also related to a strand of literature studying the political economy determinants of environmental regulations. Much of

this research is summarized in Oates and Portney (2003), who provide a review of both theoretical and empirical approaches to the evaluation of environmental policy-making. This body of research shows that interest groups influence environmental regulations, but also that voters' preferences and social benefits play an important role.

The role of interest groups has been extensively studied in the context of environmental policies. Ackerman and Hassler (1981), for example, highlight the role that "dirty" industries, in particular the coal sector, had in the structure of the Clean Air Act in the United States. More recently, Fredriksson (1997) builds a model showing how interest groups shape pollution taxes. His theoretical framework suggests that the political equilibrium tax rate on pollution differs from the Pigouvian rate. This finding can be partly explained by the fact that a government faces lobbying pressures from both environmentalists and industrialists, who can form lobbying groups that offer incentives to the government in return for a particular policy selection. The work of Aidt (1998) argues that political competition is an important source for the internalization of economic externalities. Indeed, some lobby groups adjust their economic objectives to reflect environmental concerns, which translates into a Pigouvian adjustment of policies set by the government. Both Fredriksson (1997) and Aidt (1998) draw from the literature on the political economy of trade policies, formalized in Hillman (1982), Grossman and Helpman (1994), and Rausser et al. (2011). In these models, a government sets policies maximizing a function that includes both social welfare and political contributions from interest groups.

Our paper is also related to a body of literature on the influence of electoral incentives on environmental policies. These works draw from the median voter theory by Downs (1957), who argues that policy decisions made by elected representatives converge towards the preferences of voters. An application of the median voter model to environmental policies is presented by McAusland (2003), who focuses on the links among inequality, openness to trade, and environmental regulations. Fredriksson and Millimet (2004) study the formation of environmental standards in majoritarian vs. proportional electoral systems. In this analysis, under majoritarian rule, when politicians only need to be elected by 50% of voters, there is less incentive to maximize voters' welfare and, thus, to enact effective environmental policies.

On a range of different state government policies, other literature has been published on how politicians from different parties (Republicans vs. Democrats) implement non-environmental economic policies in the United States. Reed (2006) finds that the legislators' parties influence tax burdens; when states' legislatures are controlled by Democrats, taxes are, on average, higher. Tax policies are also studied by Fredriksson et al. (2013), who use a Regression Discontinuity Design (RDD) to account for the endogeneity associated with a governor's party affiliation. Their work finds that Democratic governors raise

income taxes more than their Republican counterparts, but this difference only holds when governors can be reelected (namely, when they do not face term limits). Lee et al. (2004) use an RDD for congressional elections, showing that party affiliation significantly matters for congressional voting behavior. The same identification strategy is also used by Beland (2015), who evaluates labor policies, finding that Democratic governors tend to implement policies aimed at reducing the income and labor participation gap between black and white workers. Finally, Besley et al. (2010) test a model for political competition, showing that, when competition is higher, all political parties implement growth-promoting policies as opposed to special-interest policies.

3 Theoretical Framework

Our theoretical framework presented below relies on Yu (2005), whose model, based on the Grossman and Helpman (1994) framework, investigates the political economy determinants of electoral incentives and lobbying on environmental policy. In addition to the determinants identified by Yu (2005), we include governors' ideology as another determinant influencing environmental policy. As previously noted, our policy variable of interest is the level of environmental expenditures. Within a state, the governor, located at the center of governance structuring, is the fundamental actor of policy making. His role is crucial for determining environmental expenditures, which are aimed at preserving parks, forests, and other natural resources as well as regulating industries' polluting activities. Environmental expenditures will affect, in turn, the level of emissions:

$$e = Z(g) \tag{1}$$

where the level of emissions is indicated by e, the level of expenditures by g and Z is a decreasing function of g.

As in Yu (2005), the production function $F(L, K)$ is characterized by constant returns to scale (CRS). Emission abatement, expressed as $A(e)$, leads to a decrease in produced units of good x:

$$X = [1 - A(e)]F(L, K) \tag{2}$$

where X is net output of good x with pollution abatement, and the cost of environmental regulations is represented by the term $A(e)$. $A(e)$ is decreasing in emissions, with $A(e)' < 0$. As a consequence, given the definition of emissions in (1), we find by the chain rule that $dA/dg > 0$.

Individuals are characterized by the following utility function:

$$U_i = x_0 + u(x) - D_i(eX) \tag{3}$$

where x_0 is consumption of the numeraire good and $u(x)$ is the utility coming from consumption of good x. $D_i(eX)$ is the negative externality coming from pollution, where eX is the total amount of pollution associated with the production of good X. The disutility of pollution is defined as $D_i(eX) = \mu_i d(eX)$, where μ_i is individual i's subjective belief. An individual with high μ_i will be more sensitive to environmental issues than an individual with low μ_i. The indirect utility function of individual i is obtained as follows:

$$V_i(Y_i, e) = s(e) + Y_i - \mu_i d(e) \tag{4}$$

where Y_i is income and $s(e)$ is consumer surplus of consuming good x, which is increasing in e, since the price of the good is decreasing in e ($dp/de < 0$). If each individual provides one unit of labour, and we normalize the wage rate to one, then the level of emission for individual i will be given by:

$$e_i = \arg\max_e \{V_i = s(e) + 1 - \mu_i d(e)\} \tag{5}$$

In this formulation, society is composed of three different groups: the general public (represented by the median voter), environmentalists and industrialists. We designate the median voter as p, environmentalists as E and industrialists as I. We define the policy preferred by the median voter as e_p, and its subjective belief as μ_p. Environmentalists have a stronger subjective belief $\mu_E > \mu_p$. This group will prefer a lower level of emissions than the median voter ($e_E < e_p$) and, as a consequence, a higher level of environmental expenditures ($g_E > g_p$). The third group of people, industrialists, own the specific factor and will thus have the following optimal level of emissions:

$$V_I = \arg\max_e \left\{ s(e) + 1 + \frac{\pi(p(e), e)}{N_I} - \mu_I d(e) \right\} \tag{6}$$

where π is profit earned by the industrialists N_I. The level of emissions preferred by this third group, e_I, is higher than e_p. Both industrialists and environmentalists are organized as special interest groups, which lobby the governor.

When setting the level of environmental expenditures, the governor is driven by several forces:

$$G_j = b_{Ej} C_{Ej}(e_j) + b_{Ii} C_{Ij}(e_j) - a_j M(e_j - e_p) \tag{7}$$

where G_j is the objective function of governor j; C represents contributions from interest

groups (I, industrialist, and E, environmentalist); and M is a measure of general welfare, adjusted by the political cost of deviating from the median voter's preferred level of pollution e_p. Finally, a_j is the weight given to general welfare by governor j. If j is the governor of a "green" state (borrowing the definition presented by List and Sturm (2006)), where citizens are more concerned about the environment, then e_p will be higher. Accordingly, the political cost to the governor will depend on whether a state is "green" or "brown". Moreover, e_p can also be influenced by indirect lobbying (messaging) conducted by interest groups engaging in persuasion actions directed to voters. As argued by Yu (2005), this second form of lobbying can modify the median voter's belief μ_p, resulting in a shift in her preferred policy. Yu (2005) argues that this second form of resources allocation by interest groups is particularly relevant for the environmentalist interest group, which is generally more effective at persuading the public relative to a governor's lobbying contributions.

Governors mediate between the interests of environmentalist vs. industrialists groups, and the policies preferred by the median voters. Moreover, we include governor's ideology in the objective function in a similar fashion to Rausser et al. (2011). Ideology is captured by the governor specific parameters b_I and b_E, which represent the relative power of the two interest groups in their attempts to influence environmental policy. If governor j is very much ideologically driven towards the environment, then he will be more sensitive to lobbying from the environmentalist interest group and less sensitive to lobbying from the industrialist interest group ($b_{Ej} > b_{Ij}$). Conversely, if the governor is ideologically closer to industrialist group, then b_{Ij} will be higher than b_{Ej}. From (1), we can re-express (7) as follows:

$$G_j = b_{Ej}C_{Ej}(Z(g)) + b_{Ij}C_{Ij}(Z(g)) - a_jM(Z(g) - e_p) \tag{8}$$

Thus, equilibrium level of environmental expenditures will be given by:

$$g^\circ = \arg\max_g \{b_{Ej}C_E(Z(g)) + b_{Ij}C_I(Z(g)) - a_jM(Z(g) - e_p)\} \tag{9}$$

The equilibrium expenditures policy g° will be given by the following first order condition[1]:

$$b_{Ej}W'_E(Z(g^\circ)) + b_{Ij}W'_I(Z(g^\circ)) - a_jM'(Z(g^\circ) - e_p) = 0 \tag{10}$$

where the truthful contribution schedule is imposed, i.e. $C'_\omega = W'_\omega$ for $\omega = E, I$. The derivatives of interest groups' welfare with respect to expenditures represents the economic

[1]The first order condition in (10) comes from simplification of the following derivative, obtained by applying the chain rule:

$$b_{Ej}W'_E(Z(g^\circ)) * Z'(g^\circ) + b_{Ij}W'_I(Z(g^\circ)) * Z'(g^\circ) - a_jM'(Z(g^\circ) - e_p) * Z'(g^\circ) = 0$$

"stake" of each group in environmental policy. The larger the marginal gain in welfare from the policy, the more the interest group contributes at the margin.

Note that if $|b_{Ej}W'_E| > |b_{Ij}W'_I|$, the environmentalist group will have a greater impact on policy than the industrialist group, and $Z(g^\circ) < e_p$, which implies that the preferred level of environmental expenditures will be higher than the one preferred by the median voter ($g^\circ > g_p$). Conversely, if $|b_{Ij}W'_I| > |b_{Ej}W'_E|$, the industrialist group will be more influential, and g° will be lower than g_p.

In contrast to Yu (2005), interest groups' political influence not only depends on their relative "stake" in environmental policy, but also on the magnitude of b_{Ij} and b_{Ej}, which are linked to the ideology of governor j. In other words, the same amount of contributions will affect an environmentalist governor less than a governor with neutral preferences towards the environment. If we hypothesize that governors from different parties have different ideologies, and specifically that Democratic governors are more sensitive to the environment than Republican governors, we should expect b_E to be higher for the former. As a consequence, we should expect that, *ceteris paribus*, Democratic governors will select a higher level of expenditures than Republican governors. Along similar lines, we expect that contributions from industrialist interest groups are more effective at persuading a governor with high b_I, while donations from environmentalists have greater effectiveness at influencing a governor with high b_E. As a consequence, if interest groups maximize the effectiveness of their contributions, we might expect industrialists to give more contributions to Republican governors, and environmentalists to donate more to Democratic governors.

4 Data

4.1 Environmental Expenditures

As a measure of environmental expenditures, we use *per capita* environmental expenditures. This variable, employed by List and Sturm (2006), is taken from the annual Census publication *State Government Finances*, and is available in every year of our sample period (1980-2014). We aggregate in a single variable expenditures for "fish and game," "forests and parks," and "other natural resources." According to the definitions from *State Government Finances*, these expenditures include the portion of a state's budget which is allocated to the development and conservation of natural resources, as well as to the regulation of productive activities affecting the environment[2].

[2]More specifically, the *Census* defines expenditures on fish and game as expenditures for the "conservation, improvement, development, and propagation of fish and game resources; and the regulation and enforcement of fish and game laws and rules." Expenditures on forests are defined as expenditures for the "conservation,

Analyzing the role of governors' parties on environmental expenditures is particularly relevant since state governments have a substantial degree of autonomy with respect to the federal government in deciding degree of environmental support. Within the decisional process of each single state, the governor plays a vital role, given the assigned executive authority. Specifically, the governor is in charge of the state budget and appropriations approval, and, in some states, he also has veto power that can be used for the removal of appropriations to which he objects. Accordingly, it is reasonable to hypothesize that governors' ideology matters for environmental expenditure policies.

4.2 Lobbying Data

Lobbying data at the U.S. state level come from the *National Institute on Money in State Politics*. The Institute collects lobbying contributions targeting candidates running for all U.S. state elections. To the best of our knowledge, this source of data has not yet been used with any empirical political economy literature. The principal advantage of this data is that they include a sectoral classification, allowing us to disentangle lobbying from the major polluting industries. In particular, the *National Institute on Money in State Politics* classifies lobbying data into three types of expenditures: contributions from Political Action Committees (PACs), lobbying spending, and independent spending. We only use contributions from PACs, since they have longer time availability (2000-2014) and they are regulated by laws that do not change across states. Contributions are monetary donations which can be given to three different types of recipients: candidates, party committees, or ballot measures committees. While candidates and party committees can be associated with a specific party (Democratic, Republican, or third party), ballot measure committees cannot be matched to political parties and are excluded from our analysis. Moreover, the affiliation party of each candidate is reported[3].

In order to disentangle contributions from polluting industries, we use rankings of sectors according to the level of toxic releases and waste. Rankings are taken from the *Toxic Release Inventory* (TRI). The contributions of different sectors to total waste production and total release of toxic substances are shown in Figures 5 and 6, reported in Appendix A. According to TRI, which is based on the NAICS classification, a majority (66%) of chemical waste is produced by three sectors: chemical manufacturing, primary metals,

development, management, and protection of forests and forest resources; regulation and inspection of forest products and industries; and provision of assistance to private or local government owners of woodlands." Expenditures on parks are defined as "provision and support of recreational and cultural scientific facilities maintained for the benefit of residents and visitors." Finally, expenditures on other natural resources include the "conservation, promotion, and development of natural resources (soil, water, energy, minerals, etc.) and the regulation of industries which develop, utilize, or affect natural resources."

[3]We exclude from our data candidates affiliated to independent parties, considering only Democratic and Republican politicians.

Table I: Political Contributions by Candidates' Party and Type of Industry, 2010

	Democratic Party (#)	Republican Party (#)
Candidates	5,708	6,094
Governors	59	90
Lieutenant Governors	73	105
House Members	1,155	1,226
Senate Members	4,429	4,684
General Elections	4,541	4,595
Primary Elections	1,166	1,499
	All Candidates	
Mean of Contributions from All Industries	\$ 15,721 (155,643)	\$ 20,037 (670,120)
Mean of Contributions from Polluting Industries	\$ 7,079 (44,534)	\$ 11,712 (142,299)
	Governors Only	
Mean of Contributions from All Industries	\$ 244,586 (919,166)	\$ 398,887 (4,577,592)
Mean of Contributions from Polluting Industries	\$ 76,906 (292,677)	\$ 152,559 (779,962)

Notes: Data are taken from the *National Institute on Money in State Politics*. Standard deviations are reported in parentheses.

and petroleum products manufacturing. As for toxic releases, we can observe that almost two-thirds are originated by three industry sectors: metal mining, chemical manufacturing and electric utilities. Matching the NAICS classification from TRI with sectors defined by the *National Institute on Money in State Politics*, we note that almost all the top polluting sectors are included in the category "Energy and Natural Resources." Only the chemical industry is associated with a separate sector, named "Chemical and Related Manufacturing." We use the two above sectors to define the group "Polluting Industries."

Table I shows sample means for contributions data for a representative year, 2010. The sample includes 11,802 candidates, equally divided between Democrats and Republicans. Most of the candidates seek office as House and Senate members, while only 193 run for gubernatorial elections. Candidates for both general and primary elections are considered, with the former outnumbering the latter. For political contributions' sample means, note that contributions given to Republican candidates are higher than contributions given to Democratic candidates and that this difference is bigger when it comes to "polluting" industries. Moreover, the table shows that governors receive, on average, much higher contributions than all the other candidates.

4.3 Other Variables

Data on governors' political parties, margins of victory and information on term limits are taken from Dave Leip's Atlas of U.S. Elections. Data on U.S. states' income, population, and age characteristics of residents come from the Census Bureau. The variable accounting for the number of green voters comes from List and Sturm (2006) and consists of the number of members of the largest United States environmental organizations (*Sierra Club*, *National Wildlife Federation*, and *Greenpeace*). We construct this variable from 1987 membership data. Finally, data on proven oil reserves is sourced from the EIA (Energy Information Administration). Reserves are measured in barrels and available for all U.S. states. We weight oil reserves by a state's area in order to rule out potential effects due to a state's size.

Table II shows summary statistics for all variables employed in our model. Our sample, covering the period 1980-2014, consists of 48 states and 1617 observations, equally divided between years when Democratic governors are in charge and years when Republican governors hold office. From the sample means, note that *per capita* environmental expenditures are lower under Republican governors ($35.4), than under Democratic governors ($33.29). Moreover, we also report summary statistics for various characteristics (population, income, age of population) for elected Democratic versus Republican governors, as well as for the time-invariant variables (percentage of "green" voters and area-weighted oil reserves).

5 Empirical Strategy

Our empirical strategy is stuctured as follows. We first conduct an exploratory analysis, where we relate candidates' party affiliation to contributions from industrial lobbies. This exploratory analysis is designed to investigate whether a relationship exists between political parties (Democratic vs. Republican) and the pattern of contributions.

Subsequently, we concentrate on investigating the relationship between the ideology of states' governors, lobbying, and environmental expenditures. As emphasized by our theoretical framework, we hypothesize that expenditures depend both on the personal preferences of governors and political pressures from interest groups and voters. Our first purpose is to evaluate whether Democrats implement more environmentally-friendly policies as compared to Republicans, as conventional wisdom holds. Our second purpose is to test whether governors tend to deviate from their own ideology in response to lobbying pressures and/or electoral incentives.

To address the endogeneity of party affiliation, we implement a Regression Discontinuity Design (RDD), which allows a causal effect to be inferred. To address the endogeneity

Table II: Summary Statistics: Sample Means, Main Variables

	Democratic Governors	Republican Governors
Environmental Expenditures (*per capita* 1984 real $)	35.5 (29.75)	33.29 (27.46)
Margin of Victory	16.90 (13.45)	-15.78 (13.23)
Population (Mn)	52.17 (52.74)	61.17 (67.63)
% Over 65 years	11.25 (3.98)	10.98 (4.51)
% Under 18 years	18.45 (1.73)	18.70 (1.77)
% Green Voters (1987)	0.87 (0.37)	0.80 (0.33)
Oil Reserves (1980) (barrels/area)	3,189 (9,588)	5,051 (12,682)
Terms	224	220
Years with Term Limit	210	196
Observations	815	802

Notes: Standard deviations are shown in parentheses. Margin of Victory is computed as the difference between the percentage of votes given to the Democratic candidates and the percentage of votes given to the Republican candidate.

of lobbying, we extend the baseline model by testing for potential heterogeneity effects of governors' parties across states, interacting the party variable with time-invariant variables on the amount of oil reserves (used as a proxy for the power of major polluters' lobbies). We also interact the party dummy variable with characteristics of voters and the existence of a term limit for the governor (used as a proxy for the existence of electoral incentives).

Our analysis of both components is conducted on all 48 lower U.S. states. We exclude Hawaii and Alaska because of their exceptional dependence on federal funds. For our major empirical analysis (the second component), we consider a 35-year period (from 1980 to 2014), which allows comparison of a high number of gubernatorial terms.

5.1 Empirical Specification

To investigate how ideology and contributions affect environmental expenditures across U.S. states, we would test the following specification:

$$Y_{st} = \alpha + \beta_1 D_{st} + \beta_2 D_{st} * C_{st} + \gamma' X_{st} + \delta_s + \phi_t + \epsilon_{st} \tag{11}$$

where the dependent variable, Y, is the amount of *per capita* environmental expenditures in state s and year t. D is a dummy variable equal to 1 if the governor is a Democrat, and 0 if she is a Republican. C is a variable accounting for the amount of electoral contributions received by governor of state s and year t from the most polluting sectors. Finally, X is a vector of controls, δ_s accounts for state fixed effects, ϕ_t for time fixed effects, and ϵ_{st} is the error term.

However, in estimating equation 11, we might encounter two potential different endogeneity issues. First, as already noted in previous literature (see, for example, Beland (2015) and Fredriksson et al. (2013)), political ideology could be endogenous resulting from omitted variable bias. In our specific case, there may be some variables influencing both votes in gubernatorial elections and environmental expenditures. This may be the case, for example, of some preferences of voters, as well as economic shocks affecting specific states. If an economic shock happening in state s at time t affected the spending behavior of politicians, and at the same time influenced voting behavior of citizens, then the ideology of the governor and the level of expenditures would be related due to factors that are not included in equation 11. Second, political contributions might be endogenous because of a reverse causality with environmental expenditures. Indeed, lobbying behavior of polluting firms could be a response to stricter or looser environmental regulations.

To address the above potential sources of endogeneity and the difficulty of isolating appropriate instuments, we implement a Regression Discontinuity Design (RDD). Lee (2008) demonstrates that focusing on close elections provides quasi-random variation in winners, allowing an identification of the causal effect of party affiliation on political outcomes. Our treatment variable is an indicator which is equal to 1 for Democratic governors and 0 for Republican governors. Our "forcing" variable is the Democratic margin of victory, given by the difference between the percentage of votes received by the Democratic candidate and the percentage of votes received by the Republican candidate. The threshold, representing the cutoff between Democratic and Republican victory, corresponds to zero margin of victory. This methodology has been previously implemented by Beland (2015) and Lee et al. (2004) investigating other political economic processes.

As exogenous proxy for lobbying, we use the time-invariant amount of oil reserves across states, that is interacted with the political party indicator variable. This results in a heterogeneous RDD along the line of Becker et al. (2013), allowing us to asses whether the effect of belonging to the Democratic party (as opposed to the Republican party) varies with the presence of lobbying groups from polluting sectors.

Instead of using a non-parametric RDD, which only allows using observations close to the threshold, we use a parametric specification that accounts for all observations, both close and far away from the threshold.

Our RDD is specified as follows:

$$Y_{st} = \alpha + \beta_1 D_{st} + \beta_2 D_{st} * Oil_s + \beta_3 D_{st} * E_s + F(MV_{st}) + F_b(MV_{st}) * D_{st} + \delta_s + \phi_t + \epsilon_{st} \quad (12)$$

where D is a dummy variable equal to one if the governor of state s in year t is a Democrat and zero if he is a Republican. The state-specific variable Oil, that we find interacted with D, accounts for time-invariant oil reserves, estimated at the beginning of the period and normalized by a states' area. This variable is used as exogenous proxy for the power of polluting lobbies in a specific state. MV is the margin of victory of the Governor, and $F(MV)$ is a polynomial function of the margin of victory. For $F(MV)$, we investigate first, second, third, and fourth order polynomials. State fixed effects (δ_s) and time fixed effects (ϕ_t) are included in (12), and the error term is ϵ_{st}.

The use of different polynomial forms for MV is based on Lee and Lemieux (2010). Their analysis recognizes that, since we cannot know *a priori* which specification produces the smallest bias and best approximates the data, the most appropriate solution is to test different parametric forms in order to check for the robustness of results[4].

For the inclusion of the interaction term between party affiliation and oil reserves, we rely on Becker et al. (2013), who first theoretically specified the heterogeneous RDD model. The use of a state's estimated oil reserves (Oil_s) as proxy for industrial lobbies' power has several advantages. First, the heterogeneous RDD requires interaction terms to be continuous about the forcing variable at the threshold. This would not be the case for political contributions, which have a strong relationship with politicians' ideology. Moreover, using political contributions would also be fraught with potential endogeneity. By contrast, oil reserves are exogenous by construction since they depend on geographical characteristics of states.

To account for electoral incentives, we use two different interaction terms, indicated by E in 12. First, we investigate whether the effect of political parties differs between years when governors face a term limit and years when they are, instead, eligible for re-election. The idea of using term limits as a potential determinant is based on existing literature. In particular, List and Sturm (2006), find that states' environmental expenditures differ between years when governors are term limited and years when they can run for re-election. Fredriksson et al. (2013) found that term limits significantly matter in determining states' tax policies. The intuition is that, when a politician can no longer be elected, she may tend to implement less populist policies, since she is less interested in increasing voters' support. Second, we use an interaction variable, taken from List and Sturm (2006),

[4]We do not include additional covariates in equation 12, since, according to the RDD theory by Lee and Lemieux (2010), their inclusion should not affect the results if the model is well specified. This only holds if the covariates are balanced at the threshold, which we show holds in our robustness checks section.

accounting for the number of "green" voters as a percentage of states' population. Green voters are defined as those people who are members of one of the three largest U.S. environmentalist organizations (*Greenpeace*, the *Sierra Club* and the *National Wildlife Federation*). As in List and Sturm (2006), we use a time-invariant variable built from 1987 membership data. While the number of green voters over time could be influenced by lobbying from environmentalist associations, the use of a variable measured in the initial period attenuates this potential endogeneity problem.

6 Results

6.1 Preliminary Evidence from Political Contributions

We first explore the link between the ideology of the members of states' legislatures and the contributions they receive from polluting industry groups. Indeed, the pattern of contributions can give us some indication about the ideology of politicians. We focus on testing whether there is a relationship between the level of oil reserves across states and the amount of contributions from polluting sectors. This tells us whether states' oil reserves are a good exogenous proxy for the contributions from lobbies. Note that the existence of a correlation between politicians' parties and political contributions is already evident in Figures 1 and 2. Here, using contributions data from the *National Institute on Money in State Politics*, we find that environmentalist associations mainly give money to Democratic candidates, while polluting industry groups allocate most of their lobbying resources to Republicans. Moreover, the contributions from environmentalists are much smaller in magnitude than contributions from industries. (In particular, we show in Figure 2 donations from the "Energy and Natural Resources" sector, which includes most of the industries classified as polluting.) This first result seems to confirm what has been theoretically suggested by Yu (2005), namely that polluting industrial groups are more efficient at direct lobbying as compared to indirect actions such as public persuasion, while the reverse holds for environmentalists. In Table III, the results are reported from the estimation of an OLS regression, mainly aimed at testing the relationship between the ideology of state candidates and contributions from polluting industries[5]. To evaluate this relationship, we use a dataset structure combining all possible candidate-industry pairs

[5]The estimated baseline equation is the following:

$$Ln(Contributions_{ip}) = \alpha + \beta_1 Poll_i + \beta_2 D_p + \beta_3 Poll_i * D_p + \delta X'_p + \sigma_s + \epsilon_{cp} \quad (13)$$

where the dependent variable is the amount of money (in logarithm) given by contributors in sector i to politician p. $Poll_i$ is a dummy variable indicating whether sector i is a polluting industry; D_p is an indicator variable equal to 1 when politician p is a Democrat, and to 0 when he is a Republican. X_p is a vector of control variables specific to politician p; finally, σ_s accounts for state fixed effects, and ϵ_{ip} is the error term.

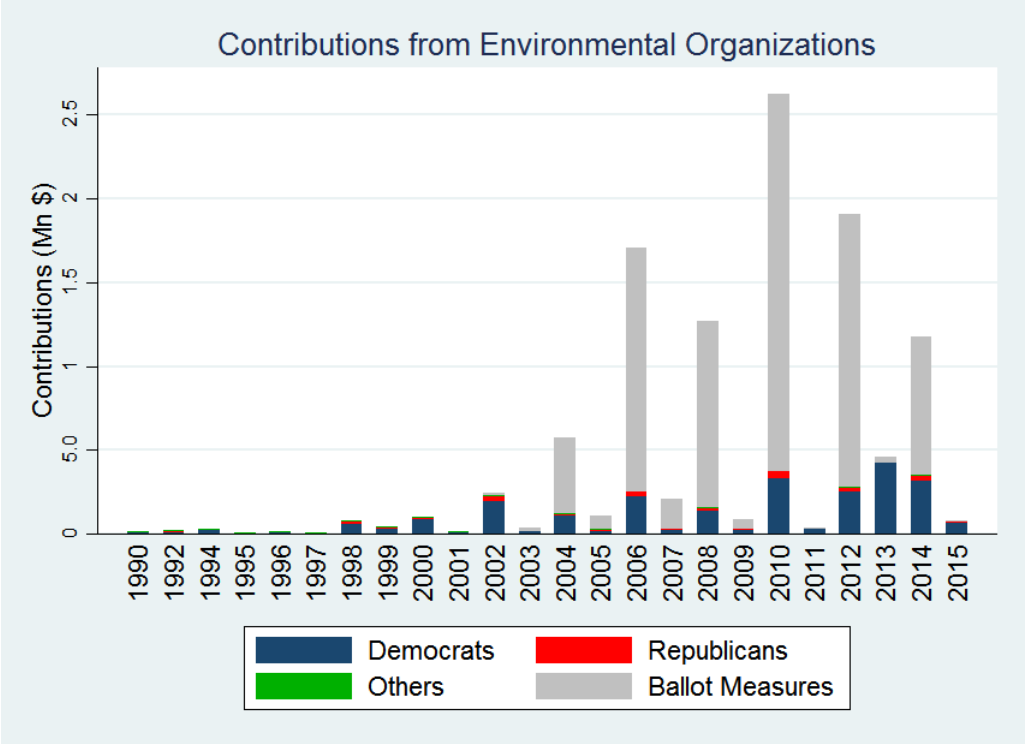


Figure 1: Source: Authors' calculation from *National Institute on Money in States' Politics*

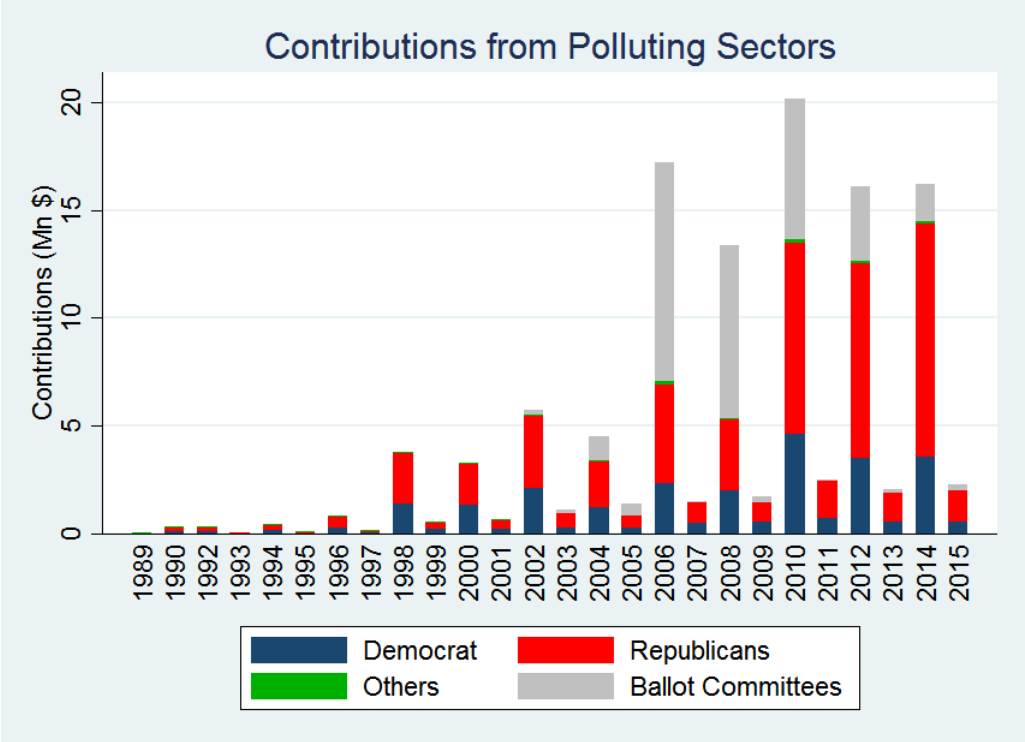


Figure 2: Source: Authors' calculation from *National Institute on Money in States' Politics*

and consider all candidates running for office within state legislatures and all industries classified by the Institute on Money in States Politics. The analysis is performed on elections from the year 2010. Results show that, even if Democratic candidates are associated, on average, with higher contributions as compared to Republican politicians for all the other industries, this relationship is inverted for "polluting" sectors. In other words, these industries give more contributions to Republicans as compared to Democrats, as shown by the coefficient on the interaction term between the "Democrat" dummy variable and the "Polluting Sector" indicator. Furthermore, contributions from polluting sectors significantly increase with a state's estimated oil reserves. This is in line with the distribution of contributions across industries displayed in Figure 3, showing that the oil sector is, among polluter industries, the sector donating the most to politicians. All results are robust to the inclusion of different fixed effects (state, industry and candidate) and control variables (general vs. primary elections; governors vs. members of the House or Senate).

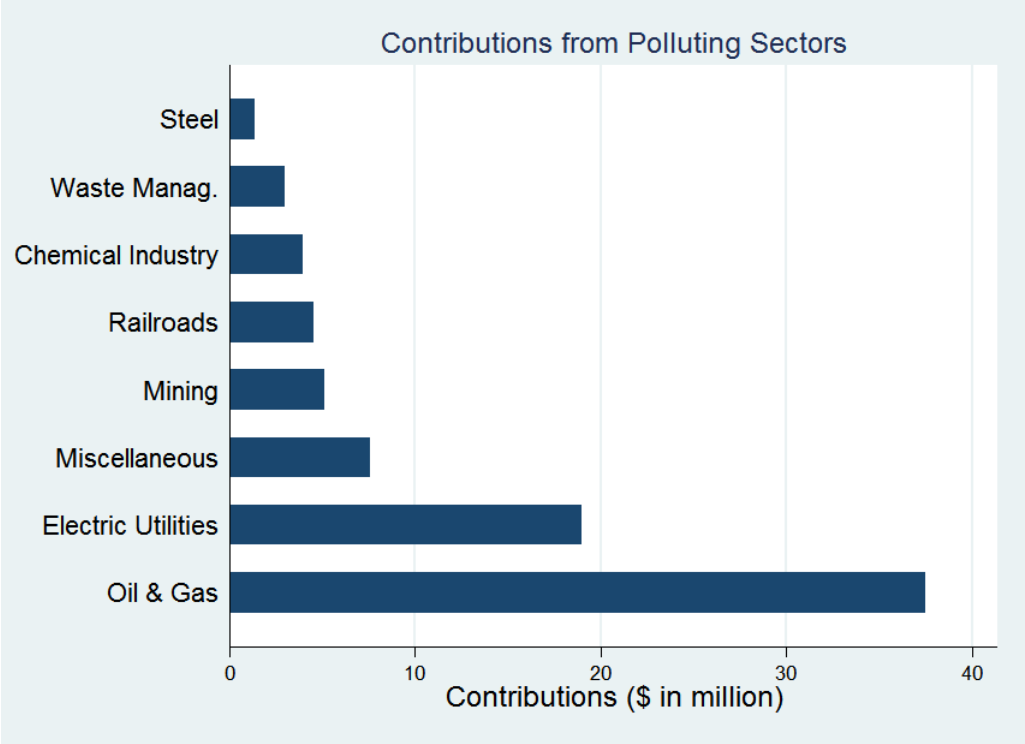


Figure 3: Contributions from Polluting Sectors by Industry

In the Appendix, we show results from evaluating such relationship through a linear probability model instead of an OLS and from using a different time period (2000 instead of 2010). In all cases, the core results are robust.

The empirical results from Table III can be explained by the fact that Democrats might have a more environmentalist ideology as compared to Republicans, attracting more contributions from ideological environmental groups and fewer donations from polluting

Table III: Determinants of Political Contributions, 2010

Dependent Variable ln(Contributions)	(1)	(2)	(3)	(4)
Democrat	0.153*	0.181**	0.152*	-
	(1.87)	(2.12)	(1.86)	-
Polluting Sector	-1.270***	-5.304***	-5.314***	-1.271***
	(-16.26)	(-27.05)	(-27.20)	(-15.87)
Democrat*Polluting Sector	-0.600***	-0.598***	-0.599***	-0.597***
	(-9.68)	(-9.66)	(-9.66)	(-9.58)
Polluting Sector*Oil	0.041***	0.040***	0.041***	0.038***
	(3.96)	(3.70)	(3.96)	(4.23)
Democrat*Polluting Sector*Oil	-0.025**	-0.021*	-0.025**	-0.019***
	(-2.22)	(-1.82)	(-2.22)	(-2.71)
House Member	-3.444***	-3.319***	-3.443***	-
	(-10.91)	(-11.25)	(-10.91)	-
Senate Member	-2.572***	-2.569***	-2.571***	-
	(-7.97)	(-8.01)	(-7.97)	-
General Election	2.319***	2.062***	2.321***	-
	(31.13)	(11.21)	(31.16)	-
Ln(Oil)	-	0.037**	-	-
	-	(2.39)	-	-
Constant	5.309***	7.674***	7.717***	3.854***
	(14.38)	(24.44)	(19.75)	(527.91)
State F.E.	Yes	No	Yes	-
Industry F.E.	No	Yes	Yes	No
Candidate F.E.	No	No	No	Yes
N	237,461	237,461	237,461	237,461

Notes: t statistics are shown in parentheses. Standard errors are clustered at candidate level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
The variable *Oil* is weighted by states' area.

industries. This explanation would be in line with previous findings from the literature as well as with the theoretical framework outlined in Section 3, where the link between ideology and contributions has been shown within the political science literature. In particular, Barber (2016) shows that individual contributors rank ideological concerns as highly important when deciding whom to give money to. Bonica (2014) argues that the pattern of contributions can be used to define the ideology of candidates. Finally, Bertrand et al. (2014) find that ideological affinity between lobbyists and candidates is an important determinant of lobbying patterns at the federal level.

6.2 Principal Results

The main focus of our empirical analysis consists of investigating the causal impact of the party affiliation of the governor on state expenditures on environment and natural resources. Specifically, we evaluate whether and how governors deviate from their ideology in response to lobbying interests and electoral incentives. Figure 4 plots a correlation graph between political contributions received by state governors from polluting sectors and environmental expenditures over the period 2000-2014. The figure shows that there is a negative correlation between these two variables, suggesting that governors receiving higher contributions are associated with lower expenditures on the conservation of the environment and regulation of polluting activities. It is not possible to infer, from a simple correlation, to what extent the relationship is attributable to governors' parties and to what extent it is due to political contributions themselves. Indeed, as we have shown, there is a strong association between contributions and whether a candidate is affiliated with the Democratic or Republican party.

Table IV reports results from the Regression Discontinuity Design model specified in equation 12. We first test an RDD where the only dependent variable of interest is an indicator equal to 1 for Democratic governors and to 0 for Republican governors. We choose a parametric form, using four different polynomials (from first order to fourth order). Given the quasi-random assignment to treatment (where the treatment variable is our dummy D), it is possible to infer causal effects. Yet, we have to keep in mind that RDD identifies a *local* average treatment effect (LATE); namely, that the coefficients that are isolated apply to cases where the margin of victory between the Democratic and the Republican candidate is close to zero. The results reveal that the political party of the governor has an impact on *per capita* environmental expenditures. The relevant coefficient, β_1, from (12) is always positive and statistically significant at conventional levels, irrespective of the estimated polynomial, suggesting that results are stable across alternative specifications. The magnitude of the coefficient ranges between 0.08 and 0.15,

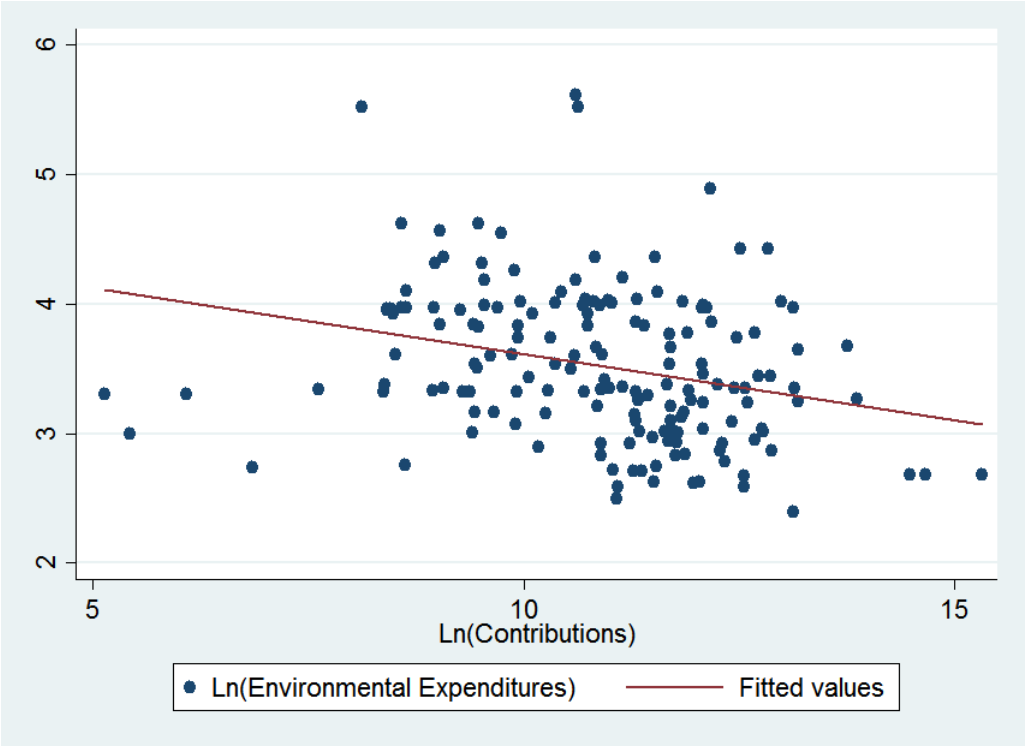


Figure 4: Correlation between contributions and environmental expenditures

suggesting that environmental expenditures increase by about 10% under Democratic governors as compared to Republican ones. These results are confirmed in Figures 7a-7c (see Appendix), graphically showing that there exists a discontinuity in environmental expenditures at the threshold corresponding to margin of victory equal to zero.

Given that party affiliation matters for environmental expenditures, we investigate whether this effect is heterogeneous across states, considering time-invariant variables accounting for polluting industries' presence and electoral incentives. As a first indication of the presence of heterogeneous effects, we split our sample in two according to our interaction variables. Table V shows results from our baseline RDD, dividing the sample into subsamples of observations above and below the median value of states' oil reserves (both unweighted and weighted by a state's area) and percentage of "green" voters. Since the states' oil reserves are positively and significantly correlated with polluting industries' contributions, such a measure can be used as a proxy for industrialists' lobbying activity. The results reported in Table V suggest that the party effect coming from our baseline specification is heterogeneous across states' abundance in oil resources. Indeed, the coefficient on the dummy variable D is larger in magnitude for observations below the median than above the median, and only statistically significant for the former. In other words, in oil-abundant states, the difference in environmental expenditures between Democratic and Republican governors is smaller than for the complement states, which is likely driven

Table IV: RDD, Governor's Political Ideology and Environmental Expenditures

	I Order	II Order	III Order	IV Order
Democrat	0.078***	0.102**	0.144***	0.154**
	(2.84)	(2.52)	(2.73)	(2.33)
Margin	-0.035***	-0.042	-0.017	-0.146
	(-3.48)	(-1.24)	(-0.24)	(-1.01)
Democrat*Margin	0.038***	0.016	-0.141	0.080
	(2.74)	(0.36)	(-1.63)	(0.45)
$Margin^2$	-	-0.001	0.013	-0.103
	-	(-0.19)	(0.37)	(-0.89)
Democrat*$Margin^2$	-	0.00749	0.057	0.094
	-	(0.79)	(1.33)	(0.67)
$Margin^3$	-	-	0.002	-0.032
	-	-	(0.44)	(-1.00)
Democrat*$Margin^3$	-	-	-0.010**	0.046
	-	-	(-2.01)	(1.18)
$Margin^4$	-	-	-	-0.003
	-	-	-	(-1.10)
Democrat*$Margin^4$	-	-	-	0.001
	-	-	-	(0.40)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
N	1,617	1,617	1,617	1,617

Notes: t statistics are shown in parentheses. Standard errors are clustered at term level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
Margin of Victory is computed as the difference between the percentage of votes given to the Democratic candidates and the percentage of votes given to the Republican candidate.

by the impact of polluting lobbies on governors' decisions.

For the "green voters" variable, we find that the party effect is only relevant in magnitude and statistically significant for observations below the median, namely for those states where the number of memberships of environmental organizations is smaller. A possible explanation of this effect is that Republican governors, when their margin of victory is small, tend to deviate from their preferred policy to attract environmentalists' votes.

Finally, in Table V, we evaluate our RDD specification for re-electable governors vs. term-limited governors. The distribution of observations in the two samples is imbalanced, since we have 1,210 observations where the governor is term limited vs. 406 observations where he is re-electable. The magnitude of the party effect does not considerably change between the two samples, even if the coefficient is only statistically significant for governors not facing a term limit.

Overall, the Table V results point to the presence of heterogeneity of treatment effects. Yet splitting the sample according to median values of interaction terms is arbitrary, and we implement a heterogeneous RDD following the methodology proposed by Becker et al. (2013), whose results are presented in Table VI, which incorporates several interaction variables.

All four columns of results are based on fourth-order polynomial function and include state and year fixed-effects. Standard errors are clustered at the electoral term level. Column 1 adds to the baseline RDD specification the interaction term between our treatment variable D and the logarithm of states' oil reserves. The coefficient on the interaction term confirms previous results, namely that the gap between Democratic and Republican candidates shrinks as the amount of oil reserves increases. Based on these results, as oil reserves increase by 10%, the difference in expenditures under Democratic and Republican governors shrinks by 0.05. In column 2, we add the interaction term with a continuous and time-invariant "green voters" variable, not finding any significant heterogeneous effect. However, the positive and statistically significant coefficient on the interacted term between the Democratic governor dummy, the "green voters" variable and the logarithm of *Oil* in Column 3 suggests that the presence of oil-related (polluting) productive activities matters less as the number of environmentalist voters increases. One possible explanation of these results is that, where the presence of polluting lobbies is stronger, environmentalists become more active through persuasion of politicians and the voting public. Finally, from column 4, we do not find any significant difference in *per capita* environmental expenditures between term limited governors and re-electable ones. This is in contrast with previous literature (List and Sturm (2006), Fredriksson et al. (2013)).

Summarizing, our results from heterogeneous RDD suggest that governors take into

Table V: RDD, Sample Splitting According to Variables' Median

	(1) Oil Reserves>Median	(2) Oil Reserves<=Median
Democrat	0.112	0.194**
	(1.02)	(2.24)
N	755	862

	(1) Oil Res./Area>Median	(2) Oil Res./Area<=Median
Democrat	0.121	0.209**
	(1.19)	(2.40)
N	825	792

	(1) Green Voters>Median	(2) Green Voters<=Median
Democrat	0.003	0.209**
	(0.03)	(2.50)
N	795	822

	(1) Non Term Limited	(2) Term Limited
Democrat	0.170**	0.183
	(2.41)	(1.34)
N	1,210	406

Notes: t statistics are shown in parentheses. Standard errors are clustered at term level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
All specifications include IV order polynomial functions of the Democratic Margin of Victory and its interaction with the treatment dummy variable D.

Table VI: RDD with Heterogeneous Effects, Democratic Margin of Victory

Dependent Variable: ln(Environmental Expenditures)	(1)	(2)	(3)	(4)
Democrat	0.164**	0.197**	0.192**	0.185**
	(2.51)	(2.50)	(2.44)	(2.33)
Democrat*Oil	-0.005**	-0.006**	-0.024***	-0.024***
	(-2.07)	(-2.15)	(-4.72)	(-4.64)
Democrat*Green Voters	-	-0.036	0.001	0.009
	-	(-0.67)	(0.02)	(0.16)
Democrat*Green Voters*Oil	-	-	0.022***	0.022***
	-	-	(3.72)	(3.70)
Democrat*Term Limit	-	-	-	0.059
	-	-	-	(0.69)
Democrat*Oil*Term Limit	-	-	-	0.002
	-	-	-	(0.48)
Democrat*Green*Term Limit	-	-	-	-0.035
	-	-	-	(-0.34)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Polynomial Order	IV	IV	IV	IV
N	1,617	1,617	1,617	1,617

Notes: t statistics are shown in parentheses. Standard errors are clustered at term level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
All specifications include IV order polynomial functions of the Democratic Margin of Victory and its interaction with the treatment dummy variable D.

account both interests from industrial groups and, in some cases, preferences of "green" voters when setting environmental policies, confirming the theoretical predictions outlined in Section 3. Relying on our theoretical framework, the fact that Democratic governors spend less on environmental conservation in those states where the presence of polluting industries is stronger could have several explanations. First, industrial groups could have a higher "stake" in securing their self-interest than environmental groups. Second, in states where they are strong, polluting industries could act - aside from political contributions - through public persuasion, shifting preferences of the median voter towards less environmentally friendly policies. Finally, in states where the presence of polluting industries is strong, Democratic candidates could have, on average, a less environmentally friendly ideology, and be thus more responsive to lobbying pressures.

7 Robustness of the RDD

In this section, some tests on the robustness of our model, following Lee and Lemieux (2010) and Becker et al. (2013), are presented. Figures and Tables showing results from our robustness tests are reported in the Appendix of the paper. First, we want to rule out concerns related to potential persistence in our dependent variable. Indeed, as argued by Beland (2015), there could be some state-specific trends influencing the probability that Democratic governors are elected. To address this concern, we run two placebo tests, where the baseline RDD without interaction effects is implemented on the dependent variable from previous and subsequent electoral terms (term_{-1} and term_{+1}). Our results, summarized in Table X, show that the coefficients on D are statistically insignificant at conventional levels when lagged and anticipated environmental expenditures are considered as dependent variables.

Second, as suggested by Lee and Lemieux (2010), we test whether some baseline covariates are continuous at the threshold. Since the RDD is analyzed as a randomized experiment, one of its underlying assumptions is that all the "baseline characteristics" should have the same distribution just above and just below the cutoff. If this condition does not hold, then one could argue that there are some factors determining the treatment variable at the threshold and the validity of the RDD would be questionable. To test this condition, we perform "placebo" tests, replacing the dependent variable of our RDD with baseline covariates. We rely on List and Sturm (2006) to select variables which can be correlated with environmental expenditures, namely characteristics of states' population (percentage of people under 17 years old and over 65 years old), personal income, and population. Results from our "placebo" tests, displayed in Table XI, show that none of the covariates is discontinuous at the threshold, providing further evidence of the reason-

ableness of our RDD strategy.

In addition, we show evidence of the validity of our RDD with heterogeneous effects. As explained by Becker et al. (2013), a fundamental assumption under which the *HLATE* can be estimated is that interaction variables are continuous about the forcing variable (in our case, the Democratic margin of victory) at the threshold. If this assumption is verified, then we are sure to capture genuine variation in interaction variables. In order to test this condition, we plot the average value of our interaction variables by categories of margin of victory. The graphs are constructed in the same way as the ones on environmental expenditures shown in Figures 7a-7c. Figures 8a-8c, reporting first and third order polynomial functions for the logarithm of oil reserves, show that there is no evidence of a discontinuity of this interaction variable at the threshold. Similarly, Figures 8c and 8d show that the discontinuity does not exist for the percentage of green voters.

Overall, this additional evidence confirms that our results are robust to the potential weaknesses of the RDD.

8 Summary and Conclusions

This paper examines the determinants of environmental policies in U.S. states, focusing in particular on the party affiliation of governors and political pressure from interest groups. We present a theoretical framework, where governors choose the optimal level of environmental expenditures taking into account governors' ideology, lobbying from both environmentalist and industrialist interest groups, and preferences of the median voter. The influence of these three factors is tested through an empirical analysis aimed at investigating whether environmental expenditures within U.S. states differ when the governor is a Democrat as compared to Republican. Moreover, we test whether governors deviate from their preferred level of expenditures when they face pressures from interest groups and electoral incentives. We employ a Regression Discontinuity Design (RDD) to account for the potential endogeneity of governors' party affiliation, focusing on close elections, which allows a causal effect to be inferred. Our results reveal that, when states are governed by Democrats, environmental expenditures are, on average, higher than when a Republican governor is elected. However, this effect turns out to be highly heterogeneous. By using states' oil reserves as an exogenous component of industrial lobbying power, we find that, in oil-abundant states, Democratic governors decrease their environmental expenditures. This suggests that the presence of industrial interest groups leads politicians to deviate from their own ideology. Yet, this effect is mitigated when the presence of "green" voters is strong, revealing that electoral incentives matter as well.

Our findings add additional empirical evidence to the political economic literature for

environmental policies. The focus on governors' ideology relies in part on the theoretical framework by List and Sturm (2006), where governors are defined as either "green" or "brown". Moreover, our findings are in line with the theoretical framework by Yu (2005), arguing that a government modifies its preferences towards environmental policy according to political contributions from industrialist groups and preferences of voters, which can be in turn influenced by environmental interest groups. According to our theoretical framework and empirical results, the tendency of Democratic governors to deviate from environmentally friendly policies where the presence of poluting industries is strong may be due to a combination different mechanisms, viz., to the higher "stake" of industrial lobbies in environmental expenditures where the presence of "dirty" industries is pervasive; the persuasion actions of these interest groups towards voters; and to a less environmentally friendly ideology of Democratic governors in these states, resulting in a stronger influence of industrialist lobbies on the actual setting up of environmental expenditures.

9 Appendix A

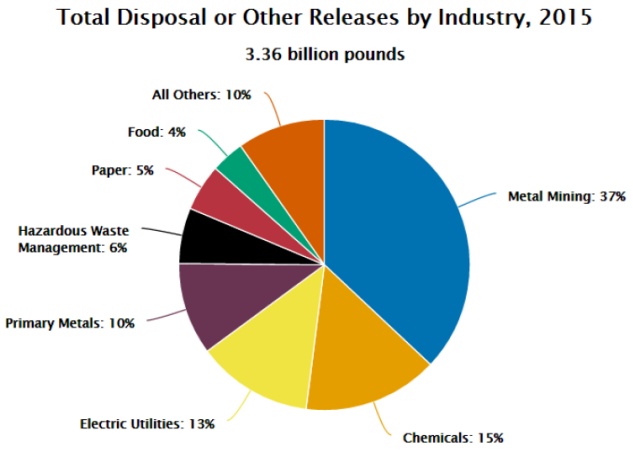


Figure 5: Contributions of NAICS sectors to toxic releases, 2015

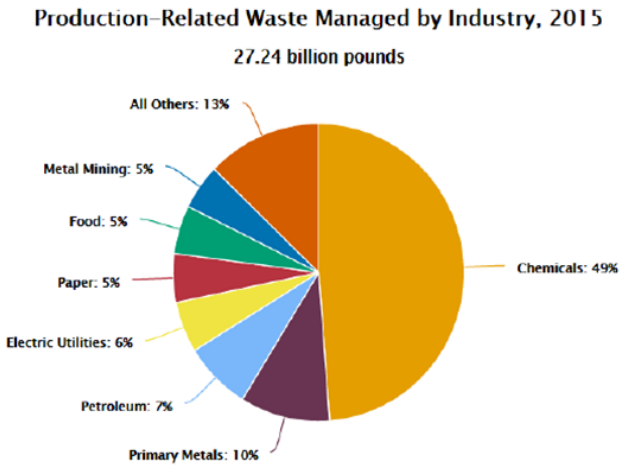


Figure 6: Contributions of NAICS sectors to production-related waste managed, 2015

Table VII: Determinants of Political Contributions, Linear Probability Model, 2010

Dependent Variable Pr(Contributions>0)	(1)	(2)	(3)	(4)
Democrat	0.018**	0.019**	0.018**	-
	(2.08)	(2.08)	(2.06)	-
Polluting Sector	-0.164***	-0.678***	-0.679***	-0.165***
	(-16.79)	(-32.88)	(-33.12)	(-16.38)
Democrat*Polluting Sector	-0.070***	-0.070***	-0.070***	-0.070***
	(-8.17)	(-8.15)	(-8.14)	(-8.00)
Polluting Sector*Oil	0.005***	0.005***	0.005***	0.005***
	(4.19)	(4.02)	(4.19)	(4.36)
Democrat*Polluting Sector*Oil	-0.003*	-0.002	-0.003*	-0.002
	(-1.79)	(-1.60)	(-1.79)	(-1.61)
House Member	-0.252***	-0.235***	-0.252***	-
	(-8.39)	(-8.47)	(-8.39)	-
Senate Member	-0.177***	-0.172***	-0.177***	-
	(-5.72)	(-5.78)	(-5.71)	-
General Election	0.266***	0.241***	0.266***	-
	(32.73)	(11.73)	(32.77)	-
ln(Oil)	-	0.003*	-	-
	-	(1.69)	-	-
Constant	0.304***	0.834***	0.610***	0.511***
	(9.10)	(27.71)	(16.16)	(582.86)
State F.E.	Yes	No	Yes	-
Industry F.E.	No	Yes	Yes	No
Candidate F.E.	No	No	No	Yes
N	237,457	237,457	237,457	237,457

Notes: t statistics are shown in parentheses. Standard errors are clustered at candidate level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
The variable *Oil* is weighted by states' area.

Table VIII: Determinants of Political Contributions, 2000

Dependent Variable ln(Political Contributions)	(1)	(2)	(3)	(4)
Democrat	-0.067	-0.024	-0.067	-
	(-0.87)	(-0.29)	(-0.87)	-
Polluting Sector	-1.026***	-1.268***	-1.270***	-1.026***
	(-11.18)	(-12.47)	(-12.50)	(-10.90)
Democrat*Polluting Sector	-0.487***	-0.487***	-0.487***	-0.486***
	(-7.40)	(-7.41)	(-7.41)	(-7.16)
Polluting Sector*Oil	0.044***	0.043***	0.044***	0.040***
	(3.81)	(3.54)	(3.81)	(3.79)
Democrat*Polluting Sector*Oil	-0.022*	-0.019	-0.022*	-0.015**
	(-1.68)	(-1.41)	(-1.68)	(-1.98)
House Member	-3.779***	-3.554***	-3.778***	-
	(-9.17)	(-7.72)	(-9.17)	-
Senate Member	-2.980***	-2.944***	-2.979***	-
	(-7.23)	(-6.28)	(-7.22)	-
General Election	2.189***	1.906***	2.188***	-
	(28.72)	(9.34)	(28.75)	-
Ln(Oil)	-	0.021	-	-
	-	(1.42)	-	-
Constant	5.518***	7.376***	7.256***	3.798***
	(13.71)	(16.32)	(17.67)	(438.95)
State F.E.	Yes	No	Yes	-
Industry F.E.	No	Yes	Yes	No
Candidate F.E.	No	No	No	Yes
N	196,752	196,752	196,752	196,752

Notes: t statistics are shown in parentheses. Standard errors are clustered at candidate level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
The variable *Oil* is weighted by states' area.

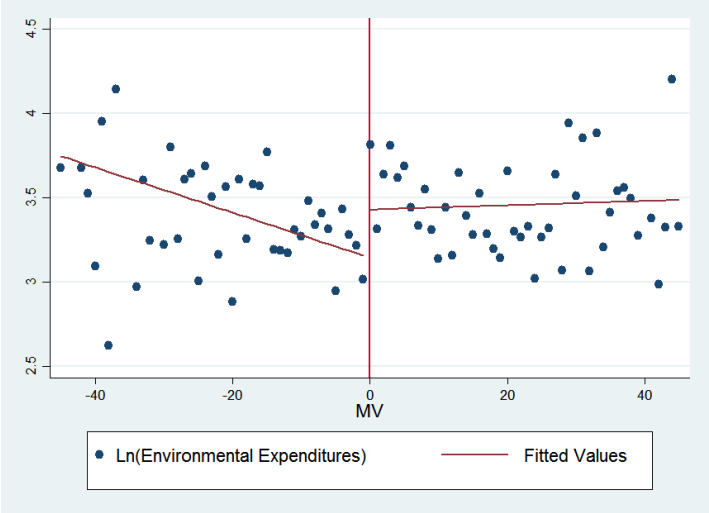
Table IX: Determinants of Political Contributions, 2000: Linear Probability Model

Dependent Variable Pr(Political Contributions>0)	(1)	(2)	(3)	(4)
Democrat	-0.009	-0.006	-0.009	-
	(-1.01)	(-0.61)	(-1.01)	-
Polluting Sector	-0.123***	-0.130***	-0.130***	-0.123***
	(-9.66)	(-10.32)	(-10.35)	(-9.41)
Democrat*Polluting Sector	-0.066***	-0.066***	-0.066***	-0.066***
	(-6.64)	(-6.64)	(-6.64)	(-6.43)
Polluting Sector*Oil	0.006***	0.006***	0.006***	0.006***
	(3.67)	(3.46)	(3.67)	(3.63)
Democrat*Polluting Sector*Oil	-0.003	-0.002	-0.003	-0.002*
	(-1.51)	(-1.31)	(-1.51)	(-1.75)
House Member	-0.265***	-0.249***	-0.265***	-
	(-8.35)	(-6.42)	(-8.35)	-
Senate Member	-0.199***	-0.202***	-0.199***	-
	(-6.25)	(-5.24)	(-6.25)	-
General Election	0.267***	0.237***	0.267***	-
	(27.92)	(10.04)	(27.93)	-
ln(Oil)	-	0.002	-	-
	-	(1.06)	-	-
Constant	0.590***	0.772***	0.796***	0.522***
	(17.01)	(20.65)	(22.26)	(457.17)
State F.E.	Yes	No	Yes	-
Industry F.E.	No	Yes	Yes	No
Candidate F.E.	No	No	No	Yes
N	196,752	196,752	196,752	196,752

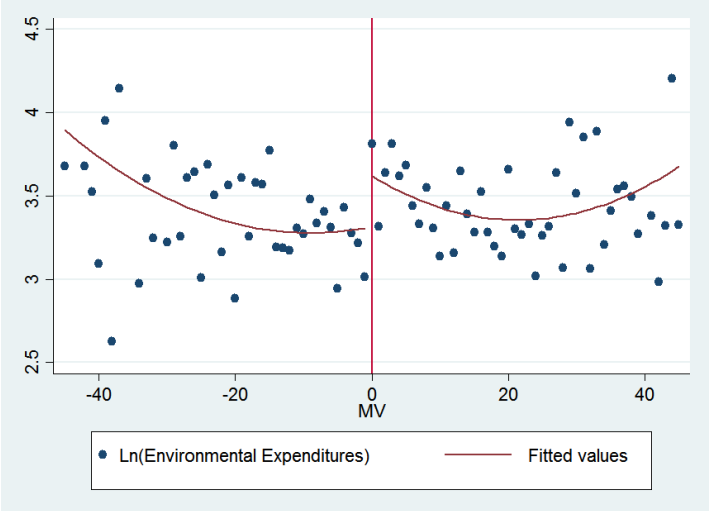
Notes: t statistics are shown in parentheses. Standard errors are clustered at candidate level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
The variable *Oil* is weighted by states' area.

Figure 7: Environmental Expenditures by Democratic Margin of Victory

(a) I order polynomial



(b) II order polynomial



(c) III order polynomial

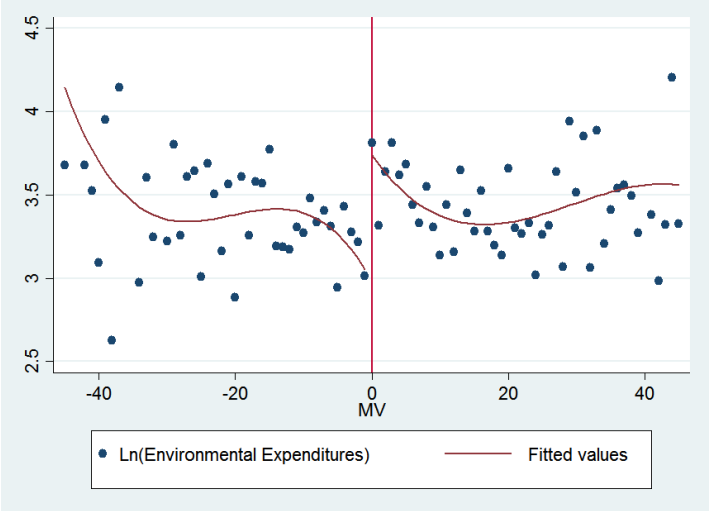


Table X: Placebo Test: RDD with Dependent Variable from Previous and Subsequent Terms

	ln(Env. Exp.)$_{term-1}$		ln(Env. Exp.)$_{term+1}$	
	(1)	(2)	(3)	(4)
Democrat	0.048	0.049	0.024	-0.040
	(0.97)	(0.84)	(0.48)	(-0.65)
Margin	0.076	-0.077	0.135*	0.237*
	(1.10)	(-0.62)	(1.93)	(1.81)
Margin^2	0.043	-0.092	0.071**	0.165
	(1.31)	(-0.93)	(2.13)	(1.46)
Margin^3	0.005	-0.034	0.008*	0.036
	(1.24)	(-1.21)	(1.94)	(1.09)
Democrat*Margin	-0.190**	0.123	-0.209**	-0.172
	(-2.21)	(0.73)	(-2.23)	(-1.08)
Democrat*Margin^2	0.009	0.005	-0.040	-0.246*
	(0.23)	(0.04)	(-0.93)	(-1.73)
Democrat*Margin^3	-0.011**	0.067*	-0.011**	-0.009
	(-2.39)	(1.82)	(-2.16)	(-0.23)
Margin^4	-	-0.004	-	0.003
	-	(-1.42)	-	(0.86)
Democrat*Margin^4	-	0.000	-	-0.005
	-	(0.12)	-	(-1.46)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Polynomial Order	III	IV	III	IV
N	1,427	1,427	1,435	1,435

Notes: t statistics are shown in parentheses. Standard errors are clustered at term level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.
Margin of Victory is computed as the difference between the percentage of votes given to the Democratic candidate and the percentage of votes given to the Republican candidate.

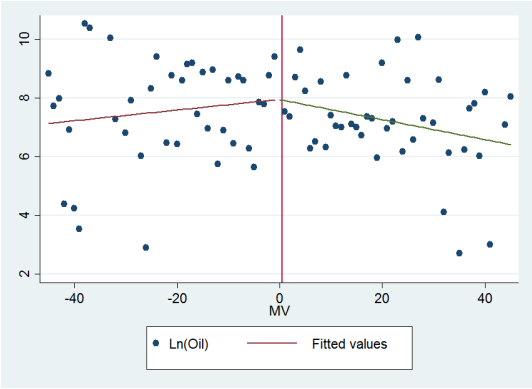
Table XI: Placebo Test: RDD with Baseline Covariates

	% Pop.<17 yrs.	% Pop.>65 yrs.	ln(Population)	Personal Income
Democrat	0.255	-0.082	-0.006	0.360
	(1.18)	(-0.46)	(-0.21)	(0.65)
Margin	-0.465	-0.140	-0.050	-0.238
	(-0.93)	(-0.35)	(-0.86)	(-0.24)
$Margin^2$	-0.417	0.122	-0.043	-0.073
	(-1.04)	(0.38)	(-0.95)	(-0.09)
$Margin^3$	-0.125	0.057	-0.011	0.026
	(-1.10)	(0.62)	(-0.87)	(0.12)
$Margin^4$	-0.012	0.006	-0.001	0.005
	(-1.14)	(0.71)	(-0.79)	(0.26)
Democrat*Margin	0.391	0.367	0.032	1.021
	(0.64)	(0.77)	(0.44)	(0.70)
Democrat*$Margin^2$	0.476	-0.200	0.057	-0.845
	(0.99)	(-0.51)	(0.91)	(-0.74)
Democrat*$Margin^3$	0.107	-0.047	0.007	0.250
	(0.81)	(-0.45)	(0.46)	(0.82)
Democrat*$Margin^4$	0.014	-0.006	0.001	-0.029
	(1.17)	(-0.67)	(0.79)	(-1.11)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Polynomial Order	IV	IV	IV	IV
N	1,617	1,617	1,617	1,617

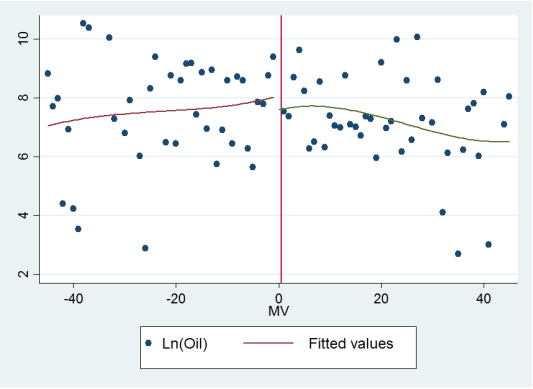
Notes: t statistics are shown in parentheses. Standard errors are clustered at term level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%. Margin of Victory is computed as the difference between the percentage of votes given to the Democratic candidate and the percentage of votes given to the Republican candidate.

Figure 8: Interaction Variables and Democratic Margin of Victory

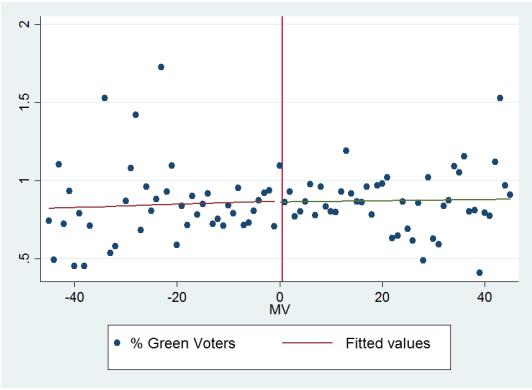
(a) Ln(Oil) and margin of victory, I order polynomial



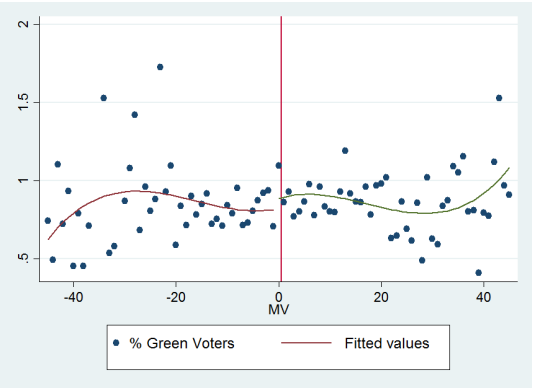
(b) Ln(Oil) and margin of victory, III order polynomial



(c) % of "green" voters and margin of victory, I order polynomial



(d) % of "green" voters and margin of victory, III order polynomial



References

Ackerman, B. and Hassler, W. T. 1981. Clean coal/dirty air: Or how the clean air act became a multibillion-dollar bail-out for high-sulfur coal producers. Yale University Press.

Aidt, T. S. 1998. Political internalization of economic externalities and environmental policy. Journal of Public Economics, 69(1):1–16.

Barber, M. 2016. Donation motivations: Testing theories of access and ideology. Political Research Quarterly, 69(1):148–159.

Becker, S. O., Egger, P. H., and Von Ehrlich, M. 2013. Absorptive capacity and the growth and investment effects of regional transfers: A regression discontinuity design with heterogeneous treatment effects. American Economic Journal: Economic Policy, 5(4):29–77.

Beland, L.-P. 2015. Political Parties and Labor Market Outcomes : Evidence from US States. American Economic Journal: Applied Economics, 7(4):198–220.

Bertrand, M., Bombardini, M., and Trebbi, F. 2014. Is it whom you know or what you know? an empirical assessment of the lobbying process. The American Economic Review, 104(12):3885–3920.

Besley, T. and Coate, S. 2001. Lobbying and welfare in a representative democracy. The Review of Economic Studies, 68(1):67–82.

Besley, T., Persson, T., and Sturm, D. M. 2010. Political Competition, Policy and Growth: Theory and Evidence from the US. Review of Economic Studies, 77:1329–1352.

Bonica, A. 2014. Mapping the ideological marketplace. American Journal of Political Science, 58(2):367–386.

Downs, A. 1957. An Economic Theory of Democracy. Harper and Row, New York.

Fredriksson, P. G. 1997. The political economy of pollution taxes in a small open economy. Journal of Environmental Economics and Management, 33(1):44–58.

Fredriksson, P. G. and Millimet, D. L. 2004. Electoral rules and environmental policy. Economics letters, 84(2):237–244.

Fredriksson, P. G., Wang, L., and Warren, P. L. 2013. Party politics, governors, and economic policy. Southern Economic Journal, 80(1):106–126.

Grossman, G. and Helpman, E. 1994. Protection for sale. The American Economic Review, 84(4):833.

Herrnstadt, E. and Muehlegger, E. 2014. Weather, salience of climate change and congressional voting. Journal of Environmental Economics and Management, 68(3):435–448.

Hillman, A. L. 1982. Declining industries and political-support protectionist motives. The American Economic Review, 72(5):1180–1187.

Lee, D. S. 2008. Randomized experiments from non-random selection in us house elections. Journal of Econometrics, 142(2):675–697.

Lee, D. S. and Lemieux, T. 2010. Regression discontinuity designs in economics. Journal of Economic Literature, 48(2):281–355.

Lee, D. S., Moretti, E., and Butler, M. J. 2004. Do voters affect or elect policies? evidence from the US House. The Quarterly Journal of Economics, 119(3):807–859.

List, J. A. and Sturm, D. M. 2006. How elections matter: Theory and evidence from environmental policy. The Quarterly Journal of Economics, 121(4):1249–1281.

McAusland, C. 2003. Voting for pollution policy: the importance of income inequality and openness to trade. Journal of International Economics, 61(2):425–451.

Oates, W. E. and Portney, P. R. 2003. The political economy of environmental policy. Handbook of Environmental Economics, 1:325–354.

Rausser, G. C., Swinnen, J., and Zusman, P. 2011. Political power and economic policy: Theory, analysis, and empirical applications. Cambridge University Press.

Reed, W. R. 2006. Democrats, Republicans, and taxes: Evidence that political parties matter. Journal of Public Economics, 90(4):725–750.

Yu, Z. 2005. Environmental protection: a theory of direct and indirect competition for political influence. The Review of Economic Studies, 72(1):269–286.