

Essays on the Political Economy of Trade and Environmental Policies

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CHAPTER 1

Introduction

In the last decades, the world trading system has been the object of progressive and profound evolution. On the one hand, globalization and the pervasive influence of the international economy have involved all the world countries, due to a trade liberalization process. According to recent *World Trade Organization* statistics, trade flows have dramatically increased in the last 20-30 years, with the value of world merchandising exports growing by more than 7 percent per year since 1980 (WTO (2013)). An important factor influencing these dynamics has been the reduction in trade barriers, with the WTO and other trade arrangements being successful in reducing tariffs and restrictive non-tariff measures such as quotas. On the other hand, there has been a shift in the focus of trade protection. The decrease in border measures has revealed a new and more diverse category of policy instruments: the numerous regulations enacted by governments to protect their citizens' health and the environment in which they live (Trebilcock and Howse (2005)). These measures are also referred to as "behind-the-border" regulations, since they are imposed internally on the domestic economy (Baldwin et al. (2000), Staiger (2012)). Today, such regulations represent a large proportion of the broader category defined as "Non-Tariff Measures" (NTMs). The proliferation of regulatory measures such

as product labeling, food inspection and environmental policies has expanded the debate on international trade, in which consumers' associations and environmental organizations have assumed a leading role. Indeed, these organized groups fear that trade liberalization will lead to a decrease in standards for both their own countries and international trade partners. Two significant manifestations of these concerns have been the recent negotiations on the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP)¹, in which consumers' associations and environmentalists have played an important role, participating in the debate on standards, health risks and regulations. Vogel (2009) describes the involvement of environmentally concerned individuals in the trade debate as "eco-protectionism", referring to the fact that some groups of citizens prioritize environmental protection over other policy goals, such as trade openness and production expansion. Indeed, an important concern of environmentalists is that, as countries move forward toward liberalization, businesses will be free to relocate where environmental regulations are laxer, and this will progressively create an incentive for all states to decrease environmental protection. This concept has been defined by the literature as the "pollution haven hypothesis", namely the idea that polluting industries will be attracted by those jurisdictions where regulations are less strict. Although empirical evidence on this theory is mixed (see Brunnermeier and Levinson (2004) for a review), there exist some works finding confirmation of a pollution haven effect. One of the most recent papers studying this phenomenon is the work by Broner et al. (2012), who find a causal relationship between environmental regulations and industries' comparative advantage.

Given the above dynamics, it appears to be important to theoretically and empirically investigate whether and how consumers' concerns about safety and the environment shape governments' decisions about trade policy and environmental regulations. Indeed, despite consumers' associations and environmental groups not having the same financial resources as business interest groups, they can represent a powerful lobbying force for the government, since they act by spreading information to the general public and by increasing voters' awareness.

¹The Trans-Pacific Partnership (TPP) is a trade agreement between Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, the United States (until 23 January 2017) and Vietnam. The Transatlantic Trade and Investment Partnership (TTIP) is a proposed trade agreement between the European Union and the United States.

As far as international trade is concerned, the above research question adds to a large theoretical and empirical literature studying the political economy of trade policy (see Rodrik (1995) and Gawande and Krishna (2003) for surveys). The aim of this strand of literature is the study of “endogenous” trade policy determination, which consists of identifying the main political factors leading government to set policies that diverge from welfare maximization. Numerous works studying the political economy of trade policies have focused on the role of interest groups, which are able to exert influence on politicians. In particular, policy makers are predicted to be influenced by domestic industrial groups, lobbying the government to obtain higher protection against competition coming from imports. The influence of lobbying on government’s decisions has been theorized by Hillman (1982), Findlay and Wellisz (1982) and, more recently, by Grossman and Helpman (1994), whose “Protection for Sale” framework occupies center stage in the theoretical and empirical political economy literature². In the latter framework, politically organized sectors influence politicians through campaign contributions. Politicians, in turn, maximize an objective function weighing political contributions from industries and consumers’ welfare.

A similar structure has been applied to environmental policy by a strand of literature focused on the political economy determinants of regulations related to the environment. These models, summarized in Oates and Portney (2003) and Olper (2017), intend the political process as conditioned by two opposing interest groups, the “environmentalist” lobby and the “industrialist” lobby, the latter being represented by polluting industries aiming at lowering regulations which would inhibit their productive activities (see, for example Fredriksson (1997), Aidt (1998) and Yu (2005)). The interesting feature of this class of models for the contexts presented above is that they include the “disutility of pollution”, namely the fact that consumers - or, at least, that fraction of the population who is particularly sensitive towards the environment - can perceive lax environmental expenditures as causing harm.

My dissertation, “Essays in the Political Economy of Trade and Environmental Poli-

²These lobbying models, also called “interest groups models”, find their roots in the collective action theory by Olson (1965) and in the theory of competition among interest groups by Becker (1983). The literature on the political economy of trade policies is also related to the theory of economic regulation by Stigler (1971), who showed that regulations are set to improve the economic status of industry groups. Moreover, the inclusion of voters’ welfare in the government’s objective function draws from the median voter theory by Downs (1957) and from the paper by Peltzman (1987).

cies”, adds to the above literature, bringing about new theoretical and empirical evidence. The first chapter of the thesis, “Protection for Sale with Consumer Externality: An Application to Non-Tariff Measures”, consists of an extension of the Grossman and Helpman (1994) “Protection for Sale” model, which is augmented by the inclusion of consumer externality and applied to NTMs such as standards and technical barriers to trade. The second chapter, “The Role of Political Ideology, Lobbying and Electoral Incentives in Decentralized U.S. State Support of the Environment”, focuses instead on environmental policies and empirically investigates their political economy determinants, studying in particular the political ideology of policy makers, lobbying activities, and - to a minor extent - electoral incentives. Both works focus on the United States: while the first chapter studies non-tariff measures imposed by the US on all the world trade partners, and considers trade policy formation at the federal government level, the second chapter investigates state-level environmental expenditures. The United States represent an ideal case study for this research. Indeed, thanks to a mandatory lobby register, U.S. lobbying data are available at both federal and state level, listing the amount of contributions given to candidates and other lobbying expenditures incurred by interest groups³.

The first chapter of my dissertation brings to existing literature two main elements of novelty. First, the application of the “Protection for Sale” framework to recent (2014) non-tariff measures is new, since the Grossman and Helpman (1994) framework had only been tested on border non-tariff barriers⁴. The specific nature of NTMs, which are set with the purpose of safeguarding consumers’ well being as opposed to the stated aim of protecting the internal markets, puts into question the original predictions by Grossman and Helpman (1994), making it interesting to apply the model to recent data. Secondly, the presented theoretical framework includes the externality of consumers in the main model equation, allowing investigation into whether industries where attention towards health and environmental issues is greater are more protected. Results from the empirical application of the model provide evidence of higher NTM coverage in organized sectors, showing that lobbies are still able to influence the government and obtain higher protection.

³Transparency rules regarding lobbying activities were defined by the 1995 *Lobbying Disclosure Act*

⁴Previous empirical papers, such as Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000) and Bombardini (2008), used a database on non-tariff barriers from 1983, including mainly border measures such as quotas, anti-dumping and countervailing duties.

Moreover, sectors where consumers are more sensitive towards safety and the environment turn out to be covered by a higher number of NTMs, confirming that consumers' safeguard is a relevant political economy motivation for trade protection.

The second chapter of my thesis adds new evidence to the theoretical and empirical political economy literature applied to environmental policies. A theoretical framework is outlined, where U.S. states' environmental expenditures are influenced by governors' ideology, lobbying and the median voter's preferences. Both ideology and lobbying have rarely been considered by the political economy literature about environmental policies, representing elements of novelty in the framework. The empirical analysis focuses on governors' parties as a proxy for ideology, and investigates whether states' legislatures invest a higher proportion of the budget on the environment when a Democratic governor is in charge as opposed to a Republican one. Moreover, the study tests whether governors who are subject to higher lobbying pressures deviate from their own ideology to accommodate interest groups. To conduct this analysis, a 35-year (1980-2014) database is used including yearly environmental expenditures by state, as well as states' and governors' characteristics. The impact of governors' party affiliation on environmental policies is connected to the dynamics, explained above, of increasing involvement of voters in the policy debate. Indeed, as the general public develops more awareness towards environmental problems, policy makers are also asked to provide clearer responses and take stronger measures on these issues. As Dunlap (2001) points out, these dynamics have led, at least in the United States, to a progressive parties' polarization on environmental issues since 1970. This hypothesis is confirmed by the main results of the study, showing that, under Democratic governors, environmental expenditures are on average higher than under Republican governors. Although evidence that parties matter for policy outcomes has been provided by several works within the political economy literature (see, for example, Reed (2006) and Beland (2015)), the present study is the first showing that such effect exists on environmental policies. Moreover, it turns out that Democrats deviate from their political ideology when they are subject to lobbying pressures from polluting industries, as well as from environmentalist groups. This finding is in line with the special interest groups models focused on environmental policies, such as the works by Fredriksson (1997) and Aidt (1998) and the lobbying model by Yu (2005). Given such results, it is advisable to con-

sider lobbying and electoral incentives together when investigating the political economy determinants of environmental regulations.

Overall, my dissertation expands current political economy literature on regulatory measures, emphasizing the role of voters and its interaction with industries' interests within the policy formation process. Given the complexity of the issue, the plurality of actors involved and the multiplicity of policy instruments used by governments in domestic and international policies, such a work could stimulate new questions for future research and lead to further investigation.

CHAPTER 2

Protection for Sale with Consumer Externality: Evidence from Non-Tariff Measures¹

¹This Chapter is based on the paper “Protection for Sale with Consumer Externality: Evidence from Non-Tariff Measures” by Lucia Pacca (L.A.S.E.R. Doctoral School, Universities of Milan, Pavia and Brescia).

Abstract

In this paper, we investigate the effect of lobbying and consumer externality on the pattern of protection through non-tariff barriers to trade (NTMs) across United States manufacturing sectors. We first extend the Grossman and Helpman (1994) model, “Protection for Sale”, incorporating consumer externality. Externality is intended, in our framework, as the concern of a government for consumers’ safety and the environment, which should result in increased protection through standards and technical measures. In our model, externality adds to interest groups’ lobbying activity in determining the increase in non-tariff measures. We test the predictions of our model using a novel database on 2014 stock of NTMs. We measure political organization of industries through lobbying expenditures data, and we identify sectors where government cares the most about consumers’ well-being using media sources. Our results suggest that both pressure from interest groups and concerns about safety and environmental issues lead to an increase in the pattern of protection across US manufacturing sectors.

2.1 Introduction

Over the last two decades, besides a general trend of trade protection reduction, the world has witnessed a change in the pattern of protection of countries. Indeed, tariffs have progressively ceded their place to non-tariff measures (NTMs). This category of policies consists of a diverse and complex array of measures: besides direct restrictions to import, such as quotas or anti-dumping measures, it includes so-called technical measures (Sanitary and Phytosanitary Standards, SPS; and Technical Barriers to trade, TBT). The latter category of measures have seen a particularly consistent increase in the last years. Technical NTMs, by comparison with those manifestly employed as instruments of commercial policy (the so called non-tariff barriers to trade, or NTBs), are also put in place for consumers' safeguard purposes, being often related to safety of products and environmental protection (UNCTAD (2012)). Within international trade literature, it has often been argued that NTMs are set as a substitute or complement to tariffs with a similar protectionist purpose (see, for example, Hoekman and Nicita (2011) and Beverelli et al. (2014)). However, in recent work, some authors have pointed out that technical measures substantially differ from tariffs and NTBs, given their important function of mitigating negative externalities and protecting consumers' safety and the environment (see Van Tongeren et al. (2009) and Beghin et al. (2015)). In this respect, as shown by Beghin et al. (2015), NTMs are not always protectionist with regards to trade, but in some cases they can even facilitate it, and enhance welfare. This happens when these measures succeed in addressing negative externalities mitigation (or positive externalities accentuation) purposes. If this is the case, consumers may perceive the quality of imports protected by standards as higher, increasing their purchases or switching their preferences towards these products.

The complexity and the different purposes of NTMs result from a heterogeneous set of political economy determinants. The Grossman and Helpman (1994) model ("Protection for Sale"), which has been applied and extended in several directions, shows how government shapes tariffs (and non-tariff barriers) as a response to lobbies from the industry on one side, and attention towards consumers' welfare on the other. According to this framework, interest groups from manufacturing sectors lobby the government asking for

higher protection, while consumers are interested in loosening protection to have access to lower priced goods. Being originally thought for tariffs and non-tariff barriers such as quotas, the Grossman and Helpman (1994) model (GH hereafter) does not take consumer externality into account. Some recent literature has taken steps to fill this gap. Swinnen and Vandemoortele (2008), focusing on nutrition and health standards on food products, develop a general political economy model that accounts for the “externality effect” of standards. Yu (2005), who adapts the Grossman and Helpman (1994) model to the case of environmental policy, integrates the disutility of pollution into the consumer’s utility function, which is then taken into consideration by the government when having to set the policy. These two models share a common element, namely the importance of risks for consumers as a fundamental political economy determinant of standards and environmental regulations. Consumers’ preferences, which may be influenced by media or by specific groups’ action (e.g. consumers’ associations), can be an important driver of the policies decided by a government.

Despite the two models cited above representing a theoretical alternative to the traditional GH, no paper to date, to the best of our knowledge, has tested the impact of consumer preferences (consumer externality) on the level of standards set by the government. Our work attempts to fill the gap, by extending the traditional Grossman and Helpman (1994) model to the inclusion of an externality component and by empirically testing such extension. According to our framework, the externality is considered by the government when consumers are sensitive to the impact that some products can have on their health, safety or the environment. The fact that some products are associated with higher health risks or potential environmental damages than others is considered as a determinant, together with lobbying pressures, of the pattern of protection across industries. We test such theoretical framework on the United States, considering all manufacturing industries at a detailed level of disaggregation (NAICS 6-digit). We use the most recent available data on NTMs (2014 stock) and we define political organization based on lobbying expenditures data from the *Federal Election Commission*. Applying the Grossman and Helpman (1994) model on recent NTMs data is a novelty *per se*. Indeed, most of the empirical applications based on the GH framework (e.g. Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000), Gawande et al. (2006)) were carried out on non-tariff barriers data from

1983. However, the pattern of protection has considerably changed since then, making it interesting to study whether the “Protection for Sale” framework is still valid. Moreover, we build a more accurate measure of sectoral lobbying activity than the ones used in previous works, using data on trade-related lobbying expenditures at a detailed level of disaggregation. As a proxy for consumers’ externality, we construct a variable taken from *Lexis Nexis*, a comprehensive database including articles from all the main newspapers, journals and reviews from around the world. By classifying US news by sector and selecting the articles associated with topics such as “safety” and “environmental protection”, we construct our externality variable. In our view, the attention of media towards safety, health or environmental issues can be a proxy for consumer externality across products and sectors. This is in line with some recent literature on the political economy of media (see Prat and Strömberg (2011)) arguing that media attention across issues creates a bias in policy responses by influencing the government and raising attention.

The first finding coming out of our results is that the main prediction from the Grossman and Helpman (1994) model is still valid today, when recent lobbying data and non-tariff measures are taken into account. Indeed, the weighted number of NTMs turns out to be significantly higher in politically organized sectors (namely, when industries spend a considerable amount of money for lobbying activities). In addition to this, we find that consumer externality is an important determinant of the pattern of NTMs across sectors: when consumers are more sensitive towards safety and potential risks coming from products, the NTM prevalence ratio is, *ceteris paribus*, significantly higher. These results suggest that NTMs are not only set by the government as a protectionist policy, but also as a response to consumers’ concerns.

The remainder of the paper is organized as follows. Paragraph 2.2 reviews the literature that is most connected to our work. Paragraph 2.3 presents our theoretical framework, which consists of a modified version of the model by Grossman and Helpman (1994). Paragraphs 2.4 and 2.5 describe the empirical strategy and the econometric methodology used in our empirical application, which is aimed at testing our theoretical model. Paragraph 2.7 presents and discusses the main results coming out of our empirical application, and paragraph 2.8 draws some final remarks.

2.2 Discussion of Related Literature

This paper relies on several strands of literature investigating the political economy determinants of trade protection and studying the trade and welfare effects of NTMs.

Our theoretical framework is based on the model by Grossman and Helpman (1994), which they call “Protection for sale”. In the GH framework, the government sets trade policies (import and export taxes and subsidies) maximizing a weighted sum of social welfare and contributions received by interest groups (lobbies), which represent domestic industries’ interests. Lobbies give contributions to the government with the aim of raising import taxes, since they want to protect the sectors they represent from import competition. According to the model, when an import-competing industry is politically organized, it is able to “buy” protection and push the government to raise tariffs. By contrast, when an industry is unorganized, the government will only take consumers’ welfare into account, penalizing the internal sector with import subsidies. The Grossman and Helpman (1994) model identifies three main determinants of protection: the level of import competition; import demand elasticities - according to the Ramsey rule, goods with low import demand elasticity are taxed more, since taxing high elasticity goods would bring about a bigger welfare loss - and whether or not an industry is politically organized.

The GH model was first applied by Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000), who brought the main predictions by Grossman and Helpman (1994) to an empirically testable equation. Their works use US political contributions data from the 1980s, testing whether politically organized industries are affected by a different pattern of protection with respect to unorganized sectors. Both works find support for the predictions outlined by the theoretical model: everything else equal, the level of non-tariff barriers (NTBs) turns out to be higher in politically organized industries by contrast to unorganized ones.

The popularity of the Grossman and Helpman (1994) framework has remained unchanged over time. In more recent years, the model has been modified in several directions. The aim of these extensions has been to attenuate some sources of bias in the original GH model, as well as to account for some additional determinants of protection. Facchini et al. (2006), for example, modified the model taking into account that NTBs, unlike tariffs,

allow the government to only partially capture rents from protection. For this reason, according to the authors, the coefficients from traditional GH are biased when applying the model to non-tariff barriers. In response to this issue, Facchini et al. (2006) augment the original framework in order to include the degree of rent capturing, which modifies the main model's parameters.

An important work for our framework is the one by Ederington and Minier (2008), who argue that the traditional applications of Grossman and Helpman (1994) may suffer from some bias. The authors identify, among the sources of the bias, the fact that a correct specification of the model should include some extraneous political factors. According to Ederington and Minier (2008), these factors should be included in the objective function of the government, and would allow protection to increase in some sectors for reasons other than lobbying from interest groups. Our framework partially draws from Ederington and Minier (2008), identifying the consumer externality as an additional variable affecting the pattern of protection. Similarly to Ederington and Minier (2008), we argue that, even in politically unorganized industries, protection could increase when government acts to safeguard consumers.

In addition to the works mentioned above, other extensions of the Grossman and Helpman (1994) model have been theoretically built and tested. Gawande et al. (2006) consider, in addition to internal lobbies, also foreign interest groups, which may put pressure on the government to decrease the level of protection. Belloc and Guerrieri (2008) adapt the GH framework to European trade policies, taking into account lobbying at both national and European level. Finally, Bombardini and Trebbi (2012) argue that firm size matters in determining the pattern of protection; they note that in sectors where firms are larger, lobbies are formed more efficiently, and protection will be easier to obtain.

Regarding consumer externality, our paper is not the first work incorporating such factor into a political economy model. The model by Aidt (1998) shows that environmental policy is a product of lobbying activities, and that political competition is a source of internalization of economic externalities. The author argues that some lobby groups (e.g. trade unions and consumers associations) modify their demand to take account of environmental concerns. Similarly, the work by Yu (2005) models the political economy of environmental policies including consumers' "disutility of pollution" (negative externality)

in a GH-like framework. The environmental damage depends on the beliefs of individuals, and can be influenced by environmental groups through persuasion activity. This indirect lobbying activity of environmentalists is in contrast with direct lobbying from industrial groups, which ask for less strict environmental regulations instead. Both forces are taken into account by the government when it sets the optimal environmental policy. Although the frameworks by Yu (2005) and Aidt (1998) are mainly thought for emission standards, our model is partly related to theirs, since we also take account of potential damages to consumers' safety or the environment coming from imported products not compliant with adequate standards. Our paper stresses that this element is considered by the government when setting the level of protection, representing, together with lobbying activity from the industry, an important determinant of trade protection.

Consumer externality is also included in the model by Swinnen and Vandemoortele (2008), who focus on the political economy determinants of health and nutrition standards. Their framework includes externality in the government objective function as a cost (negative externality) or benefit (positive externality) coming from consumption of goods. Moreover, their model allows for the fact that not only producers, but also consumers can be politically organized and lobby the government giving contributions.

Although our paper does not investigate the effect of NTMs on consumers' economic well being, but only their political economy determinants, the inclusion of externalities is in common with some recent works studying the trade and welfare effects of non-tariff measures (see, for example, Marette and Beghin (2010); Disdier and Marette (2010); Beghin et al. (2015)). Overall, these works argue that NTMs substantially differ from tariffs, since they may lead to an increase in consumer welfare by mitigating negative externalities. Disdier and Marette (2010) measure the impact of non-tariff measures through a welfare approach, identifying potential damages coming from imported products as one of the elements taken into account by the regulator. Their paper shows that stricter standards, despite being trade restricting, can lead to an increase in both domestic and international welfare through a reduction in damages. Marette and Beghin (2010) concentrate on the trade effect of standards, showing that standards are not always protectionist, but may be anti-protectionist sometimes. This happens when foreign producers are more efficient than domestic ones in meeting the standard. Finally, the paper by Beghin et al.

(2015) measures the *ad valorem* equivalent of NTMs (AVEs) by taking into account that non-tariff measures can, in some cases, mitigate negative externalities and enhance foreign products' safety and quality, being thus trade facilitating. Beghin et al. (2015), through their results, show that about 39% of the product lines affected by NTMs exhibit negative AVEs, having thus trade-facilitating and welfare-enhancing effects.

Finally, our decision to approximate the attention towards consumer externality with a variable measuring media coverage is in line with some recent literature on the political economy of mass media. This literature, summarized by Prat and Strömberg (2011) in a survey, argue that news can influence government policy. The literature review cites some case studies confirming the above hypothesis. Eisensee and Strömberg (2007) studied the US government response to natural disasters, showing that relief was higher when the events were newsworthy. Similarly, Snyder and Strömberg (2010) show that congressmen who are more covered by local press tend to work more for their constituency: they are more likely to stand witness before congressional hearings and to vote against the party line. Relying on these findings, we proxy attention towards consumer externalities with a variable of journal coverage on safety and environmental issues. We hypothesize that policies set by governments may be more responsive in sectors that are covered by the news.

2.3 Theoretical Framework

Our theoretical framework relies on Grossman and Helpman (1994). Their model has the structure of a common agency framework, that is, a situation where several principals (the interest groups) induce an agent (the government) to take an action that may be costly for him. We make a simple extension of GH, including consumer externality in the government objective function. In our model, externality is intended as potential damage coming from importing risky products.

In our framework, a small economy is populated by individuals with identical preferences, whose utility function is represented by:

$$U = c_0 + \sum_{i=1}^n u_i(c_i) \quad (2.1)$$

where c_0 is consumption of the numeraire good, 0, and c_i is consumption of goods $i = 1, 2, \dots, n$.

Good 0 is assumed to be produced by labor alone, and freely traded internationally. As in Grossman and Helpman (1994), goods $i = 1, 2, \dots, n$ are produced using labor and a sector-specific input, and traded internationally. In this framework, the government is only allowed to implement policies (tariffs, subsidies, non-tariff measures) that drive a wedge between domestic and world prices. A tariff or a protectionist NTM leads to higher domestic price with respect to world price: $(p_i - p_i^* > 0)$.

The government maximizes the following linear objective function:

$$G = \sum_{i \in L} C_i(p) + aW(p) - b \sum_{i=1}^n Ext_i(p) \quad (2.2)$$

where $p = (p_1, p_2, \dots, p_n)$ is a vector of prices of the nonnumeraire good. C_i represents contributions received from sector i , and L represents the subset of sectors where the specific-factor owners are organized in a lobby. W represents aggregate welfare, and a is a constant accounting for the weight that government places on welfare as compared to contributions. The novelty of our framework, with respect to GH, is the term Ext_i , which represents the potential damage coming from the consumption of imported product from industry i . The parameter b represents the weight that the government puts on externality as compared to political organization. As in Disdier and Marette (2010), we associate the externality to foreign products only, and we model it as the risk for consumers to purchase a defective product from abroad and to be thus affected by damage. Ext_i is defined as follows:

$$Ext_i(p) = m_i(p)\omega_i * \gamma_i \quad (2.3)$$

where m_i is consumption of good i imported from abroad, given by $m_i = Nd_i - y_i$, where y_i is domestic output of good i , d_i is the individual demand, and N is the number of consumers. ω_i is the per-unit damage brought by products in sector i ($\omega \geq 0$), and γ_i is the probability of products in sector i to be contaminated ($0 \leq \gamma_i \leq 1$).

The aggregate social welfare results from the sum of aggregate income, revenue from

trade taxes and consumer's surplus, as in GH:

$$W(p) = l + \sum_{i=1}^n \pi_i + N[r(p) + s(p)] \quad (2.4)$$

where l is total labor supply. Since GH assume that wage is equal to one, l is also equal to total labor income. The term π_i is the aggregate reward to the specific factor used in producing good i . $s(p)$ is consumer surplus derived from consumption of nonnumeraire goods, and $r(p)$ is the net revenue from trade policies, which is redistributed across consumers and is expressed as:

$$r(p) = \sum_{i=1}^n (p_i - p^*) \left[d_i(p_i) - \frac{1}{N} y_i p_i \right] \quad (2.5)$$

Following Goldberg and Maggi (1999), we assume a Nash bargaining game mechanism, where trade policies are set to maximize the sum of the surpluses of the involved parties (the government and the lobbies):

$$\Omega = \sum_{i \in L} W_i(p) + aW(p) - b \sum_{i=1}^n Ext_i(p) \quad (2.6)$$

where the welfare of lobby i is given by:

$$W_i = l_i + \pi_i(p_i) + \alpha_i N[r(p) + s(p)] \quad (2.7)$$

where α_i accounts for the number of voters who are represented by lobby i .

If we differentiate the joint welfare Ω with respect to the price of good j , and we sum over all lobbies, we obtain:

$$\frac{\partial \Omega}{\partial p_j} = (I_j - \alpha_L) y_j(p_j) + (a + \alpha_L)(p_j - p^*) m'_j(p_j) + b Ext'_j = 0 \quad (2.8)$$

which, after rearranging, becomes:

$$-(a + \alpha_L)(p_j - p^*) m'_j(p_j) = (I_j - \alpha_L) y_j(p_j) - b Ext'_j \quad (2.9)$$

where Ext'_j can be expressed as $Ext_j = m'_j(p_j) \omega_j \gamma_j$. Isolating the price wedge on the left

hand side and rearranging it in terms of *ad valorem* equivalent:

$$\frac{(p_j - p^*)}{p_j} = \frac{(I_j - \alpha_L)}{(a + \alpha_L)} \frac{y_j}{(-p_j m'_j)} - \frac{b}{(a + \alpha_L)} \frac{Ext'_j}{(-p_j m'_j)} \quad (2.10)$$

which can in turn be re-expressed as follows:

$$\frac{(p_j - p^*)}{p_j} = \frac{(I_j - \alpha_L)}{(a + \alpha_L)} \frac{y_j}{(-p_j m'_j)} + \frac{bext'}{(a + \alpha_L)} \frac{y_j}{(-p_j m'_j)} \quad (2.11)$$

where ext'_j is the absolute value of Ext'_j , rescaled by the value of production y_j . The positive sign in front of the last term of equation 2.11 is given by the fact that $Ext'_j = m'_j \omega_j \gamma_j$ carries a negative sign, driven by $m'_j < 0$.

As in Grossman and Helpman (1994), we can express equation 2.11 in terms of elasticity and import penetration, dividing and multiplying each term by m . The resulting specification will be as follows:

$$\frac{(p_j - p^*)}{p_j} = \frac{(I_j - \alpha_L + bext'_j)}{(a + \alpha_L)} \frac{z_j}{e_j} \quad (2.12)$$

where z_j is the inverse import penetration, and e_j is the absolute import demand elasticity. Equation 2.12 can be interpreted as follows. As in Grossman and Helpman (1994), the relationship between $\frac{z_j}{e_j}$ and the level of protection is predicted to be positive when sector j is organized in a lobby, namely when $I_j = 1$. Indeed, the higher the “stakes from protection”, the more the government will increase protectionist policies when a sector is organized. Moreover, protection is expected to increase with the absolute derivative of the externality, as shown by the positive sign in front of $bext'_j$. Given that the last term of equation 2.11 always carries a positive sign, and that $bext'_j$ depends on $\omega_j \gamma_j$, with $\omega_j \gamma_j \geq 0$, we can draw the following general prediction. When the government does not perceive any damage coming from imported products from sector j ($\omega_j \gamma_j = 0$), then the relationship between $\frac{z_j}{e_j}$ will be the same as in GH, being positive when sector j is organized in a lobby, and negative when sector j is unorganized. When, instead, $\omega_j \gamma_j > 0$, there will be an additional force, dependent on consumer externality, positively conditioning the relationship, which will be increasing in ext'_j . Therefore, in politically unorganized sectors, the negative relationship between $\frac{z_j}{e_j}$ and the level of protection will be mitigated

by a positive sign carried by that relationship when the government perceives a risk for consumers and the environment. In other words, the level of protection can be raised also in sectors which are considered unorganized by the traditional Grossman and Helpman (1994) model if the government cares about environmental, health, safety or other risks for consumers in that sector.

In the above equations, we have expressed all terms as function of the inverse of import penetration over the elasticity ($\frac{z_j}{e_j}$). Another way to express equations 2.10 - 2.12 is the following:

$$\frac{(p_j - p^*)}{p_j} = \frac{(I_j - \alpha_L)}{(a + \alpha_L)} \frac{y_j}{(-p_j m'_j)} - Ext_j \frac{m'_j}{(-p_j m'_j)} \quad (2.13)$$

where externality is not weighted by the value of internal production. After simplification, we will obtain:

$$\frac{(p_j - p^*)}{p_j} = \frac{(I_j - \alpha_L)}{(a + \alpha_L)} \frac{y_j}{(-p_j m'_j)} + \frac{Ext_j}{(p_j)} \quad (2.14)$$

where the last term of equation 2.14 carries a positive sign. The term $\frac{Ext_j}{p_j}$ represents a ratio between the valuation of externalities from products in sector j and the price p_j of these products. Equation 2.14 confirms the overall predictions of the model: besides the effect of political pressures from interest groups, there is an additional factor positively conditioning protection, which is increasing in the perceived damage that consumers have from imported products (negative externality).

2.4 Empirical Strategy

Our empirical strategy has the purpose of testing the extension of the Grossman and Helpman (1994) model illustrated in the theoretical section of the paper. Despite the original model having been thought for tariffs, we test it using NTMs, employing a novel dataset on US non-tariff measures in force in 2014. Although our data include all non-tariff measures, both technical (e.g. sanitary and phytosanitary measures) and non-technical (e.g. licensing, quotas and prohibitions), the former represent the major share of NTMs. As in previous applications of the GH model, the choice of focusing on the United States is driven by data availability. Indeed, the US is the only country where it is possible to obtain detailed lobbying expenditures data, due to strict rules on the disclosure of interest groups' activity.

Using recent NTMs is interesting in several respects. First, and most importantly for our purpose, our extension includes the externality component. Being NTMs (technical regulations in particular) often tied to safety, quality or environmental concerns, the externality should be more relevant here than when dealing with tariffs and NTBs. Moreover, testing the GH model on tariffs and NTBs nowadays would not be as relevant as it was in the early applications of the model. Indeed, as outlined in the introduction, NTMs have been progressively replacing tariffs in many countries over the last decades. In addition to this, testing the GH model on NTMs is interesting *per se*, irrespectively of our extension including externalities. Indeed, the uncertain protectionist effect of technical NTMs makes it particularly interesting to study their political economy determinants. Given the double nature of NTMs, which might be trade protectionist in some cases, and trade facilitating and welfare enhancing in other cases, it is uncertain whether the GH predictions previously tested on NTBs and tariff will be confirmed or not.

Our theoretical model predicts that protection should depend on the level of externalities. Indeed, the higher the perceived risk for consumers, the higher the level of protection set by the government. However, finding a good proxy for externality is not straightforward, since the risk for consumers' depends, in our framework, on policy makers' concern about health and the environment, which is hard to measure. Given this problem, we decide to approximate externality with a variable coming from US newspapers, which is

built by counting, for each manufacturing sectors, how often products from that industry recur in the news associated with topics such as consumer safety and environmental protection.

For our empirical analysis, we bring equation 2.12 to a testable form. This implies approximating ext , which is not directly measurable, with a dummy variable. Looking at the different components of 2.12, we can state that, if no perceived risk for consumers exists, then the last term in parentheses, $bext'$, will disappear. By contrast, if $ext > 0$ in a certain sector, then the same term will have a positive sign, and the negative relationship between $\frac{z}{e}$ and the level of protection will be mitigated. Based on these considerations, we obtain the following testable equation:

$$NTM_i = \beta_1\left(\frac{z_i}{e_i}\right) + \beta_2(I_i * \frac{z_i}{e_i}) + \beta_3(E_i * \frac{z_i}{e_i}) + \epsilon_i \quad (2.15)$$

where the dependent variable, NTM_i , accounts for the average number of non-tariff measures affecting products in sector i . As in GH, β_2 is expected to be positive: when a sector is politically organized ($I_i = 1$), the level of protection is expected to display a positive relationship with $\frac{z_i}{e_i}$. With a similar logic, β_3 is expected to carry a positive sign. The term E_i is a dummy variable accounting for whether products imported from abroad and produced by sector i are perceived as bearers of a potential damage to consumers and derives from our proxy for externality. β_1 is, instead, predicted to be negative: if industry i is not politically organized and its products are not perceived as relevant in terms of safety, quality or environmental characteristics, then the the level of protection is on average lower, and decreasing with an increase in $\frac{z_i}{e_i}$. Finally, ϵ_i is the error term, accounting for unobserved industry-level characteristics affecting industry i .

2.5 Econometric Methodology

We estimate equation 2.15 using the econometric methodology proposed by Gawande and Bandyopadhyay (2000) and later adopted in other applications of extended versions of the GH framework (e.g. Gawande et al. (2006), Bombardini (2008)). The econometric strategy consists of a two-stage least squares procedure, which accounts for the potential endogeneity of import penetration, political organization and our externality measure.

The fact that lobbying and the level of protection could be simultaneously determined has been already pointed out by previous works (e.g. Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000)). Stronger lobbying pressures in a sector could be a reaction to a certain level of protection, which generates a reverse causality issue. Import penetration could be also endogenously determined with respect to NTMs, as first recognized by Treffler (1993). Indeed, trade policies may lead to a change in import flows, which would translate into a change in the ratio of internal consumption over imported goods. Finally, our additional variable accounting for the potential risk (negative externality) for consumers could suffer from endogeneity as well. Since our variable derives from the media, one can argue that the attention of journals towards specific products or classes of products could increase as a response to stricter (or looser) policies set by the government on those products.

To solve the concerns outlined above, our econometric strategy is made of four different equations, where each dependent variable is treated as endogenous:

$$NTM_i = \beta_0 + \beta_1 \frac{z_i}{e_i} + \beta_2 \frac{z_i}{e_i} I_i + \beta_3 \frac{z_i}{e_i} E_i + \epsilon_1 \quad (2.16)$$

$$\frac{1}{z_i} = \eta_0 + \eta_1 NTM_i + X_{P_i} + \epsilon_2 \quad (2.17)$$

$$\ln\left(\frac{Lobbying_i}{Va_i}\right) = \gamma_0 + \gamma_1 \ln(NTM_i) + \gamma_2 \ln\left(\frac{1}{z_i}\right) + \gamma_3 \ln(e_i) + x_{L_i} + \epsilon_3 \quad (2.18)$$

$$\ln\left(\frac{E_i}{Va_i}\right) = \theta_0 + \theta_2 \ln(NTM_i) + \theta_3 \ln\left(\frac{1}{z_i}\right) + x_{I_i} + \epsilon_4 \quad (2.19)$$

where equation 2.16 is aimed at testing the main predictions of the model, and derives from equation 2.15. NTM_i is a measure taking account of the number of non-tariff measures in sector i ; z_i is the inverse import penetration variable, computed as the value of output over imports, and e_i is the import demand elasticity. Finally I_i is our political organization variable, and E_i is our proxy for externality, being both expressed as indicators assuming the value of 0 or 1.

Equation 2.17 is the import penetration equation and includes NTM_i as dependent variable and a vector of exogenous instruments, X_{P_i} . To instrument import penetration, we use some of the variables suggested by Treffler (1993), selecting them according to

their correlation with z_i . The selected instruments are related to the structure of the labor market, and include the percentage of white collar workers, unskilled workers and semiskilled workers. Labor market structure, as argued by Trefler (1993) and by other works applying the GH model (e.g. Gawande and Bandyopadhyay (2000), Goldberg and Maggi (1999)), is a component of a sector's comparative advantage, which determines in turn import penetration.

Equation 2.18 is the lobbying equation, where the logarithm of lobbying expenditures over value added ($\frac{Lobbying_i}{V_{a_i}}$) is regressed on the logarithm of import penetration, NTM and elasticity, as well as instrumented with an exogenous variable, x_{L_i} . We use, as exogenous instrument for lobbying expenditures on trade issues, those lobbying expenditures that are not related to trade. This is done by manually selecting those lobbying issues that are far away from trade. Moreover, we exclude those issues that are related to regulations, like, for example, environment and food safety, in order to rule out potential sources of correlation with NTMs. For a list of the issues selected to build the instrument, see Table 2.9, reported in the Appendix of the paper.

Finally, in equation 2.19 the externality indicator variable taken from *LexisNexis* and weighted by value added, $\frac{E_i}{V_{a_i}}$, is regressed on the other model's variables, NTM and import penetration, and on its exogenous instrument x_{L_i} . To instrument the number of articles on US journals related to consumers' safety and environment, we use the number of articles from non US journals, excluding safety and environment as issues. With a similar logic as the one applied to lobbying, it is very unlikely that generic articles not related to consumers' health and environment are correlated with the level of trade policies.

In our system of equations, variables are regressed one to each other in a nonlinear fashion. Indeed, political organization and externality are measured as dummy variables and interacted with the inverse ratio of import penetration to elasticity in the NTM equation, but expressed as continuous variables in the import penetration and externality equation. The lobbying and the externality equations are in *log*, while the other two equations are in level. Moreover, import penetration enters equation 2.16 as z_i , and equations 2.18-2.19 as $\frac{1}{z_i}$. Finally, z_i and e_i enter equation 2.16 interacted with each other and with the dummy variables, and the other equations alone. Because of these nonlinearities, the estimation by normal two-stage or three stage least square would return biased structural coefficients.

For this reason, as in Gawande and Bandyopadhyay (2000), we implement the two-stage least squares estimator proposed by Kelejian (1971). This method consists of regressing the nonlinear expressions on linear, squared and first-order cross products of the exogenous variables. Kelejian (1971) shows that, in this way, a traditional two-stage least squares can be used and has the desirable properties of consistency and asymptotic efficiency.

In addition to the baseline specification shown in equations 2.16-2.19, we also implement an extended version of our model, where additional determinants of protection are included in the NTM equation.

2.6 Data Sources

2.6.1 Non-Tariff Measures

As anticipated in the above paragraphs, the GH framework was originally created for tariffs. The protection measure conceived by Grossman and Helpman (1994), indeed, creates a wedge between domestic price and world price. However, the majority of the papers applying the GH model to real data (Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; Gawande et al., 2006) have used non-tariff barriers (NTBs) instead of tariffs. This choice has been driven mainly by the fact that tariffs were generally set cooperatively, being thus not ideal for testing a model based on a non-cooperative game such as the GH framework. The extension of the Grossman and Helpman (1994) model presented here is applied on NTMs instead. These measures, by comparison with NTBs used in previous applications of GH, do not have a declared protectionist intent, and include technical measures (SPS and TBT). Therefore, they are appropriate to test the GH extension that includes consumer externality. Moreover, testing the model on NTMs is more reasonable nowadays than 20 or 30 years ago, given the consistent decrease in tariffs in all manufacturing sectors.

In order to measure NTM coverage across industries, we exploit a new database taken from UNCTAD, relative to 2014². These data comprehend the 2014 stock of non-tariff measures imposed by the United States to all the world partners, each measure being associated with a sector covered in the Harmonized System (HS) classification at 6-digit

²We warmly thank Marco Fugazza and Alessandro Antimiani for providing us this new data source.

Imports	Technical measures	A SANITARY AND PHYTOSANITARY MEASURES B TECHNICAL BARRIERS TO TRADE C PRE-SHIPMENT INSPECTION AND OTHER FORMALITIES
	Non technical measures	D CONTINGENT TRADE-PROTECTIVE MEASURES E NON-AUTOMATIC LICENSING, QUOTAS, PROHIBITIONS AND QUANTITY-CONTROL MEASURES OTHER THAN FOR SPS OR TBT REASONS F PRICE-CONTROL MEASURES, INCLUDING ADDITIONAL TAXES AND CHARGES G FINANCE MEASURES H MEASURES AFFECTING COMPETITION I TRADE-RELATED INVESTMENT MEASURES J DISTRIBUTION RESTRICTIONS K RESTRICTIONS ON POST-SALES SERVICES L SUBSIDIES (EXCLUDING EXPORT SUBSIDIES UNDER P7) M GOVERNMENT PROCUREMENT RESTRICTIONS N INTELLECTUAL PROPERTY O RULES OF ORIGIN
	Exports	P EXPORT-RELATED MEASURES

Figure 2.1: Non-tariff measure classification by chapter, official international classification by UNCTAD. Source: UNCTAD (2012)

level of disaggregation (HS-6). As shown in Figure 2.1, NTMs are classified into technical and non-technical. Given the strong prevalence of technical measures over non-technical NTMs in the dataset, our analysis is focused on the former. Indeed, almost the totality of NTMs is represented by categories SPS (category A, 30% of the total) and TBT (category B, 65% of the total).

In order to merge our NTM data with lobbying data and sectors' characteristics, it is necessary to convert non-tariff measures at NAICS-6-digit level. Since the concordance between HS and NAICS exists at the HS-10 level of disaggregation (see Pierce and Schott, 2012), we expand the NTM dataset to such a level. To do this, we assume that, when

an HS-6 sector is covered by one NTM, then all the underlying HS-10 sub-sectors are affected³.

In order to quantify NTM at sectoral (e.g. NAICS 6-digit) level, previous GH applications have used NTM coverage ratio, which measures the percentage of products covered by at least one NTM. Coverage ratio is based on a dummy variable assuming the value of 1 if a product is covered by at least one measure, and 0 otherwise. However, the NTM structure has considerably changed from 1983 to 2014, and the majority of sectors turns out to be covered by at least one non-tariff measure. We would thus have an absence of variation in NTMs across sectors. In order to obtain a measure taking account of the number of NTMs by NAICS sector, we compute a prevalence score using the approach proposed by Gourdon et al. (2014):

$$NTM_i = \frac{\sum_{j \in i} N_j * IMP_j}{IMP_i} \quad (2.20)$$

where i is the specific NAICS 6-digit sector whose prevalence score we want to compute, and the subsectors j are, in our case, the HS-10 sectors associated with the NAICS industry i . N_j is the number of NTMs covering HS-10 product j , and IMP is the value of general imports from all the partners in the world to the United States. Being the majority of products subject to more than one regulatory measure, the score NTM_i gives the average number of NTMs affecting imports in sector i . Employing this measure, we assume that, the higher the number of NTMs applied to a product, the more regulated the commerce of that product is.

Despite the fact that the prevalence ratio is a more precise indicator than the coverage ratio is, we are aware that the number of NTMs might not be exactly proportional to their protectionist effect. Given our theoretical framework, which intends trade policies as measures that drive a wedge between domestic and world price, the ideal dependent variable would be *ad valorem* equivalent of NTMs. Such a variable would quantify the price effect of NTMs, allowing us to distinguish the measures that have a protectionist effect

³The original database is restricted to non-tariff measures imposed on all the World trade partners. To associate HS-10 sectors to NAICS 6-digit industries, we exploited the conversion produced by Pierce and Schott (2012). This classification is partially incomplete, since the last available year is 2009 and some HS10 have been removed and added since then. We thus classify by hand the remaining sectors, basing on their official description.

from the ones that don't. However, *ad valorem* equivalents are not easy to measure, and have not been estimated for recent years. Therefore, we limit our analysis to the prevalence ratio, leaving the estimation of *ad valorem* equivalents to possible future developments of this research.

2.6.2 Political Organization

The data used to define the political organization indicator represent one of the elements of novelty of our analysis. The authors who tested the GH model on 1983 data (e.g. Goldberg and Maggi (1999); Gawande and Bandyopadhyay (2000); Bombardini (2008)) defined political organization of sectors using data on contributions from Political Action Committees (PACs). Contributions, however, are not attributable to any specific issue, making it difficult to disentangle trade-related lobbying. For our analysis, we use instead industry-level data on lobbying expenditures. This data is available since 1998 and consist of money spent by firms and associations to hire lobbyists, who carry out lobbying activities directed at members of the United States Congress. This type of activity has been often defined as “informational lobbying”, since interest groups mainly act through providing information to members of the government. Despite the original Grossman and Helpman (1994) model having been conceived for political contributions, using informational lobbying data to define the degree of political organization of sectors has some advantages with respect to the use of PACs. First, differently from PACS data, lobbying data give the opportunity to select the specific issues on which the lobbying activities are carried out. We can thus identify those firms that lobby on trade issues, having a more precise measure than the one obtained from PACs. Moreover, expenditures on lobbying activities are much higher than money spent on lobbying contributions. Figure 2.2 shows the total amount of lobbying expenditures, trade-related lobbying expenditures and contributions from PACs for the period considered by our analysis. From the graph, we can notice that firms and organizations allocate to lobbying spending more than 3 billion dollars a year, a much higher amount than political contributions from PACs. Trade-related lobbying expenditures represent around one third of the total, meaning that trade is a relevant issue for interest groups. Moreover, there are good reasons to believe that informational lobbying influence the government in a similar way as contributions. First,

there is evidence that the two activities (lobbying and campaign contributions) are strictly related. Grossman and Helpman (2001) argue that contributions often have the role of buying access to politicians or strengthening the credibility of interest groups, which then influence decision makers through the use of information. Moreover, like contributions, informational lobbying activities represent a cost from the interest groups' perspective, since they involve hiring lobbyists. At the same time, information is an important resource for policy makers, since it helps them learning about technical details, shaping policies and maintaining relationships with industry and with relevant trade associations and organizations.

Data on lobbying come from the *Center for Responsive Politics* and have been downloaded from the www.opensecrets.org webpage, which the center maintains. This public database allows one to obtain annual registration records, where each "registrant" (the company carrying out lobbying activities) is linked to a "client" (the firm, association or organization hiring the lobbyists). We cover the period from 2008 to 2014. Differently from PACs contributions, lobbying data are available every year, since they are not strictly linked to congressional cycles. Being as our specific interest is on trade policy, we select only those records listing "TRADE" or "TARIFF" among the issues of interest. This allows disentangling trade-related lobbying activities. Previous works using PACs had, instead, assumed proportionality between total PACs and trade-related PACs (e.g. Goldberg and Maggi (1999)), or implemented econometric procedures to link general PACs to trade policies (Gawande and Bandyopadhyay (2000)).

In order to get sectoral lobbying expenditures, we manually classified every client into a 6-digit NAICS sector. When it was not possible to match a client to a 6-digits sector, we linked it to lower level of disaggregation (5- 4- or 3-digits). To obtain a measure of lobbying intensity in each sector, we divide lobbying expenditures by the number of firms and we weight them by the industry's value added (Va_i). Since our model, as shown in equation 2.15, requires a dummy variable to distinguish between organized and unorganized sectors (I), we use thresholds of $\frac{Lobbying}{Va}$ to define the cutoff. Since the threshold is based on an arbitrary decision, we use different values of $\frac{Lobbying}{Va}$ to define our indicator variable I , with the purpose of testing for the sensitivity of our results when the cutoff value to define political organization changes.

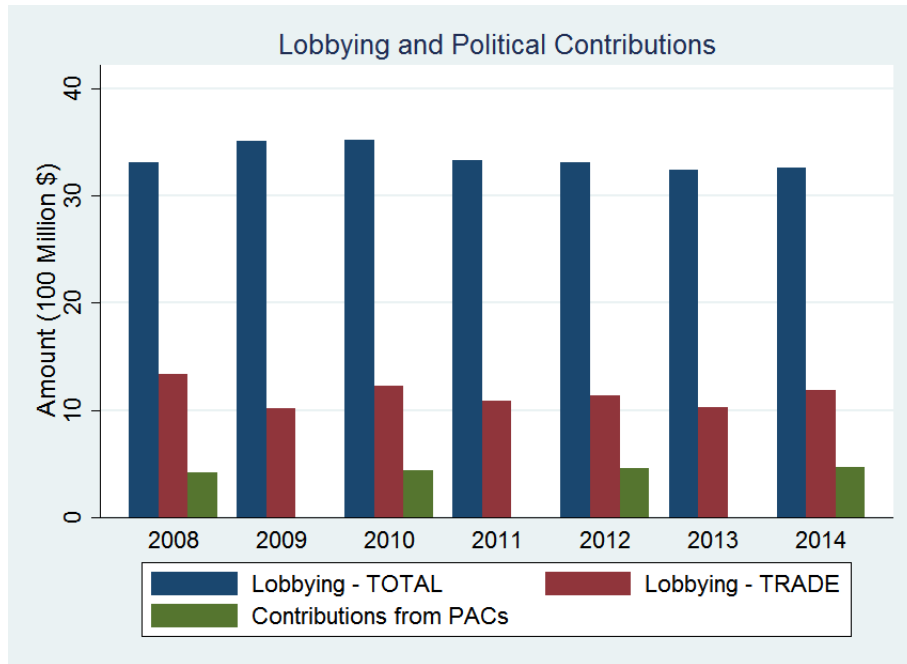


Figure 2.2: Source: Authors' own calculations using data from *Opensecrets*

2.6.3 Consumer Externality

In the extension of GH presented by this work, consumer externality plays a major role in determining the pattern of protection across sectors. In our framework, the number of NTMs covering a specific sector should depend on government's perception of consumer safety or environment-related risk coming from consumption of imported goods. Being as externality is very hard to measure, in our empirical analysis we approximate it with a categorical variable accounting for consumers' sensitivity to specific characteristics of products. We build this variable using US journal articles related to safety or environmental issues. The idea of using media to approximate the attention of politicians towards consumers' well being and the environment is in line with a strand of literature studying the political economy of media and, in particular, the policy effects of media coverage (see Prat and Strömberg (2011) for a survey). This literature studies the co-movement over time in coverage of an issue in the media, the importance attached by the public to that issue, and policy responses. Indeed, media are sometimes able to create a policy bias, favoring policy responses on issues that get higher press coverage.

To define our externality indicator variable, we first build an index of journal coverage by sector, making use of the online platform *Lexis Nexis Academic*. *Lexis Nexis Academic*

contains full-text news from major international and national sources, reported since 1980⁴. The use of *Lexis Nexis* presents, for our purpose, several important advantages. First, the platform itself classifies the articles from the news by industry or product. Secondly, the industry classification of *Lexis Nexis* is based on the NAICS classification, allowing us to match the media variable with the other data used in our analysis. Third, the articles are also classified by topic. Among the listed topics, *Lexis Nexis* includes “Safety” and “Environment”, which we have chosen to analyse.

To define our E dummy variable, we implemented the following strategy. All the manufacturing industries and products listed by *Lexis Nexis* were matched to a NAICS 4-digit category⁵. Since the classification operated by *Lexis Nexis* is, in some cases, less refined than the NAICS, we decided to build the externality variable at 4-digit level. Moreover, for those industries or products not precisely corresponding to a NAICS sector, we helped ourselves with the official website <http://siccode.com/>, which provides a detailed description of all goods and services included in each NAICS code. Then, for each sector, we ran our search on the online platform, obtaining a count of the number of articles associated with each industry and product category. This count was done multiple times, filtering *Lexis Nexis* according to different criteria: first, we picked articles from all US newspapers associated with the topics labeled as “Safety” and “Product Safety”; second, we specifically selected the reviews *Consumer Report* and *Consumer Report - Health*; third, we selected as topics “Environment” and “Environmental Protection”.

In our analysis, the number of safety or environment-related articles represents a proxy of the sensitiveness of consumers to a specific product category. We approximate consumer externality with the dummy variable (E), which is equal to 1 when the articles number exceeds a certain threshold. With a similar logic as the one used to define the organization I , we first take the median and then change thresholds in order to test for the robustness of our results.

⁴As for the United States, all the major US journals are included, except for the *Wall Street Journal*.

⁵To obtain the best correspondence between industry and product codes in *Lexis Nexis* and the NAICS classification, we manually selected all codes that can be linked to the manufacturing industry. Specifically, we selected the whole “Manufacturing” category, as well as the other following categories: “Defense and Aerospace”, “Electronics”, “Consumer Products”, “Chemicals”, “Automotive”, “Fashion and Apparel”, “Food and Beverage”, “Paper and Packaging”, “Pharmaceuticals”, “Computer and Information Technology”.

2.6.4 Elasticities and Other Variables

Import demand elasticities are taken from Kee et al. (2008), who estimated them at HS-6 digit level of disaggregation. We matched these estimates with the HS-10 products included in each HS-6. Then, the mean of elasticities by NAICS-6 digit sector was computed. Since elasticity is an estimated variable, its reliability may be limited. For this reason, following Gawande and Bandyopahdyay (2000), we decided to exclude the elasticity values with the highest standard errors (s.e.>9), as well as the ones with a positive sign. This leads us to exclude part of the observations, ending up with a smaller sample size with respect to the original database (277 NAICS 6-digit sectors instead of 316).

The other variables included in our empirical specification are the exogenous instruments for the Import Penetration equation, as well as the control variables included in the main equation when testing the extended version of the GH model. These variables were obtained from different sources.

The value of imports comes from the *United States Census Bureau* (UCB) and was downloaded at both NAICS 6-digit and HS-10 level. This variable is used to compute import penetration, as well as to weight the number of NTMs in our prevalence ratio index (see equation 2.20).

All the structural characteristics of sectors (value added, employment, capital expenditures, etc.) are taken from the *Annual Survey of Manufacture* (ASM), which can be found on UCB. The Concentration Index is taken from UCB and represents the percentage of value added held by the 4 largest firms. The latest available data are the ones from 2007. When these variables were not available for all NAICS-6 digits sectors, we computed the mean over the NAICS-4 for the missing observations. The number of union members by sector is taken from *Unionstats*, which draws these data from the *Current Population Survey* (CPS). The occupation categories are taken from the *Bureau of Labour Statistics* (BLS). Following Treffer (1993), we group BLS categories into 5 broader groups of employees: engineers and scientists, white collars, skilled workers, semiskilled workers, and unskilled workers.

Finally, the percentage of final goods over total output is taken from input-output account data from the *Bureau of Economic Analysis* (BEA). We compute this variable from

the *Use* table, which shows how each industry's output is shared between final consumption and intermediate use. The BEA sectors are matched to the NAICS classification through specific correspondence tables.

2.7 Results

2.7.1 Main Results

Table 2.1 displays summary statistics for our main variables of interest. NTM prevalence ratio has a sample mean of 20.18, meaning that NAICS sectors used in our analysis are covered, on average, by around 20 non-tariff measures. Of primary interest are also the import penetration and its inverse (z_i), which show sample mean of 0.82% and 13.8%, respectively, and import demand elasticity, with an average absolute value of 2.29. The variable entering our main specification is the inverse ratio of import penetration over the absolute elasticity, $\frac{z_i}{e_i}$, which has a sample mean of 37.17. We also show summary statistics for lobbying expenditures at the beginning and at the end of our considered period, and for lobbying weighted by sectoral value added, that we use to create our political organization indicator. Moreover, table 2.1 displays summary statistics for our baseline variable from *Lexis Nexis* counting the articles related to safety from 2004 to 2014, that are on average 910. Finally, summary statistics for the control variables used in the extended version of the model are also reported. We first test the baseline Grossman and Helpman (1994) model, without taking account of consumer externality. Table 2.2 shows results coming from the application of GH, using NTM prevalence ratio as dependent variable. As in Gawande et al. (2006), the indicator variable I is equal to one when lobbying expenditures weighted by sectoral value added are above a certain threshold in all considered years (2008-2014). We run the same regression using four different thresholds, of which the lowest corresponds to the 10th percentile and the highest to the 40th percentile.

Our results are consistent with the Grossman and Helpman (1994) framework, which predicts that the relationship between trade protection and import penetration (or better, its inverse) depends critically on whether an industry is politically organized or not. Indeed, the estimated coefficients β_1 and β_2 have positive and negative signs, respectively, with $\beta_2 > \beta_1$. The coefficient β_1 is statistically significant at the 0.01 level only for the

Table 2.1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
NTM Prevalence Ratio	20.18	18.93	4	224.19
Import Penetration	0.82	2.12	0.00	22.60
Elasticity	2.29	2.50	0.03	30.38
z_i	13.80	55.26	0.04	767.05
$\frac{z_i}{e_i}$	37.17	130.42	0.09	1,540.06
Mn \$ LOBFIRM (2008)	2.94	6.36	0	31.40
Mn \$ LOBFIRM (2014)	1.57	2.30	0	17.50
LOBFIRM/Va (2008)	0.90	3.08	0	34.95
LOBFIRM/Va (2014)	0.38	0.52	0	3.36
Safety Related Articles	910.63	2,661.26	0	22,000
Concentration Index	43.62	20.66	0	97.37
% Union Members	9.65	6.17	0	30.40
Capital-Labor Ratio	0.26	0.30	0.03	2.77
Scale	31.33	104.56	0.92	1,512.24

lowest threshold (10th percentile). By contrast, β_2 is positive and significant for all thresholds, showing that the main prediction coming from the Grossman and Helpman (1994) model and found by previous works is still valid today, using NTMs as dependent variable and defining political organization based on recent trade-related lobbying data. Indeed, our results tell us that, *ceteris paribus*, NTMs tend to be numerically higher in politically organized sectors than in unorganized ones.

Table 2.3 shows results obtained by testing equation 2.15, where the externality component is added to the GH equation. The variable $\frac{z_i}{e_i}$ is interacted not only with the political organization dummy variable, but also with the externality indicator. For our baseline analysis, we use the 50th percentile of our externality variable, obtained as the number of safety-related articles from *Lexis Nexis* weighted by value added, to discriminate between sectors where $E = 0$ and those where $E = 1$. Since, similarly to political organization, we use an arbitrary threshold to identify those sectors where the government is actually concerned about consumer safety, we also test the model with higher

Table 2.2: Baseline GH model with different thresholds for political organization

Dependent Variable: NTM_i	10th Percentile	20th Percentile	30th Percentile	40th Percentile
$\frac{z_i}{e_i}$	-0.307** (-2.34)	-0.054 (-1.30)	-0.057 (-1.37)	-0.057 (-1.44)
$\frac{z_i}{e_i} * I_i$	0.354*** (2.64)	0.133** (2.48)	0.139** (2.55)	0.150*** (2.79)
Constant	20.79*** (11.59)	18.76*** (12.56)	18.84*** (12.52)	19.16*** (12.47)
N	277	277	277	277
% I=1	0.80	0.70	0.60	0.46
Model F	4.38**	4.17**	4.31**	4.92***

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.

NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is absolute import elasticity. Percentile values of lobbying expenditures (from 10th to 40th) are used to define the cutoff above which I is equal to 1.

and lower thresholds as a robustness check. Our results are in line with the predictions coming out of our theoretical framework. The relationship between import penetration and protection through non-tariff measures depends not only on whether the industry is politically organized, but also on whether the government is concerned about consumers' safety. The coefficient β_1 is negative, showing that, when there is neither political activity from industry nor government's concern about potential externalities, NTM prevalence ratio depends negatively on the inverse of import penetration. By contrast, both β_2 and β_3 carry a positive sign, showing that the above relationship is mitigated when either lobbying pressure from industry is high or consumers are subject to health or safety risks coming from imported products. Note that, even if the negative relationship between the inverse ratio of import penetration to elasticity is softened by the existence of both political organization and attention towards consumer safety, the negative sign on $\frac{z_i}{e_i}$ is never reversed. Indeed, if we sum β_1 and β_2 , the resulting effect of $\frac{z_i}{e_i}$ on NTMs is still negative for politically organized sectors, even if much less strong than for unorganized ones. The same happens when summing β_1 and β_3 , which turn out to be very close in magnitude.

Table 2.3: Parsimonious Specification: GH Model Including Externalities

Dependent Variable: NTM_i	10th Percentile	20th Percentile	30th Percentile	40th Percentile
$\frac{z_i}{e_i}$	-0.249*	-0.195***	-0.192***	-0.156***
	(-1.83)	(-2.84)	(-2.84)	(-2.59)
$\frac{z_i}{e_i} * I_i$	0.219	0.135**	0.138**	0.121**
	(1.15)	(2.24)	(2.26)	(2.07)
$\frac{z_i}{e_i} * E_i$	0.0944	0.190***	0.185***	0.157**
	(0.92)	(2.72)	(2.65)	(2.24)
Constant	20.87***	20.16***	20.20***	20.30***
	(12.37)	(11.48)	(11.55)	(11.74)
N	277	277	277	277
% I=1	0.80	0.70	0.60	0.46
% E=1	0.50	0.50	0.50	0.50
Model F	3.67**	4.43***	4.48***	4.27***
AIC	15.85	16.01	16.00	15.98

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.

NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is absolute import elasticity. Percentile values of lobbying expenditures (from 10th to 40th) are used to define the cutoff above which I is equal to 1. The cutoff to set E equal to 1 corresponds to the 50th percentile value of our media variable.

In general, we can draw from our results that government tends to set a higher number of NTMs in industries that are more affected by foreign imports. This result is in line with findings from other papers on the political economy of trade protection (see, for example Maggi and Rodriguez-Clare (2000), Lee and Swagel (1997) and Hergehelegiu (2016)).

More importantly for our framework, we can state that, all else held constant, NTMs are higher both in industries represented by organized lobbies and in sectors where the attention towards consumers' safety is high. The thresholds for I are the same as in Table 2.2. As shown at the bottom of the table, the higher the threshold, the lower the percentage of NAICS industries considered as politically organized. All three coefficients of interest are statistically significant for all thresholds, with the exception of the lowest one.

Table 2.4 adds some control variables to our baseline specification with externality.

Table 2.4: Extended Specification: GH Model Including Externalities

Dependent Variable: NTM_i	10th Percentile	20th Percentile	30th Percentile	40th Percentile
$\frac{z_i}{e_i}$	-0.252* (-1.86)	-0.207*** (-2.95)	-0.203*** (-2.96)	-0.166*** (-2.74)
$\frac{z_i}{e_i} * I_i$	0.209 (1.11)	0.140** (2.25)	0.141** (2.27)	0.124** (2.11)
$\frac{z_i}{e_i} * E_i$	0.103 (1.03)	0.197*** (2.80)	0.191*** (2.73)	0.162** (2.31)
Concentration Index	-0.111 (-1.60)	-0.134* (-1.76)	-0.132* (-1.75)	-0.128* (-1.72)
% Union Members	0.156 (0.69)	0.090 (0.36)	0.078 (0.31)	0.109 (0.44)
$\frac{Capital}{Labour}$	2.523 (0.42)	2.433 (0.37)	3.065 (0.47)	3.028 (0.47)
Scale	0.026 (1.56)	0.030 (1.64)	0.029 (1.58)	0.030* (1.66)
Constant	22.92*** (6.20)	23.75*** (5.95)	23.69*** (5.97)	23.30*** (5.99)
N	277	277	277	277
% I=1	0.80	0.70	0.60	0.46
% E=1	0.50	0.50	0.50	0.50
Model F***	2.64**	2.79***	2.82***	2.78***
AIC	15.56	15.73	15.72	15.70

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.

NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is absolute import elasticity. Percentile values of lobbying expenditures (from 10th to 40th) are used to define the cutoff above which I is equal to 1. The cutoff to set E equal to 1 corresponds to the 50th percentile value of our media variable.

Following previous literature (e.g. Trefler (1993), Gawande and Bandyopadhyay (2000), Gawande et al. (2006)), we include some explanatory variables which could influence the level of protection through NTMs: the concentration index of sectors; the percentage of workers that is part of a union; capital-labor ratio; the average firm size (scale). The coefficients on these variables turn out to be almost always statistically insignificant, with the

exception of the concentration index. More importantly, our coefficients of interest β_1 , β_2 and β_3 are only affected by very small changes when the additional regressors are included. Akaike information criterion (AIC) is reported to compare the parsimonious specification with the extended specification. According to such criterion, which is appropriate for nested models, the “best” model is the one with minimum AIC. By comparing Table 2.3 with Table 2.4, we can conclude that the extended specification performs somewhat better than the parsimonious one, being as the AIC value is slightly lower in the former than in the latter.⁶ In our words, we can state that the fit of our baseline model is not damaged by including additional regressors.

With reference to the above results, Table 2.5, shown in the Appendix of the paper, reports first stage estimation outcomes of the import penetration, political organization and externality equations. All three potentially endogenous variables are regressed on their exogenous instruments, as well as on the other model’s variables, as shown in equations 2.18-2.19. Results from all three equations show that all selected instruments are strongly correlated with the endogenous variables. Moreover, the positive and statistically significant coefficient on NTMs in both the lobbying equation and the externality equation is an indication of the existence of an endogenous relationship, showing also the direction of the bias, which turns out to be positive in both cases.

Our estimates allow us to draw some considerations about the magnitude of the effect of both political organization and presence of consumer externality on NTM prevalence ratio. Consider, for example, results from Column 2 of Table 2.4. Looking at our main coefficients of interest, we can infer that an increase of 1 in the inverse of import penetration over elasticity leads to a decrease of 0.20 in NTM prevalence ratio for politically unorganized sectors. The same increase in the inverse ratio of import penetration to import elasticity leads to a 0.06 decrease in NTMs when a sector is politically organized (given by $\beta_1 + \beta_2$), and to a 0.01 decrease in NTMs when the government cares about consumer externality. Looking at our summary statistics, which show a mean value of 37 for our inverse ratio of

⁶The Akaike information criterion is computed as $\frac{-2(\ln L - k)}{N}$, where $\ln L$ is the log of the maximum likelihood, k are the degrees of freedom, and N is the sample size. The other possible test to compare models is the Schwartz criterion (SIC) (see Gawande and Bandyopadhyay (2000)). In our model comparison, the Schwartz criterion gives the same results as the Akaike. Values of the test are not reported, but are available upon request.

import penetration to elasticity, we can conclude that the presence of an organized sector leads, on average, to a 5.18 (37×0.14) increase in NTM prevalence ratio. With the same logic, we can say that, in sectors where some concern about consumer externality exists, NTM prevalence ratio increases by 7.29 on average with respect to the sectors with no such concern. Given these numbers, we can conclude that our estimates find an economically significant effect of both political organization and attention towards consumer safety on the NTM prevalence ratio. This sheds some light on the dual nature of NTMs: on one side, they are aimed at protecting the domestic manufacturing industry; on the other side, they also have the objective of protecting consumers from the risk of negative externalities coming from imported products.

Unlike previous applications of the GH framework, we do not aim here at inferring the weight attributed by the government to social welfare, lobbies and consumer's externality. Indeed, the original Grossman and Helpman (1994) model is microfounded, allowing the retrieval of precise values of α_L (the fraction of people organized into a lobby) and a (the weight that government places on social welfare as compared to lobbying). In our model, externality is included as an additional factor in government's function, multiplied by the weight b , which is the relative importance of externality for the government with respect to political contributions (see equation 2.12). Given the structure of our model, inferring the exact value of b would only be possible if we were able to compute the precise value of the externality (and its derivative) at the sectoral level. However, externality is unmeasurable, and our empirical strategy consists in an approximation of the model, where a dummy variable indicates whether consumers perceive any health and environmental risk or not in a certain sector. Therefore, the weights a and b cannot be precisely inferred. The purpose of our empirical test is instead to investigate whether government's concern about health and potential risks for consumers, besides lobbying pressure from industries, is a relevant motivation for increasing the number of non-tariff measures.

2.7.2 Robustness Checks

In this section, we present some robustness checks that we performed to test for the sensitivity of our results.

Table 2.6 shows our first test, which consists in using alternative definitions of the

externality indicator variable E . In the first two columns of the table, the dummy variable is still based on the number of articles taken from *Lexis Nexis*, selecting articles from all US journals associated with the topic labeled as “Environment” rather than “Safety”. Since NTMs are often associated, besides health and safety of consumers, with protection from environmental risks, it is interesting to test whether environmental concerns actually push the government to increase the number of non-tariff measures. The third and fourth column of Table 2.6, instead, show results with the externality dummy variable built using only the reviews *Consumer Reports* and *Consumer Reports Health*. These two reviews are published by *Consumers Union*, a non-profit organization dedicated to product testing and consumer-oriented research. By selecting these media sources, we are only considering articles related to consumer safety and product quality. Results in Table 2.6 confirm our main findings⁷. For all definitions of E , the ratio $\frac{z_i}{e_i}$ shows a positive relationship with the NTM prevalence ratio in sectors where products are associated with externalities for consumers. At the same time, the coefficient on organized sectors remains positive and significant.

Table 2.7 presents results obtained defining the variable E with different thresholds with respect to the one used in our main specification. While results shown in subsection 2.7.1 use the 50th percentile of our externality variable taken from *Lexis Nexis* to identify industries whose products are associated with consumers’ safety and quality issues, we use here the 40th and 60th percentiles, to test whether our results are sensitive to decreasing and increasing the threshold. Results prove to be robust to this sensitivity test, since the coefficient β_3 is similar in sign, significance and magnitude to its estimate in Table 2.4.

Finally, Table 2.8 displays results from our extended model obtained by excluding those sectors whose output is mainly employed as intermediate goods as opposed to final consumption. Indeed, being an externality is often related to a damage (if negative) or a benefit (if positive) for consumers, it is reasonable to think that intermediate products are unlikely to raise concerns related to product safety. Therefore, it is interesting to test whether our results change when we restrict our analysis to those sectors where the ratio between final and intermediate products is sufficiently high. As explained in the data

⁷For this robustness check, as well as for the other sensitivity analyses shown in this subsection, we only show two of the four used thresholds for the political organization variable. However, results from the other thresholds also confirm previous findings and are available upon request.

section, we build the ratio of final goods over total output using the BEA *Use* tables and then matching the BEA classification with the NAICS one. Then, we test results from our extended model by excluding those sectors where the percentage of output used for final consumption is lower than the 10th and 20th percentile value, respectively. Results confirm the predictions of our model. After restricting the sample, the coefficient β_2 , relative to politically organized sectors, is still positive and significant at the 0.5 or 0.1 level. More interestingly, the coefficient β_3 on sectors raising concerns about consumers' externalities is substantially larger here than in our baseline results, and further increases when we switch from the 10th to the 20th percentile as threshold to restrict our sample. This indicates that comparing sectors where consumer externality is relevant with sectors where it is not is even more important when a sufficient fraction of products are employed in final consumption.

2.8 Summary and Conclusions

With the progressive increase of non-tariff measures as trade policy instrument, studying the political economy determinants of these measures has become of primary relevance. In particular, when considering technical measures such as standards and labelling requirements, it is important to take into account that they reflect public policy goals. Indeed, they are set with the intention of ensuring consumers' health and safety and protecting the environment. However, they may be also be applied in a way that restricts trade, resulting sometimes in a protectionist effect.

Our paper extends the "Protection for Sale" model by Grossman and Helpman (1994) to the inclusion of consumer externality. In our framework, the government sets trade policies taking account of political contributions, public welfare, and the concern about the potential damage coming from imported products and affecting consumers (negative externality). The model predicts that protection should increase, on average, both when a sector is politically organized, and when consumers and the environment are exposed to risk of damages.

We test the predictions of our framework using 2014 data on non-tariff measures imposed by the United States on all the World partners. Given the consumer safeguard

purpose of NTMs, these measures represent the ideal trade policy instrument to test our Grossman and Helpman (1994) model with consumer externality. Our application represents a novelty with respect to previous empirical literature (e.g. Goldberg and Maggi (1999), Gawande and Bandyopadhyay (2000)) in several respects. First, we use recent data on non-tariff measures instead of non-tariff barriers to trade. Second, we measure political organization using data on trade-related lobbying expenditures instead of generic contributions from Political Action Committees. Finally, we augment our empirical specification with a measure of consumer externality, using US journals to build a proxy for the attention towards safety and health issues across products from manufacturing sectors.

Our results confirm predictions from our theoretical framework. In line with the Grossman and Helpman (1994) model, we find a negative relationship between the inverse ratio of import penetration to absolute elasticity and the average number of NTMs across industries. However, this relationship is mitigated when an industry is politically organized, as well as when consumers and the environment are exposed to risks according to our externality measure. Overall, we find that NTMs significantly increase in number in presence of both interest groups' political pressure and government's concern about potential damages for consumers.

Our work brings some new insight to research on the political economy of NTMs, suggesting that governments' decisions on these measures may be driven by a protectionist intent, as well as concerns about consumers' well-being and the environment. This topic may lead to further research. In the future, the trade effect of NTMs might be more precisely estimated, with the aim of understanding whether the political economy determinants differ between protectionist and non-protectionist measures. Furthermore, we may also try to extend our theoretical framework, internalizing externality in consumers' utility function, thus envisaging its direct impact on demand.

Appendix A

Table 2.5: First Stage Results

Dependent Variables:	Import Penetration	$\ln\left(\frac{Lobbying}{Va}\right)$	$\ln\left(\frac{SafetyArticles}{Va}\right)$
NTM_i	0.01 (0.34)	- -	- -
% White Collar	9.43*** (7.67)	- -	- -
% Semiskilled	6.66*** (7.00)	- -	- -
% Unskilled	-33.40** (-2.77)	- -	- -
$\ln(NTM_i)$	-	0.18* (2.38)	0.92*** (5.66)
$\ln(e_i)$	-	-0.02 (-0.67)	0.02 (0.31)
$\ln\left(\frac{1}{z_i}\right)$	-	0.02 (0.87)	0.09 (1.55)
$\ln\left(\frac{Lobbying_{exo}}{Va}\right)$	-	0.33*** (8.05)	- -
$\ln\left(\frac{Articles_{exo}}{Va}\right)$	-	-	0.09*** (12.93)
Constant	-5.41*** (-5.69)	-0.32* (-1.68)	-2.36*** (-5.43)
Model F	18.63***	24.08***	49.98***
N	277	277	277

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.

NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is the absolute value of the import demand elasticity. $Lobbying_{exo}$ accounts for lobbying expenditures considered exogenous with respect to trade and regulations. $Articles_{exo}$ is built using *LexisNexis* news not listed under the topics “Safety” and “Environment”.

Table 2.6: Robustness Check: Alternative definition of the “Externality” indicator variable

Dependent Variable: NTM_i	<i>Environment</i>		<i>Consumer Reports</i>	
	20th Percentile	40th Percentile	20th Percentile	40th Percentile
$\frac{z_i}{e_i}$	-0.285** (-2.41)	-0.301** (-2.51)	-0.171*** (-2.76)	-0.168*** (-2.80)
$\frac{z_i}{e_i} * I_i$	0.188** (2.36)	0.209*** (2.62)	0.096* (1.65)	0.114** (2.03)
$\frac{z_i}{e_i} * E_i$	0.263** (2.15)	0.282** (2.20)	0.161** (2.45)	0.151** (2.27)
Concentration Index	-0.104 (-1.14)	-0.118 (-1.24)	-0.092 (-1.36)	-0.100 (-1.47)
% Union Members	0.028 (0.09)	0.054 (0.17)	0.131 (0.57)	0.137 (0.59)
$\frac{Capital}{Labour}$	4.405 (0.55)	5.344 (0.64)	2.750 (0.46)	3.255 (0.54)
Scale	0.023 (1.02)	0.023 (0.99)	0.026 (1.58)	0.027 (1.60)
Constant	21.84*** (4.65)	22.56*** (4.57)	21.09*** (6.01)	21.51*** (6.07)
% I=1	0.70	0.46	0.70	0.46
% E=1	0.50	0.50	0.50	0.50
N	277	277	277	277
Model F***	1.79*	1.90*	2.86***	3.04***
AIC	18.32	18.41	18.01	18.02

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.

NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is absolute import elasticity. Percentile values of lobbying expenditures (from 10th to 40th) are used to define the cutoff above which I is equal to 1. The cutoff to set E equal to 1 corresponds to the 50th percentile value of our media variable.

Table 2.7: Robustness Check: Alternative thresholds for the “Externality” indicator variable

Dependent Variable: NTM_i	20th Percentile	40th Percentile	20th Percentile	40th Percentile
$\frac{z_i}{e_i}$	-0.229*** (-2.89)	-0.175*** (-2.68)	-0.175*** (-2.95)	-0.146*** (-2.74)
$\frac{z_i}{e_i} * I_i$	0.196*** (3.11)	0.174*** (3.17)	0.109* (1.86)	0.099* (1.68)
$\frac{z_i}{e_i} * E_i$	0.196** (2.53)	0.148** (2.09)	0.169*** (2.86)	0.146** (2.32)
Concentration Index	-0.121* (-1.71)	-0.118* (-1.72)	-0.096 (-1.38)	-0.096 (-1.38)
% Union Members	0.137 (0.58)	0.145 (0.63)	0.132 (0.56)	0.143 (0.61)
$\frac{Capital}{Labour}$	2.263 (0.37)	3.164 (0.53)	2.534 (0.41)	2.992 (0.49)
Scale	0.030* (1.76)	0.030* (1.80)	0.029* (1.70)	0.029* (1.70)
Constant	23.57*** (6.28)	23.16*** (6.39)	21.33*** (5.91)	21.29*** (5.90)
% I=1	0.70	0.46	0.70	0.46
% E=1	0.40	0.40	0.60	0.60
N	277	277	277	277
Model F	2.84***	2.97***	3.07***	2.99***
AIC	15.60	15.54	15.61	15.60

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%.

NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is absolute import elasticity. Percentile values of our media variable (from 10th to 40th) are used to define the cutoff above which E is equal to 1. The cutoff to set I equal to 1 corresponds to the 50th percentile value of lobbying expenditures.

Table 2.8: Robustness Check: Exclusion of sectors with the lowest proportion of final goods over total output

Dependent Variable: NTM_i	<i>Excluding 10th percentile</i>		<i>Excluding 20th Percentile</i>	
	20th Percentile	40th Percentile	20th Percentile	40thPercentile
$\frac{z_i}{e_i}$	-0.233*** (-2.71)	-0.221*** (-2.64)	-0.258** (-2.51)	-0.244** (-2.45)
$\frac{z_i}{e_i} * I_i$	0.113** (1.97)	0.108* (1.86)	0.110* (1.80)	0.104* (1.70)
$\frac{z_i}{e_i} * E_i$	0.239*** (3.01)	0.230*** (2.95)	0.261*** (2.78)	0.250*** (2.72)
Concentration Index	-0.074 (-0.96)	-0.072 (-0.94)	-0.075 (-0.89)	-0.072 (-0.86)
% Union Members	0.130 (0.52)	0.125 (0.50)	0.251 (0.88)	0.243 (0.86)
$\frac{Capital}{Labour}$	1.403 (0.21)	1.447 (0.22)	1.846 (0.22)	1.938 (0.23)
Scale	0.033* (1.84)	0.034* (1.90)	0.029 (1.40)	0.031 (1.48)
Constant	20.12*** (5.12)	20.25*** (5.15)	19.81*** (4.53)	19.87*** (4.56)
% I=1	0.70	0.46	0.73	0.50
% E=1	0.50	0.50	0.50	0.50
N	250	250	221	221
Model F	2.89***	2.86***	2.50**	2.48**
AIC	14.20	14.19	12.93	12.97

Notes: t statistics are shown in parentheses.

* denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%. NTM_i is computed as NTM prevalence ratio. z_i is the inverse of import penetration, and e_i is absolute import elasticity. Percentile values of lobbying expenditures (from 10th to 40th) are used to define the cutoff above which I is equal to 1. The cutoff to set E equal to 1 corresponds to the 50th percentile value of our media variable.

Table 2.9: List of issues selected to create the instrumental variable for lobbying

ORTHOGONAL ISSUES
ACCOUNTING
ADVERTISING
ALCOHOL AND DRUG ABUSE
ARTS/ENTERTAINMENT
BANKING
BANKRUPTCY
BUDGET/APPROPRIATIONS
CIVIL RIGHTS/CIVIL LIBERTIES
COMMUNICATIONS/BROADCASTING/RADIO/TV
CONSTITUTION
DISASTER PLANNING/EMERGENCIES
DISTRICT OF COLUMBIA
EDUCATION
ENERGY/NUCLEAR
FAMILY ISSUES/ABORTION/ADOPTION
FINANCIAL INSTITUTIONS/INVESTMENTS/SECURITIES
GAMING/GAMBLING/CASINO
GOVERNMENT ISSUES
HOMELAND SECURITY
HOUSING
INDIAN/NATIVE AMERICAN AFFAIRS
INSURANCE
INTELLIGENCE
LAW ENFORCEMENT/CRIME/CRIMINAL JUSTICE
MEDIA (INFORMATION/PUBLISHING)
MEDICAL/DISEASE RESEARCH/CLINICAL LABS
MEDICARE/MEDICAID
MINTING/MONEY/GOLD STANDARD
POSTAL
RAILROADS
REAL ESTATE/LAND USE/CONSERVATION
RELIGION
RETIREMENT
ROADS/HIGHWAY
TAXATION/INTERNAL REVENUE CODE
URBAN DEVELOPMENT/MUNICIPALITIES
UTILITIES
VETERANS
WASTE (HAZARDOUS/SOLID/INTERSTATE/NUCLEAR)
WELFARE

CHAPTER 3

The Role of Political Ideology, Lobbying and Electoral Incentives in Decentralized U.S. State Support of the Environment¹

¹This chapter is based on the paper “The Role of Political Ideology, Lobbying and Electoral Incentives in Decentralized U.S. State Support of the Environment” by Lucia Pacca (L.A.S.E.R. Doctoral School, Universities of Milan, Pavia and Brescia), Gordon Rausser (University of California, Berkeley) and Alessandro Olper (University of Milan and LICOS, KU University, Leuven)

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.

3.1 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 3.2. In Section 3.3, we illustrate the theoretical framework of our political economic analysis of environmental policies. Section 3.4 presents the data employed. Our identification strategy and the empirical results are contained in Sections 3.5 and 3.6, respectively. In Section 3.7, we present robustness tests and an evaluation of our identification strategy. Finally, Section 3.8 provides some concluding remarks.

3.2 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.

3.3 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:

$$e = Z(g) \tag{3.1}$$

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 :

$$X = [1 - A(e)]F(L, K) \tag{3.2}$$

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 (3.1), we find by the chain rule that

$dA/dg > 0$.

Individuals are characterized by the following utility function:

$$U_i = x_0 + u(x) - D_i(eX) \quad (3.3)$$

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:

$$V_i(Y_i, e) = s(e) + Y_i - \mu_i d(e) \quad (3.4)$$

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:

$$e_i = \arg \max_e \{V_i = s(e) + 1 - \mu_i d(e)\} \quad (3.5)$$

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:

$$V_I = \arg \max_e \left\{ s(e) + 1 + \frac{\pi(p(e), e)}{N_I} - \mu_I d(e) \right\} \quad (3.6)$$

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:

$$G_j = b_{Ej}C_{Ej}(e_j) + b_{Ij}C_{Ij}(e_j) - a_jM(e_j - e_p) \quad (3.7)$$

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 (3.1), we can re-express

(3.7) as follows:

$$G_j = b_{Ej}C_{Ej}(Z(g)) + b_{Ij}C_{Ij}(Z(g)) - a_jM(Z(g) - e_p) \quad (3.8)$$

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

$$g^\circ = \arg \max_g \{b_{Ej}C_E(Z(g)) + b_{Ij}C_I(Z(g)) - a_jM(Z(g) - e_p)\} \quad (3.9)$$

The equilibrium expenditures policy g° will be given by the following first order condition²:

$$b_{Ej}W'_E(Z(g^\circ)) + b_{Ij}W'_I(Z(g^\circ)) - a_jM'(Z(g^\circ) - e_p) = 0 \quad (3.10)$$

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 "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

²The first order condition in (3.10) comes from simplification of the following derivative, obtained by applying the chain rule:

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

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.

3.4 Data

3.4.1 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 environment³.

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

³More 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, 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.”

of appropriations to which he objects. Accordingly, it is reasonable to hypothesize that governors' ideology matters for environmental expenditure policies.

3.4.2 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 reported⁴.

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 3.5 and 3.6, 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, 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

⁴We exclude from our data candidates affiliated to independent parties, considering only Democratic and Republican politicians.

Table 3.1: 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.

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 3.1 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.

3.4.3 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 3.2 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).

3.5 Empirical Strategy

Our empirical strategy is structured 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

Table 3.2: Summary Statistics: Sample Means, Main Variables

	Democratic Governors	Republican Governors
Environmental Expenditures (<i>per capita</i> 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.

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 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.

3.5.1 Empirical Specification

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

$$Y_{st} = \alpha + \beta_1 D_{st} + \beta_2 D_{st} * C_{st} + \gamma' X_{st} + \delta_s + \phi_t + \epsilon_{st} \quad (3.11)$$

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 3.11, 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 3.11. 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 instruments, 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 assess 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:

$$Y_{st} = \alpha + \beta_1 D_{st} + \beta_2 D_{st} * Oil_s + \beta_3 D_{st} * E_s + F(MV_{st}) + F_b(MV_{st}) * D_{st} + \delta_s + \phi_t + \epsilon_{st} \quad (3.12)$$

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 (3.12), 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 results⁵.

⁵We do not include additional covariates in equation 3.12, 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

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 3.12. 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), 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.

holds if the covariates are balanced at the threshold, which we show holds in our robustness checks section.

3.6 Results

3.6.1 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 3.1 and 3.2. 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 3.2 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 3.3, 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 industries⁶. To evaluate this relationship, we use a dataset structure combining all possible candidate-industry pairs 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

⁶The estimated baseline equation is the following:

$$\ln(\text{Contributions}_{ip}) = \alpha + \beta_1 \text{Poll}_i + \beta_2 D_p + \beta_3 \text{Poll}_i * D_p + \delta X_p' + \sigma_s + \epsilon_{ip} \quad (3.13)$$

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.

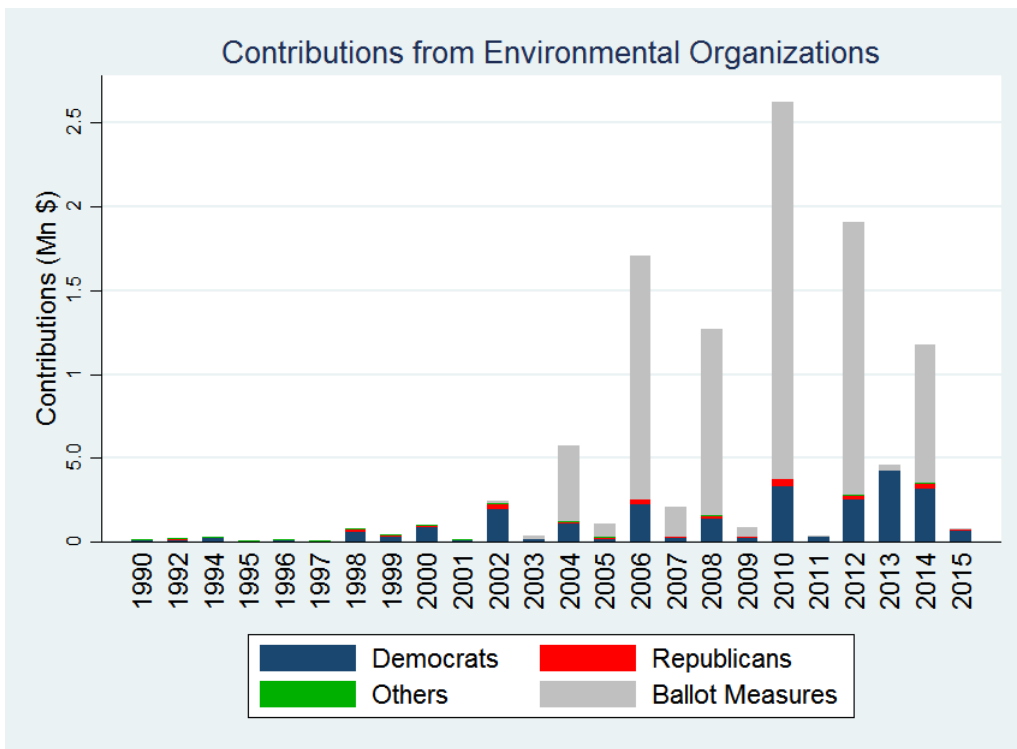


Figure 3.1: Source: Authors' calculation from *National Institute on Money in States' Politics*

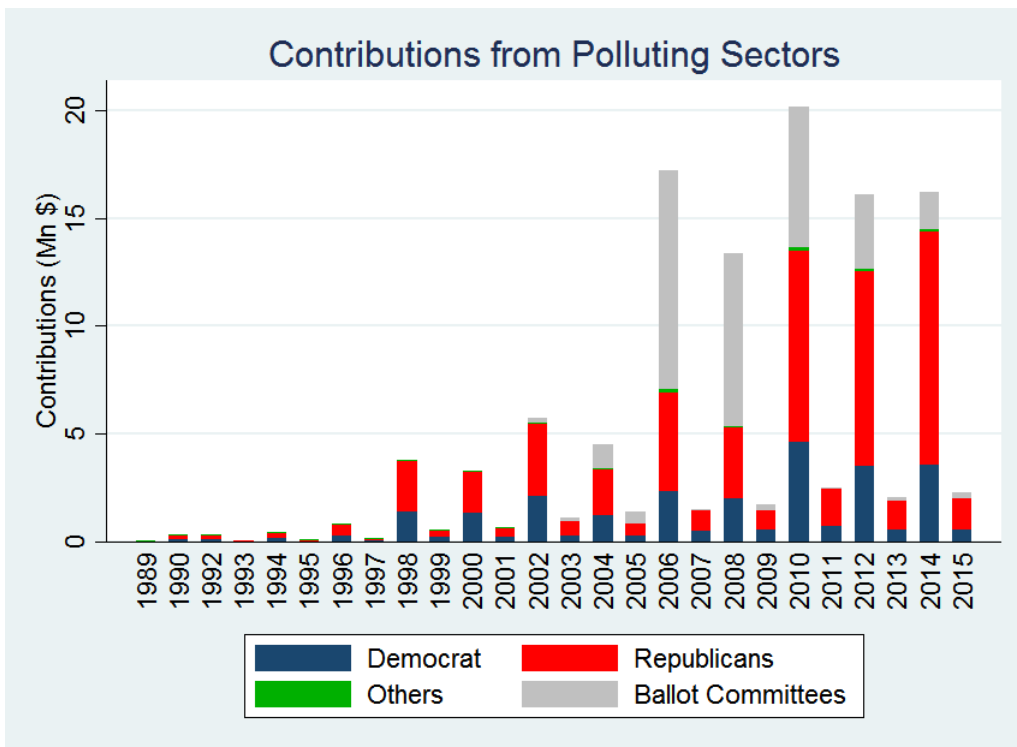


Figure 3.2: Source: Authors' calculation from *National Institute on Money in States' Politics*

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 3.3, 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).

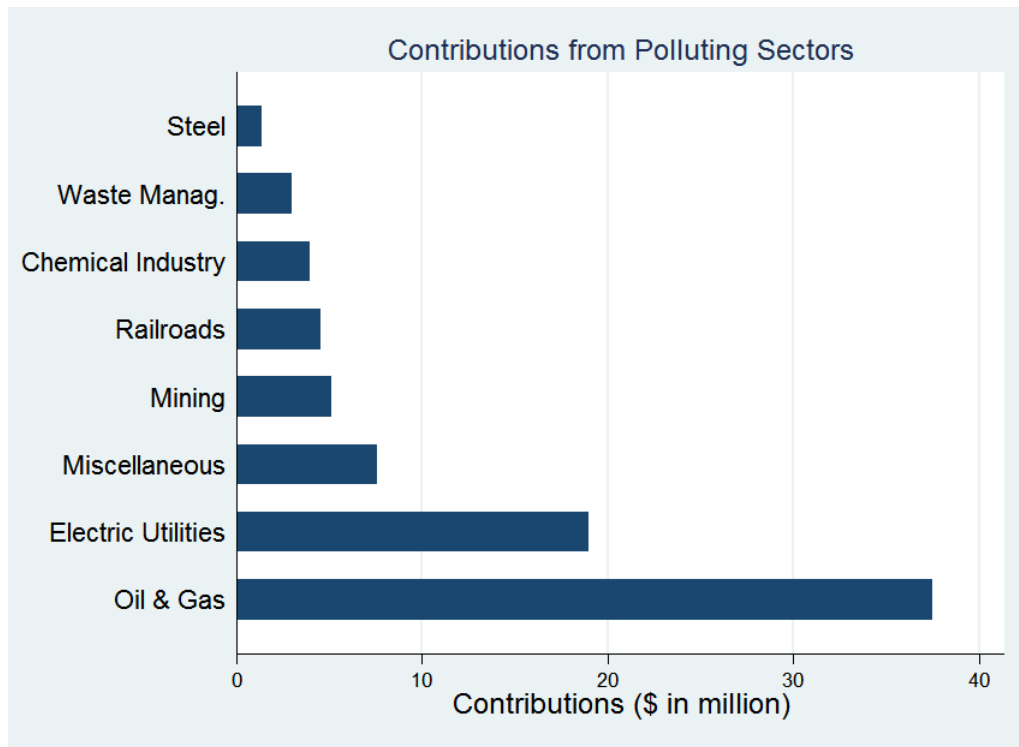


Figure 3.3: Contributions from Polluting Sectors by Industry

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 3.3 can be explained by the fact that Democrats might have a more environmentalist ideology as compared to Republicans, attracting more

Table 3.3: Determinants of Political Contributions, 2010

Dependent Variable ln(Contributions)	(1)	(2)	(3)	(4)
Democrat	0.153* (1.87)	0.181** (2.12)	0.152* (1.86)	- -
Polluting Sector	-1.270*** (-16.26)	-5.304*** (-27.05)	-5.314*** (-27.20)	-1.271*** (-15.87)
Democrat*Polluting Sector	-0.600*** (-9.68)	-0.598*** (-9.66)	-0.599*** (-9.66)	-0.597*** (-9.58)
Polluting Sector*Oil	0.041*** (3.96)	0.040*** (3.70)	0.041*** (3.96)	0.038*** (4.23)
Democrat*Polluting Sector*Oil	-0.025** (-2.22)	-0.021* (-1.82)	-0.025** (-2.22)	-0.019*** (-2.71)
House Member	-3.444*** (-10.91)	-3.319*** (-11.25)	-3.443*** (-10.91)	- -
Senate Member	-2.572*** (-7.97)	-2.569*** (-8.01)	-2.571*** (-7.97)	- -
General Election	2.319*** (31.13)	2.062*** (11.21)	2.321*** (31.16)	- -
Ln(Oil)	- -	0.037** (2.39)	- -	- -
Constant	5.309*** (14.38)	7.674*** (24.44)	7.717*** (19.75)	3.854*** (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.

contributions from ideological environmental groups and fewer donations from polluting industries. This explanation would be in line with previous findings from the literature as well as with the theoretical framework outlined in Section 3.3, 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.

3.6.2 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 3.4 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 3.4 reports results from the Regression Discontinuity Design model specified in equation 3.12. 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

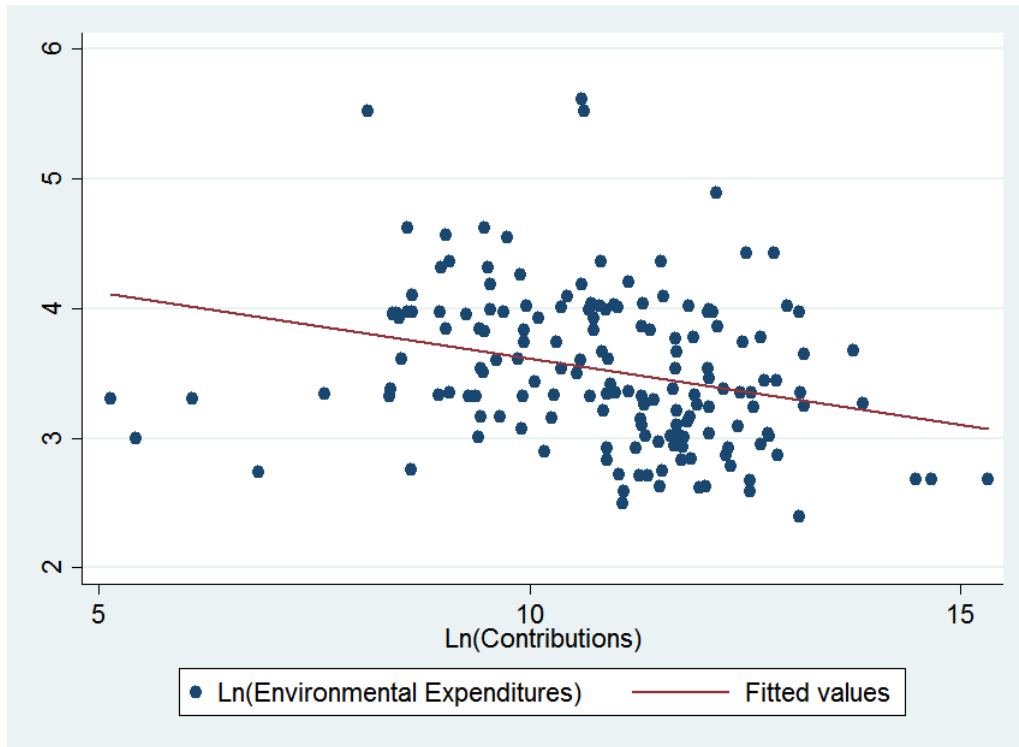


Figure 3.4: Correlation between contributions and environmental expenditures

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 (3.12) 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, suggesting that environmental expenditures increase by about 10% under Democratic governors as compared to Republican ones. These results are confirmed in Figures 3.7a-3.7c (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 3.5 shows results from our baseline RDD, dividing the sample into subsamples of observations above and below the median value of states' oil reserves

Table 3.4: RDD, Governor's Political Ideology and Environmental Expenditures

	I Order	II Order	III Order	IV Order
Democrat	0.078*** (2.84)	0.102** (2.52)	0.144*** (2.73)	0.154** (2.33)
Margin	-0.035*** (-3.48)	-0.042 (-1.24)	-0.017 (-0.24)	-0.146 (-1.01)
Democrat*Margin	0.038*** (2.74)	0.016 (0.36)	-0.141 (-1.63)	0.080 (0.45)
Margin ²	- -	-0.001 (-0.19)	0.013 (0.37)	-0.103 (-0.89)
Democrat*Margin ²	- -	0.00749 (0.79)	0.057 (1.33)	0.094 (0.67)
Margin ³	- -	- -	0.002 (0.44)	-0.032 (-1.00)
Democrat*Margin ³	- -	- -	-0.010** (-2.01)	0.046 (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
<i>N</i>	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.

(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 3.5 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 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 3.5, 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 3.5 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 3.6, 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

Table 3.5: RDD, Sample Splitting According to Variables' Median

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

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

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

	(1) Non Term Limited	(2) Term Limited
Democrat	0.170** (2.41)	0.183 (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 3.6: RDD with Heterogeneous Effects, Democratic Margin of Victory

Dependent Variable: ln(Environmental Expenditures)	(1)	(2)	(3)	(4)
Democrat	0.164** (2.51)	0.197** (2.50)	0.192** (2.44)	0.185** (2.33)
Democrat*Oil	-0.005** (-2.07)	-0.006** (-2.15)	-0.024*** (-4.72)	-0.024*** (-4.64)
Democrat*Green Voters	- -	-0.036 (-0.67)	0.001 (0.02)	0.009 (0.16)
Democrat*Green Voters*Oil	- -	- -	0.022*** (3.72)	0.022*** (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.

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 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 3.3. 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.

3.7 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 3.10, 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 3.11, show that none of the covariates is discontinuous at the threshold, providing further evidence of the reasonableness 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 3.7a-3.7c. Figures 3.8a-3.8c, 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 3.8c and 3.8d

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.

3.8 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 polluting industries is strong may be due to a combination of 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.

3.9 Appendix A

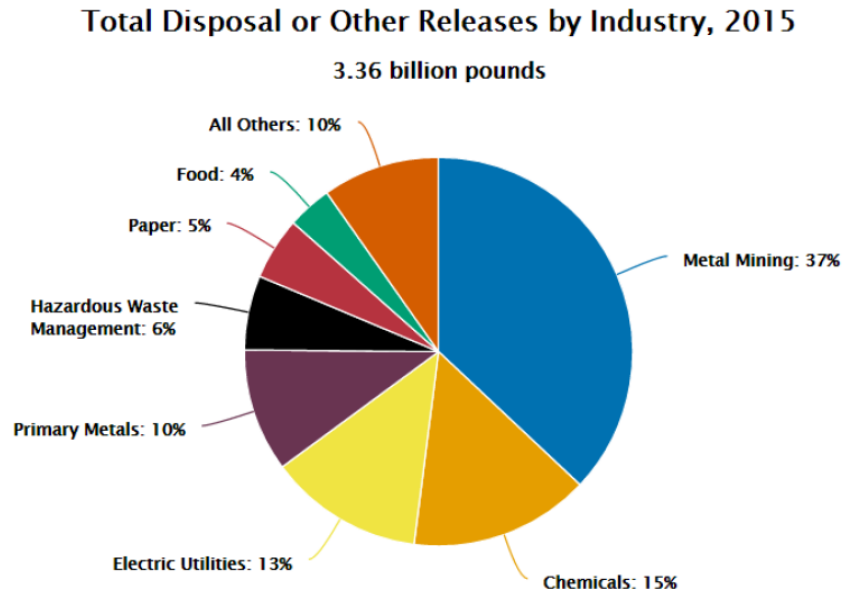


Figure 3.5: Contributions of NAICS sectors to toxic releases, 2015

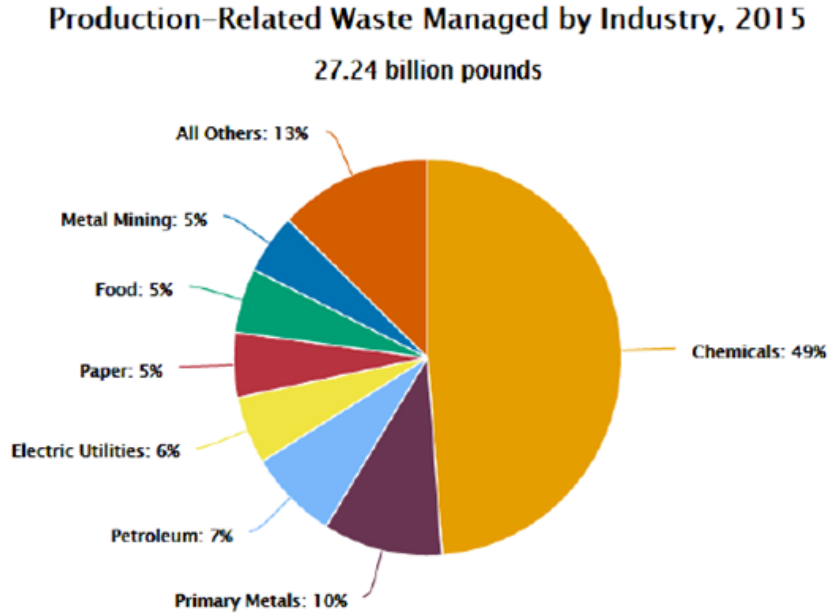


Figure 3.6: Contributions of NAICS sectors to production-related waste managed, 2015

Table 3.7: Determinants of Political Contributions, Linear Probability Model, 2010

Dependent Variable Pr(Contributions>0)	(1)	(2)	(3)	(4)
Democrat	0.018** (2.08)	0.019** (2.08)	0.018** (2.06)	- -
Polluting Sector	-0.164*** (-16.79)	-0.678*** (-32.88)	-0.679*** (-33.12)	-0.165*** (-16.38)
Democrat*Polluting Sector	-0.070*** (-8.17)	-0.070*** (-8.15)	-0.070*** (-8.14)	-0.070*** (-8.00)
Polluting Sector*Oil	0.005*** (4.19)	0.005*** (4.02)	0.005*** (4.19)	0.005*** (4.36)
Democrat*Polluting Sector*Oil	-0.003* (-1.79)	-0.002 (-1.60)	-0.003* (-1.79)	-0.002 (-1.61)
House Member	-0.252*** (-8.39)	-0.235*** (-8.47)	-0.252*** (-8.39)	- -
Senate Member	-0.177*** (-5.72)	-0.172*** (-5.78)	-0.177*** (-5.71)	- -
General Election	0.266*** (32.73)	0.241*** (11.73)	0.266*** (32.77)	- -
ln(Oil)	- -	0.003* (1.69)	- -	- -
Constant	0.304*** (9.10)	0.834*** (27.71)	0.610*** (16.16)	0.511*** (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 3.8: Determinants of Political Contributions, 2000

Dependent Variable ln(Political Contributions)	(1)	(2)	(3)	(4)
Democrat	-0.067 (-0.87)	-0.024 (-0.29)	-0.067 (-0.87)	- -
Polluting Sector	-1.026*** (-11.18)	-1.268*** (-12.47)	-1.270*** (-12.50)	-1.026*** (-10.90)
Democrat*Polluting Sector	-0.487*** (-7.40)	-0.487*** (-7.41)	-0.487*** (-7.41)	-0.486*** (-7.16)
Polluting Sector*Oil	0.044*** (3.81)	0.043*** (3.54)	0.044*** (3.81)	0.040*** (3.79)
Democrat*Polluting Sector*Oil	-0.022* (-1.68)	-0.019 (-1.41)	-0.022* (-1.68)	-0.015** (-1.98)
House Member	-3.779*** (-9.17)	-3.554*** (-7.72)	-3.778*** (-9.17)	- -
Senate Member	-2.980*** (-7.23)	-2.944*** (-6.28)	-2.979*** (-7.22)	- -
General Election	2.189*** (28.72)	1.906*** (9.34)	2.188*** (28.75)	- -
Ln(Oil)	- -	0.021 (1.42)	- -	- -
Constant	5.518*** (13.71)	7.376*** (16.32)	7.256*** (17.67)	3.798*** (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 3.9: Determinants of Political Contributions, 2000: Linear Probability Model

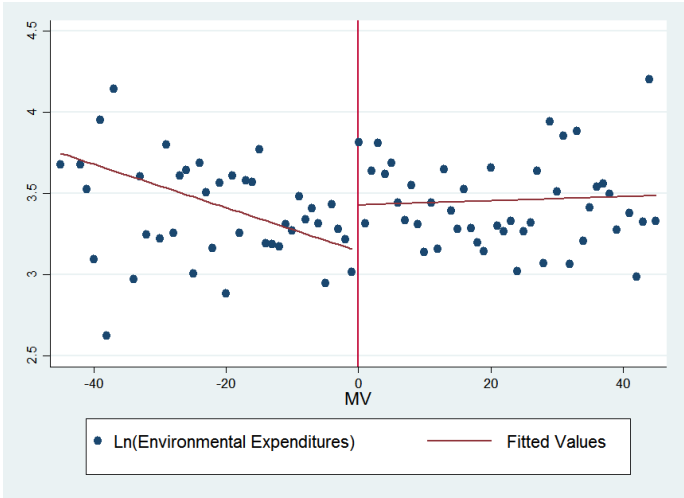
Dependent Variable Pr(Political Contributions>0)	(1)	(2)	(3)	(4)
Democrat	-0.009 (-1.01)	-0.006 (-0.61)	-0.009 (-1.01)	- -
Polluting Sector	-0.123*** (-9.66)	-0.130*** (-10.32)	-0.130*** (-10.35)	-0.123*** (-9.41)
Democrat*Polluting Sector	-0.066*** (-6.64)	-0.066*** (-6.64)	-0.066*** (-6.64)	-0.066*** (-6.43)
Polluting Sector*Oil	0.006*** (3.67)	0.006*** (3.46)	0.006*** (3.67)	0.006*** (3.63)
Democrat*Polluting Sector*Oil	-0.003 (-1.51)	-0.002 (-1.31)	-0.003 (-1.51)	-0.002* (-1.75)
House Member	-0.265*** (-8.35)	-0.249*** (-6.42)	-0.265*** (-8.35)	- -
Senate Member	-0.199*** (-6.25)	-0.202*** (-5.24)	-0.199*** (-6.25)	- -
General Election	0.267*** (27.92)	0.237*** (10.04)	0.267*** (27.93)	- -
ln(Oil)	- -	0.002 (1.06)	- -	- -
Constant	0.590*** (17.01)	0.772*** (20.65)	0.796*** (22.26)	0.522*** (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%.

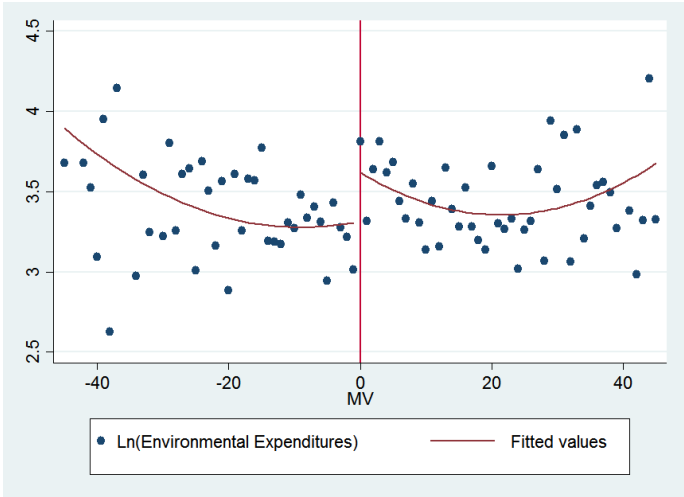
The variable *Oil* is weighted by states' area.

Figure 3.7: Environmental Expenditures by Democratic Margin of Victory

(a) I order polynomial



(b) II order polynomial



(c) III order polynomial

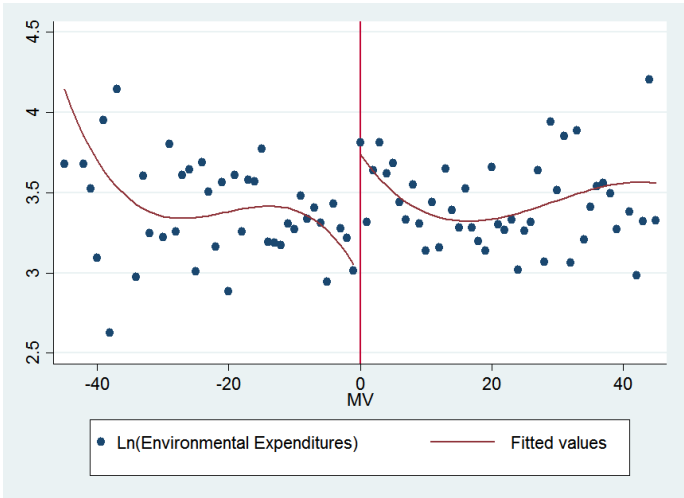


Table 3.10: Placebo Test: RDD with Dependent Variable from Previous and Subsequent Terms

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

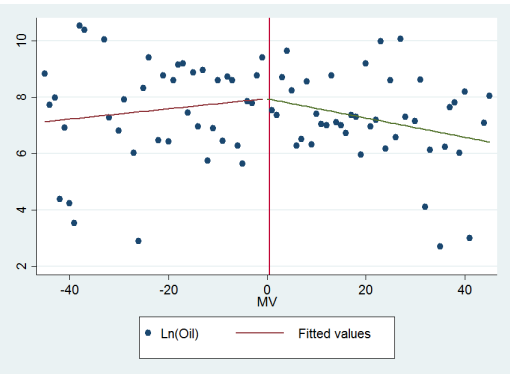
Table 3.11: Placebo Test: RDD with Baseline Covariates

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

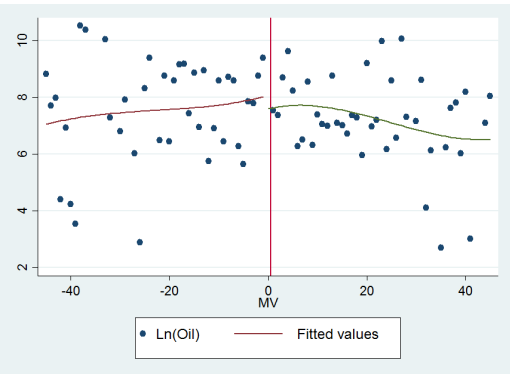
Notes: t statistics are shown in parentheses. Standard errors are clustered at term level. * denotes significance at 10%. ** denotes significance at 5%. *** denotes significance at 1%. Margin of Victory is computed as the difference between the percentage of votes given to the Democratic candidate and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

Figure 3.8: Interaction Variables and Democratic Margin of Victory

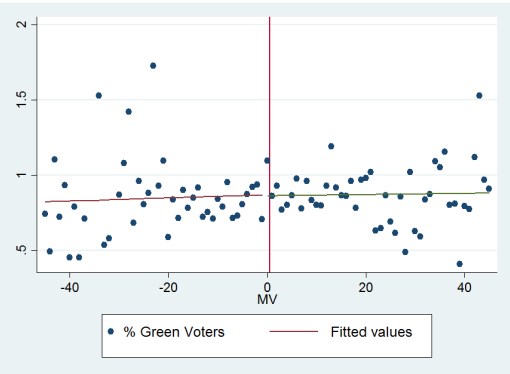
(a) $\ln(\text{Oil})$ and margin of victory, I order polynomial



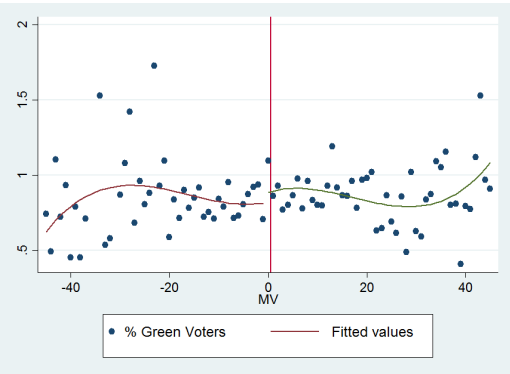
(b) $\ln(\text{Oil})$ and margin of victory, III order polynomial



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



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



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