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# Electoral Politics and Bureaucratic Discretion: Evidence from Environmental Licenses and Local Elections in Brazil\*

Claudio Ferraz<sup>†</sup>

Instituto de Pesquisa Econômica Aplicada

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## Abstract

It is widely argued that delegating policy implementation to bureaucrats, rather than politicians, insulates policies from electoral manipulations. However, when politicians have a powerful influence over bureaucrats, they can capture the implementation of policies in a way that will favor them at the polls. This paper examines whether the implementation of regulation is affected by electoral motivations using an unique dataset of applications and approvals of environmental licenses for new industrial plants in urban Brazil. I find that the approval of environmental licenses varies according to the electoral cycle and distributive politics motivations. In years of gubernatorial elections, more environmental licenses are approved, specially in municipalities with a large presence of loyal voters to the governor. In years of mayoral elections, the approval rate is larger where the mayor belongs to the same party as the governor. Using variation in binding term-limits across municipalities, I also find suggestive evidence that the approval of licenses vary according to the possibility that local politicians have of repaying political favors in the near future (through the possibility of getting re-elected).

*Keywords:* Electoral Politics, Intergovernmental Relations, Bureaucrats, Regulation;

*JEL classification:* D73, D78, H77, Q28.

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<sup>†</sup>Instituto de Pesquisa Econômica Aplicada, Av. Presidente Antonio Carlos 51, 17o andar. Rio de Janeiro, RJ, 20020-010, Brasil. Email: cferraz@ipea.gov.br

# 1 Introduction

Political accountability is generally perceived as an important mechanism to align politicians' choices with voters' preferences. There is growing evidence that re-election concerns make incumbent politicians more fiscally responsible, less corrupt, and more aligned with voters' preferences (Besley and Case (1995), Ferraz and Finan (2005), List and Sturm (2006)). However, political accountability might generate distortions when voters are imperfectly informed about the costs and benefits of policies. Agency can lead to poorer quality social decisions because in the presence of re-election incentives incumbent politicians may choose policies that are excessively popular compared to what voters might think to be optimal in the long-run (Besley (2006); Maskin and Tirole (2004)).

Modern democracies have limited this type of opportunistic behavior by delegating key policy areas to independent bureaucrats who are supposed to make policy decisions in the absence of political intervention.<sup>1</sup> However, insulation of bureaucrats from electoral politics requires strong political institutions and a large degree of transparency. In their absence, incumbent politicians seeking re-election might exert political control over bureaucrats for the implementation of policies that will favor them at the polls.

Our understanding of the relationship between electoral politics and the political influence on bureaucratic decision-making is scarce. While there is large evidence for the U.S. suggesting that bureaucrats are controlled by politicians (see Moe (1985), Scholz and Wei (1986), Weingast and Moran (1983)), few studies link bureaucratic discretion to electoral motivations. On the other hand, the literature on electoral cycles and distributive politics focuses on the choice of government expenditures without paying much attention to other important policies that can be manipulated by bureaucrats near elections.

This paper examines whether electoral politics affect bureaucrats' implementation of policies. Using a unique dataset of applications and approvals of environmental licenses in 645 municipalities of São Paulo, Brazil, and variation in election cycles, I test whether local level bureaucrats are influenced by electoral considerations in deciding whether to approve environmental licenses for firms applying to build and start operations in potentially pollutant activities.

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<sup>1</sup>See Alesina and Tabellini (2004) for a theoretical model of politicians and bureaucrats. Khemani (2005) shows that delegating the decision on intergovernmental transfers to an external agency decreases the partisan effect of targeting.

I present evidence that bureaucrats are “captured” by politicians to change the approval of environmental licenses based on electoral politics. The results suggest an increase in the approval of environmental licenses in elections years, in particular, in years of municipal elections. I also find evidence consistent with bureaucrats targeting environmental licenses based on electoral politics. In gubernatorial election years, this pattern is reversed and more licenses are approved in municipalities where there is a large presence of “core supporters”. In years of mayoral elections, there are more licenses approved in locations where the mayor belongs to the same party as the governor *and* mayors can get re-elected. This result is consistent with the model of Grossman (1994) where the central politician helps local political allies who, in exchange, use of their political capital for gathering votes for the center politician.

Although electoral politics is usually tested by looking at distributive transfers, the approval decision on environmental licenses in Brazil provide an interesting case to study the influence of electoral politics on bureaucrats’ decisions. First, there are strong reasons to believe that incumbent politicians would be interested in restricting the stringency of environmental regulation and increasing environmental license approvals in election years.<sup>2</sup> Entry regulations have been shown to reduce plant births and slow down the growth of economic activity (e.g. Becker and Henderson (2000); List et al. (2003); Bertrand and Kramarz (2002)). Moreover, environmental licenses in Brazil create a barrier to entry in industrial activities since entrepreneurs can be fined and prosecuted for building plants or starting operations without licenses. Second, the state of São Paulo is the most industrialized state in Brazil and concentrates most of the heavy polluting industries. While environmental policy in Brazil is decentralized to the state level, the São Paulo environmental agency further decentralizes the approval of licenses to 35 local branches. Thus, local bureaucrats have considerable discretion on local environmental regulation decisions. Third, mayors in Brazil have more discretionary power than in other countries since they have access to large sums of resources and are in charge of providing a substantial portion of public services. Hence, the exchange of political favors between governors and mayors is common (see Bugarin and Ferreira (2006)).

The findings from this paper contribute to four literatures. First, it is directly related to an emerging literature that examines how political considerations affect the implementation of environmental policies.<sup>3</sup> Evidence from the implementation of the clean air and water acts in the U.S. suggest that executive and legislative efforts at political control affected the EPA level of

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<sup>2</sup>See Greenstone (2002) for estimates of the impact of environmental regulation on economic activity for the U.S.

<sup>3</sup>See Oates and Portney (2005) for a recent survey on the political economy of environmental policy.

enforcement activity (Ringquist (1995), Wood (1988)). Political considerations such as the state of the local economy and characteristics of the regulated firms have also been found to affect the decision of the EPA as to what mills to inspect or the level of stringency to apply (Helland (1998), DeShazo and Lerner (2004)). Differently from these studies, I look at the decision of license approvals in a developing country context where institutions are weaker and the possibility of political capture is more likely. Also, I use variation in both state level elections as well as local elections to understand how political motivations affect the implementation of environmental policy.

My results also provide a test for theories of distributive politics using the case of environmental policy. Hird (1993) test for distributive politics using data from the Superfund in the U.S. and Dahlberg and Johansson (2002) use data on environmental grants in Sweden. Different than those papers, I use data on bureaucratic actions rather than the distribution of intergovernmental grants. In contrast to Dahlberg and Johansson (2002), who find support for a model of distributive politics for “swing-voters”, I show that environmental license approvals in Brazil’s municipalities are targeted in electoral years to districts of “core supporters” and partisan local politicians (see Dixit and Londregan (1996)).

This paper is also related to studies that examine the relationship between politicians and bureaucrats. While there is a large literature that tests for influence of politicians over regulatory agencies in the U.S., less is known about this relation for developing countries (e.g. Coate (2002), Moe (1985), Weingast and Moran (1983)). Hence, my results complement the work of Cole (2004) and Khwaja and Mian (2005) who study the effect of political connections and electoral motivations on the allocation of credit in India and Pakistan.

Lastly, this paper is related to the literature on political business cycles that study whether incumbent politicians manipulate policies prior to elections to affect their re-election prospects (e.g. Alesina and Roubini (1992)). By showing that incumbent politicians use their political influence over bureaucrats to affect policy implementation in election years, this paper complements recent studies that uncover electoral manipulations through changes in the composition of government expenditures (Akhmedov and Zhuravskaya (2004); Drazen and Eslava (2005); Khemani (2004); List and Sturm (2006)).

The rest of the paper is organized as follows. The next section presents the institutional background of environmental regulation and local politics in Brazil. Next, I provide an overview of

the theoretical framework used to think about electoral manipulations, distributive politics, and bureaucratic capture. I then describe the data used in the analysis followed by the empirical methodology and the results. I end by presenting the concluding remarks for this paper.

## 2 Environmental Regulation and Local Politics in Brazil

### 2.1 Environmental Regulation in Brazil

Polluting industries are regulated in Brazil by a 1981 federal law entitled National Policy for the Environment.<sup>4</sup> However, similar to the U.S., state governments are allowed considerable discretion in deciding how to meet the federal environmental standards.<sup>5</sup> In Brazil, each state is required to have its own environmental agency. They are in charge of approving environmental licenses with individual pollution allowances, enforcing environmental standards, and ultimately punishing firms that do not comply with the laws.<sup>6</sup>

This paper focuses on the implementation of environmental regulation in the state of São Paulo, the richer and most industrialized state of Brazil. São Paulo has the largest concentrations of polluting industries and it became famous in the early eighties for having one of the most polluted cities in the world—Cubatão.<sup>7</sup> As a response to increasing pollution concentrations in the 1970s, the São Paulo environmental agency, Cetesb, became a strong regulator of potential water and air pollution activities. Today Cetesb is perceived as one of the most stringent environmental agencies in Latin America.<sup>8</sup>

The implementation of environmental regulation in São Paulo is decentralized dividing the state territory for regulatory purposes. First, Cetesb divides the state into several regions for air quality control purposes. Air pollution concentrations are monitored in each region periodically. In addition, Cetesb has 35 local branches in charge of inspecting local industrial plants, issuing licenses, and giving warnings and fines to non-compliant plants. Each regional office is in charge of several municipalities, except for the capital, the municipality of São Paulo, where there are

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<sup>4</sup>Federal law 6938

<sup>5</sup>See Oates (2002) for a more detailed description of decentralized environmental policy in the U.S.

<sup>6</sup>One exception is the approval of environmental licenses for large projects with potential environmental impacts.

Those are in charge of the federal government.

<sup>7</sup>See Lemos (1998) for a description of the political economy of cleaning up Cubatão during the eighties.

<sup>8</sup>São Paulo created its environmental agency, Cetesb, in 1973 and was the first state to issue a state level pollution control law in 1976

actually more than one agency within its boundaries. Figure 1 shows a map of São Paulo with the location of each regional office in a red triangle. Regional offices have discretionary power for inspecting and sanctioning local plants that do not comply with the regulation as well as to distribute environmental licenses. This discretion also makes local bureaucrats more vulnerable to capture by local politicians who might try to lobby for less stringent actions.

Environmental regulation is implemented with two instruments. First, all new industrial plants planning to start operations in a potentially pollutant activity need environmental licenses. These licenses state maximum allowed pollution emissions and effluent discharges based on the type of industrial activity, the system used to control pollution emissions, the maximum volume allowed, and the type of emissions. The second mechanism used in environmental regulation are inspections and sanctions applied to firms that do not comply with the maximum allowed emission level established in their licenses. Next, I describe these two processes in more detail.

### **Environmental Licenses**

Firms that want to start operations in activities that are potentially pollutant need two types of environmental licenses.<sup>9</sup> First, they need to obtain a license to build a new industrial plant (licença de instalação). The approval of this license is based on Cetesb's judgement of whether the location chosen by the entrepreneur is appropriate for the new industrial plant. The license usually establishes minimum requirements that firms need to comply before they start their operations. Once a firm gets the approval to set up a plant, the following step is obtaining a license to start operations (licença de operação). This document states that an industrial plant is environmentally sound and allows the plant to actually start its production process. In addition to licenses required for air pollution emissions, there are further requirements for effluent discharges which depend on the industrial plant location. The São Paulo water bodies are divided into categories according to the treatment effort needed to convert the water into domestic usage. The environmental license establishes maximum allowed effluent discharges depending on the water quality in each water basin. According to the law, effluents should always be treated before being discharged into the sewage system. In locations where there is no sewage system, the license establishes maximum allowed discharges into the water bodies.

The government of São Paulo issued a decree in 2002 where it specifies the type of productive

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<sup>9</sup>In some sectors the firm may also need a preliminary license (licença previa) before applying for a license to build the plant.

activities that need an environmental license. Industrial activities are ranked by their potential pollution emissions from 1 to 5 (5 being the most pollutant). Based on this ranking, I construct a list of the most pollution intensive activities considering those activities that are ranked 3 and above. This list is presented in the Appendix.

### **Sanctions for Non-Compliance**

The Cetesb inspects industrial plants periodically for compliance with regulations and limits established in the environmental license. There are substantial penalties for an industrial plant to either start operations without an environmental license or to emit pollution levels above those approved by the license. In both cases, the environmental agency will first issue a warning followed by a fine if compliance is not attained. The value of fines for firms that generate emissions above the maximum allowed levels are higher than those applied to firms that do not have an environmental license because the federal law imposes penalties varying from R\$500.00 to R\$10,000,000 on plants that emit above the maximum level allowed. These penalties are magnified if emissions cause direct damages to population health or the need to displace local populations affected by environmental degradation. However, in the case of the absence of a license, the plant might be closed temporarily or permanently and in extreme cases, the plant can also be demolished by the government, lose all fiscal incentives and have the capital equipment apprehended. In addition to these sanctions, the owner can also be prosecuted by criminal law and punished with detention from one to six months and/or the payment of a fine.<sup>10</sup>

## **2.2 Local Politics in Brazil**

There is large evidence that politicians use distributive transfers for electoral purposes in Brazil. These practices are common for both federal deputies who target resources from amendments based on patronage motivations (Ames (1995), Finan (2004)) and governors who use voluntary transfers to favor politically aligned mayors (Bugarin and Ferreira (2006)). Both type of politicians target transfers in exchange for the future local political support.

The use of targeted transfers for electoral purposes might have increased in Brazil after 1997 when an amendment to the constitution allowed governor to run for re-election in 1998 and mayors to try re-election in 2000. This institutional change allow us to use variation in re-election incentives

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<sup>10</sup>The criminal law for environmental crimes was approved by the Brazilian congress in 1998 and has generated active prosecutions thereafter.



for mayors across time and between municipalities. While the governor of São Paulo was the same from 1998 to 2005, some mayors got re-elected in 2000 while several others did not.<sup>11</sup> Hence, during the following 2001-2004 mandate there were two type of mayors in power– those serving in a second-term and facing a binding term-limit and those serving in a first-term and facing potential re-election. I exploit this variation in the empirical section to examine if the approval of environmental licenses differs by whether the mayor faces re-election incentives or not. In addition to term-limits, it is also important to note that governor elections always occur two years away from municipal elections. This introduces variation across municipalities and over time on the political coalition between mayors and the governor and allows me to test if political influence in the implementation of environmental regulation is due to the state environmental agency favoring mayors that belong to the same political party as the governor.

Differently from other countries, municipalities in Brazil represent an important political entity. They receive a large share of resources from the federal government and are responsible for the provision of multiple public services such as education, health, transportation, and garbage collection. In addition, they have considerable flexibility for hiring local public servants and deciding on their spending patterns. The large amount of resources available for mayors translates into political power, especially for mayors in large municipalities.

While most literature on Brazilian politics emphasize patronage through redistributive transfers, there are secondary mechanisms by which politicians can gain political support. They might favor given constituencies by influencing the actions taken by bureaucrats in the implementation of public policies. I examine these secondary mechanisms by focusing on the political influence in the approval of environmental licenses. These licenses can be subject to political influence because they play an important role on job creation and can be differentially targeted across municipalities.<sup>12</sup> Moreover, The São Paulo environmental agency, Cetesb, is in charge of approving environmental licenses. It is financed by the secretary of the environment and thus, its director is appointed by the governor and a large part of the budget is financed through the state government. Hence its actions might obey political motivations dictated by the governor.

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<sup>11</sup>While the data used in the analysis starts in 1997, we can consider the 1998-2005 administration as a continuation of the previous one since the elected governor Geraldo Alckmim belongs to the same party, and was the vice-governor, of Mario Covas, the elected governor in 1994.

<sup>12</sup>In section 5 I present evidence that in fact these licenses are positively associated with the number of industrial plants and industrial employment.

### 3 Theories and Evidence on Electoral Cycles, Distributive Politics, and the Political Control of Bureaucrats

The hypothesis tested in this paper builds on three distinct literatures. This section aims at presenting the theoretical background as well as empirical tests previously used to estimate the existence of electoral cycles in policy implementation, the degree of distributive politics and the extent to which politicians control the bureaucracies.

#### 3.1 Political Cycles and Distributive Politics

Models of political budget cycles explain variation in the implementation of economic policies near elections as a consequence of either partisan cycles or frictions in the political process. Earlier models explain electoral cycles in output and inflation using variation in political parties' preferences for macroeconomic policies. They show that even with rational voters, these preferences can lead to economic cycles that coincide with elections (Alesina (1987), Alesina (1988)). More recent models explain political cycles by incorporating frictions in the political process and assuming the opportunistic behavior of incumbent politicians. Rogoff (1990) suggests that politicians use expenditures in pre-election periods to signal their competence level. Since voters cannot observe ability, they use the government spending before an election to infer post-electoral competence. Thus, incumbent politicians running for re-election have an incentive to increase spending in a way that rational voters will retribute at the polls. In alternative types of models politicians can adopt levels of effort that are not observed by voters to improve economic performance. Voters do not observe this effort (hidden action) and are not able to distinguish the higher level of effort adopted near elections from competence and may re-elect the incumbent politician (Persson and Tabellini (2000)).

In addition to manipulations in election years, politicians can use distributive politics for electoral purposes. Discretionary transfers are generally available and can be used for two purposes. First, politicians implement programmatic redistribution aimed at pleasing local median voters and helping poorer districts.<sup>13</sup> Second, politicians use "pork barrel" redistribution which consists on transfers aimed at increasing voter's income irrespective of equity or efficiency considerations.

There are two widely used models that explain the use of "pork barrel" transfers. The "core voter model", developed by Cox and McCubbins (1986), assumes that risk averse political parties

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<sup>13</sup>Expenditures in education, for example.

make credible promises to three groups of voters: core supporters, swing voters, and opposition backers. Voters belonging to the core supporters group are more responsive to targeted transfers than those belonging to the other groups. Hence politicians maximizing expected political return will target transfer to the group for which the expected return from targeting resources is higher. Since core supporters are less risky than swing voters, politicians will target transfers at this group of voters in equilibrium.

An alternative model was developed by Dixit and Londregan (1996) and Lindbeck and Weibull (1987). They use a framework where candidates in a two-party system target direct income transfers to support each group's private consumption in order to maximize the probability of winning an election. Voters have ideological preferences over parties, but take voting decisions based on promised transfers in addition to these ideological preferences. This model generates a different prediction than the Cox and McCubbins (1986) model. It predicts that politicians should avoid core supporters and target those voters close to the cut-off of ideological indifference between the two parties (swing voters).

The challenge of testing these models consists on finding an appropriate measure for the existence of core supporters and swing voters. The most common approach is to use the distribution of votes and the closeness of the last election. Districts where the last election was won by a large majority are considered core supporter districts while those where the race was tight are considered swing voter districts. The evidence on these models is mixed. While some studies have found evidence consistent with incumbent politicians targeting districts where they obtained a large electoral support in the previous election (Ansolabehere and Jr. (2003), Case (2001)), other studies have found evidence consistent with the swing-voter model (Dahlberg and Johansson (2002), Schady (2000), Wright (1974)). Recent work on Latin American politics suggests that politicians might use a mixed strategy where they target different type of goods at different districts (Diaz-Cayeros and Magaloni (2003), Finan (2004)).

While the literature on election cycles and distributive politics have developed in a parallel way, recent models have tried to incorporate the fact that distributive politics may vary along with the electoral cycle. Drazen and Eslava (2006) present a model of political budget cycles in which incumbents influence voters by targeting government spending to specific groups at the expense of other voters or other expenditures. They present evidence from municipal governments in Colombia consistent with such model (Drazen and Eslava (2006)). Additional evidence of electoral

manipulation in the composition of government expenditures near elections is found by Akhmedov and Zhuravskaya (2004) using monthly data from local governments in Russia. Cole (2004) test for both election cycles and distributive politics using data from agricultural credit in India and finds evidence for electoral; manipulations in the loans given by public sector banks.

### 3.2 Politicians and Bureaucrats

Most of the empirical tests of redistribution theories and electoral cycles focus on government expenditures. However, there are other ways that politicians can use to target potential voters near elections and influence voting decisions. Politicians may influence bureaucrats that actually implement policies in a way that policy implementation will favor incumbent politicians. This subsection surveys the literature aimed at explaining the relationship between politicians and bureaucrats in the context of political influence in a regulatory agency.

The relationship between politicians and a government agency in charge of a regulatory activity is dominated by the asymmetry of information. Banks and Weingast (1992) model this interaction as an agency relationship where bureaucrats hold an informational advantage compared to political principals concerning variables with direct policy relevance. They show that an agency can exploit this information to obtain resources from superiors when the politicians cost of auditing the agency is high. Politicians, on the other hand, devise structures, tasks and budgets in ways that facilitate their control of the agency. Various studies have noted that in the U.S. the president, the congress, and courts control enforcement activities directly through various oversight powers (Scholz and Wei (1986)). These powers, in turn, make regulators responsive to political control (McCubbins, Noll, and Weingast (1997)).

A number of empirical studies provide evidence that in fact bureaucrats respond to major political changes in congressional committees and sub-committees, presidential regimes, and appointments of agency administrators (Coate (2002), Moe (1985), Olsen (1995), Ringquist (1995), Weingast and Moran (1983)). However, most of these studies use time-series variation in political changes to identify the effect of political control on bureaucratic behavior. Hence, it is not possible to control for other time varying characteristics that might simultaneously affect bureaucratic decision-making and political changes.

This paper uses the theoretical framework of election cycle and distributive politics models presented above to examine the extent to which the approval of environmental licenses for new

firms in polluting industries was manipulated near elections and targeted to municipalities based on distributive politics considerations. It differs from previous studies in two important aspects. First, I examine electoral cycles and distributive politics in the context of environmental regulation. While the manipulation of environmental regulation is generally perceived as a secondary policy for electoral purposes, I will show that it has substantial effects on job creation. Second I focus on state level implementation of environmental regulation. Hence, I investigate the interaction between the state governor and local regulatory agencies rather than the relationship of agencies with the legislative.<sup>14</sup> Third, I look at local bureaucracies and investigate how changes in the election cycle and in political variables determined at both the municipal and state level affect bureaucratic decision-making. This allows me to follow the decisions taken by local bureaucrats with respect to a large number of municipalities over time and use a fixed-effect estimation to control for unobserved heterogeneity. Moreover, time varying municipal characteristics are used to control for several confounding factor that might be correlated with political variation and bureaucratic choices.

My approach examines differential bureaucratic responses in gubernatorial and mayoral election years. I assume that governors influence environmental regulation with the objective of maximizing their vote share in the next election (or the probability of re-election). In years of mayoral elections, governors will influence regulators to target license approvals to municipalities where mayors can pay back with votes in the future gubernatorial election. Grossman (1994) provides a model of intergovernmental grants taking into account the interaction between local and central politicians. Federal politicians transfer resources to state politicians and help them get re-elected. In return, local politicians use their power to increase the local support of federal politicians. However federal politicians may face a commitment problem since they cannot write a contract over this arrangement. One way to increase the enforcement is to use the political party as a mediator and help local politicians that belong to the same party. In gubernatorial elections, these mayors are more likely to re-pay the political favor.

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<sup>14</sup>A number of papers also use cross-section variation in EPA regulatory actions to test for political influence on bureaucratic decision-making. Ando (1999) and Sigman (2001) use duration models to examine the political determinants of delays in regulatory actions. Cropper et al. (1992) examine the EPA decision of cancel or continue the registration of cancer-causing pesticides and relate it to interest groups and the EPA administrator identity.

## 4 Data

The empirical strategy used to identify political influence in environmental regulation consists of comparing the pattern of licenses approved by the environmental agency between election and non-election years together. In order to test for distributive motivations, I use data on political affiliation between mayors and the governor and the distribution of votes from previous elections to measure margins of victory. Before describing the estimation methods in detail, I begin with a description of the data.

The unit of observation used in the analysis is the municipality. There are 645 municipalities and 35 local environmental agency branches located across the state of São Paulo. Data on the implementation of environmental regulation by each local branch in each municipality was obtained from the São Paulo environmental agency (*Cetesb*) for 1996 to 2005. The dataset includes the number of environmental licenses applications and approvals for building new industrial plants and for starting operations in existing plants. It also includes the number of inspections made by the environmental agency in each municipality as well as the number of warnings and fines issued to firms that are not in compliance with the allowed pollution emissions standards.

As previously described, the approval of an environmental license is based on *Cetesb*'s judgement of whether the location chosen by the entrepreneur is appropriate for the new industrial plant. This judgement depends on two things. First, the demographic characteristics of the population affected by the polluting plant. To account for these characteristics, I use municipal data on population, population density and the proportion of urban population. I obtain this data from the So Paulo statistical office (SEADE).<sup>15</sup> Second, the license approval depends on the existing concentration of polluting plants in a given location. In order to control for this in the econometric analysis, I use a plant level census done yearly by the Ministry of Employment to obtain data on the number of industrial plants and the number of employed workers in each municipality by three digit industrial sectors.<sup>16</sup> Using the *RAIS*, I construct a measure of the number of industrial plants in each municipality as well as the proportion of plants that belong to pollution-intensive industries.<sup>17</sup> In addition, I use the *RAIS* data to construct a measure of aggregate industrial employment in the

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<sup>15</sup>The education level of a community is also likely to affect willingness to pay for environmental quality. Unfortunately, data on education at the municipal level is only available for the 2000 census.

<sup>16</sup>The survey is called *RAIS* and includes all firms that belong to the formal sector. They are obliged to answer the survey by law.

<sup>17</sup>I use a list of the most pollution intensive industries provided by the *Cetesb*. See Appendix.

municipality which is used to control for business cycles that might influence the approval decision of environmental licenses.<sup>18</sup>

Finally, I gather election data for mayors, local legislators, and the governor from the *Tribunal Superior Eleitoral* (TSE). This data consists of names, parties and votes of all candidates in each election between 1992 and 2000.<sup>19</sup> I first use the mayoral and gubernatorial election data to construct a measure of the margin of victory (or loss) for each incumbent politician in all municipalities. In addition, I use data from the governor election to build an indicator of political match between mayors and the governor. I create an indicator that equals one if they belong to the same political party and zero otherwise. Lastly, I construct a variable that indicates whether the mayor faces a binding term-limit in the 2001-2004 mandate. I match the names of politicians elected in 1996 with those elected in 2000 by full name. Mayors that were elected for a second-term in 2000 were categorized as facing a binding term-limit. Differences in names were then checked one by one to ensure that small variations in names did not affect the classification.<sup>20</sup>

Table 1 presents summary statistics from 1997 to 2005 on the municipalities used in the analysis. Municipalities have on average 59,000 inhabitants and are largely urban (81 percent of the population lives in urban areas). There are on average 122 industrial plants located in each municipality, although the variance is large because industrial centers such as the city of São Paulo concentrate a large share. When we split these plants by ISIC codes, there are on average 20 percent on the most pollution intensive activities such as chemical products, pulp manufacturing, and pharmaceutical products. As for political characteristics, the average margin of victory for mayoral elections is 17 percent while for gubernatorial elections it is only 4 percent. Over the sample period, approximately 30 percent of mayors belong to the same party as the governor and most of them do not have a majority of the local council (approximately 27 percent of local legislators belong to the same party as the mayor). The sample used consists of 9 years, there are 2 mayoral elections (in 2000 and 2004) and two gubernatorial elections (in 1998 and 2002). Since mayors were allowed to run for re-election in the 2000 ballot, during 2001-2005 there are, on average, 29 percent of mayors that are in a second-term and face a term-limit.

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<sup>18</sup>Ideally one would use a measure of municipal GDP. However, the estimates from Brazil's statistical office (IBGE) are only available for 1999 to 2003.

<sup>19</sup>For all elections after 1994, the information is available on the web. For the 1992 election, I filed a special petition in the São Paulo *Tribunal Regional Eleitoral* and obtained the name, vote counts, and party affiliations of all mayor candidates and local legislators.

<sup>20</sup>For example Joao F. Saldanha and Joao F. Saldana are the same person.

The last set of rows in Table 1 describe the implementation of environmental regulation. There are, on average, 11 applications of licenses to build new plants per year and 8.5 are approved. For licenses to start operations there approximately the same number of applications (11.4) and slightly more applications are approved (9.3). However, the variance across municipalities and over time is large as can be seen for the standard deviations. As for the effort of regulating polluting industries, each municipality receives, on average, 67 inspections per year.

## 5 Do Environmental Licenses' Approvals Affect Job Creation?

Politicians are potentially interested in influencing the approval of environmental licenses because it can boost their electoral chances by increasing industrial economic activity. This section investigates whether the level of industrial economic activity is associated with previous approvals of environmental licenses. I follow the empirical approach used by Bertrand and Kramarz (2002) in their study of the impacts of entry regulation on job creation in large retail stores in France.

I adapt their approach to examine whether the approval of environmental licenses to build and operate new industrial plants affect industrial economic activity. Specifically, I regress measures of industrial activity (the number of industrial plants or industrial employment) on the number of approved licenses to operate and install new plants. The regressions control for previous license applications and use lagged license approvals in order to decrease concerns of endogeneity.<sup>21</sup> The equations estimated have the following form:

$$\begin{aligned} y_{it} = & \beta_1 \text{lic operate approvals}_{it-1} + \beta_2 \text{lic build approvals}_{it-1} \\ & + \gamma_1 \text{lic operate applications}_{it-1} + \gamma_2 \text{lic build applications}_{it-1} \\ & + \delta X_{it} + \alpha_i + \eta_t + \epsilon_{it}, \end{aligned} \tag{1}$$

where  $y_{it}$  is a measurement of industrial economic activity (number of industrial plants or industrial employment), “lic operate approvals $_{it-1}$ ” is the number of licenses to operate plants issued in municipality  $i$  year  $t - 1$ , “lic operate applications $_{it-1}$ ” is the number of applications for licenses to operate plants in municipality  $i$  year  $t - 1$ , “lic install approvals $_{it-1}$ ” and “lic install applications $_{it-1}$ ” are the number of approvals and applications of licenses to build new industrial plants,  $X_{it}$  is a vec-

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<sup>21</sup>Clearly, even using lagged license approvals we might still have endogeneity if shocks to employment persist over time. Since this section aims at suggesting an association between licenses and industrial economic activity rather than estimating a causal effect, I leave the correction of potential endogeneity for future work.



tor of time-varying municipal characteristics,  $\alpha_i$  are municipal fixed-effects,  $\eta_t$  are year fixed-effects, and  $\epsilon_{it}$  is an error term.

The variables included in the  $X_{it}$  vector account for changes in demographic characteristics might affect industrial employment such as demographic density or the proportion of urban population. The year dummies capture year shocks and policy changes that affect industrial economic activity in all municipalities in a given year. Municipal fixed-effects control for any fixed-characteristic that might affect the level of industrial employment in a given municipality. In all specifications I cluster standard errors by the municipality to account for serial-correlation in the error term. Similar to Bertrand and Kramarz (2002), in order to make the estimations representative of the state of São Paulo, I estimate the regressions by weighted least squares using the share of each year's total population in the municipality as weights.

Columns (1)-(2) present results for the estimations that use industrial employment while columns (3)-(4) show results for the number of industrial plants. Using both measures I find that **environmental licenses are associated with a significant increase in industrial economic activity**. In column (1) I find that an increase in one standard deviation in the approvals of licenses to operate plants (s.d.=510.3) increase industrial employment by 35,710 workers. This corresponds to a 23 percent increase in industrial employment compared to the mean level of employment during the period. An increase in the approval of licenses to build new plants also increase industrial employment. The coefficient implies that a increase in the approvals of licenses to build new plants by one standard deviation increase industrial employment by 76 percent. When I control for municipal demographics in column (2), the effect of licenses to operate increases slightly while the effect of licenses to build new plants decrease. The results also show that it is important to control for the effort made to enforce environmental regulation. The coefficient on lagged inspections suggest that more stringent regulation is associated with less industrial employment.

Similar results emerge in columns (4) and (5). The coefficient of 1.97 on licenses to operate plants in column (4) imply that increasing licenses to operate by a one standard deviation increase the number of industrial plants by 13 percent. The coefficient on licences to build new plants is significantly larger implying that one standard deviation increase on licenses to build new plants are associated with an increase in the number of industrial plants by 41 percent. Column (6) adds municipal controls and the results remain highly significant and similar in magnitude. In all specifications, the lagged inspections are associated with a decrease in the number of plants

suggesting that stringent regulation also affects plant growth.

Overall, these results suggest that increases in the approval of licenses to operate and build new industrial plants increase the number of plants and create jobs in the industrial sector. Thus, politicians motivated by re-election incentives might be tempted to influence the process of license approvals. Next section investigates whether variation in license approvals are related to political motivations.

## 6 Electoral Politics and Environmental Licenses's Approvals

### 6.1 Empirical Methodology

I begin the analysis using a simple approach to test for political influence. I compare the approval of environmental licenses in election years with the approval of licenses in non-election years. Since gubernatorial and mayoral elections in Brazil occur two years apart, I allow for separate effects by including a dummy variable for each type of election in the regressions.<sup>22</sup> I control for several other potential determinants of license approvals in the regressions. First, I control for the number of environmental license applications since approval decisions might depend on the stock of environmental license applications. License approvals also depend on Cetesb's judgement of whether the location chosen by the entrepreneur is appropriate for the new industrial plant. Licenses to build new plants in areas saturated by existing polluting plants might be harder to get approval. I control for this by adding in the regression the existing concentration of polluting industries measured by the share of pollution intensive plants as a proportion of the total number of industrial plants in a given municipality. I also control for municipal demographics that might affect the approval decision. The basic specification includes population, demographic density, and the percentage of urban inhabitants. Lastly, I include the number of employed workers and the number of industrial plants in the municipality to control for business cycle variations.

The model also includes municipal fixed-effects to control for fixed unobserved characteristics and a time trend to account for the increases in license petitions and approvals over time due to the passage of the new environmental law in 1998. The basic equation estimated is of the following

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<sup>22</sup>See Levitt (1997) for another example of the use of mayoral and gubernatorial election cycles to estimate the variation in policies adopted.

form:

$$\text{Lic approvals}_{it} = f(\beta_1 G_t + \beta_2 M_t + \pi \text{Lic applications}_{it} + \mathbf{X}'_{it}\delta + \eta_i + \delta_t + \varepsilon_{it}), \quad (2)$$

where the outcome variable “Lic approvals<sub>it</sub>” is the number of environmental licenses approved in municipality  $i$  in year  $t$ ,  $G_t$  is an indicator that takes the value of one in years of gubernatorial elections,  $M_t$  is an indicator that takes the value of one in years of mayoral elections;  $\mathbf{X}'_{it}$  is a vector of municipal characteristics that might affect the implementation of environmental regulation such as the number of existing industrial plants, the proportion of industrial employment and demographic characteristics;  $\eta_i$  is a municipal fixed-effect,  $\delta_t$  is time trend, and  $\varepsilon_{it}$  is an error term. The coefficients  $\beta_1$  and  $\beta_2$  measure the difference in the approval of environmental regulation between election and non-election years, controlling for license applications and municipal characteristics. I expect these coefficients to be positive if there is political influence in the approval of environmental licenses.

The previous model only exploits time-series variation in the approval of environmental licenses. However, if license approvals are driven by political considerations, I expect to find significant differences across municipalities depending on partisan politics and previous distributions of votes. A large literature on political economy investigates distributive politics by testing whether politicians favor regions depending on the results obtained in the previous election. I examine whether license approvals are influenced by distributive politics considerations by adding to equation (1) the margin of victory by which the incumbent governor won (or lost) the previous election in a given municipality. This aims at capturing the degree of support enjoyed by the incumbent governor. In addition, state level politicians might be interested in supporting local level political allies. I also include in the regression a dummy variable that equals one when a mayor belongs to the same political party as the state governor. The regression estimated takes the following form:

$$\begin{aligned} \text{Lic approvals}_{it} = & f(\alpha_1 \text{Margin gov}_{it} + \alpha_2 \text{Margin mayor}_{it} + \alpha_3 \text{Affiliation}_{it} \\ & + \beta_1 M_t + \beta_2 G_t + \pi \text{Lic applications}_{it} + \mathbf{X}'_{it}\delta + \eta_i + \delta_t + \varepsilon_{it}), \end{aligned} \quad (3)$$

where  $\text{Margin gov}_{it}$  is the margin of victory by which the incumbent governor won (or lost) the previous election in the specific municipality  $i$ ,  $\text{Margin mayor}_{it}$  is the margin of victory by which the incumbent mayor won the previous election in the specific municipality  $i$  and  $\text{Affiliation}_{it}$  is a dummy that equals one when the mayor belongs to the same party as the governor. A positive coefficient on  $\text{Margin gov}_{it}$  and  $\text{Margin mayor}_{it}$  provides evidence that municipalities with more support receive

more environmental licenses' approvals. This is generally interpreted in the literature as evidence of political patronage. That is, the incumbent politician rewarding districts that voted for him while punishing districts that voted for the opposition.<sup>23</sup> Alternatively, a negative coefficient on the average margin of victory can be interpreted as the incumbent politician targeting "swing municipalities". That is, locations where the electoral race was tight in the previous election.

Having showed that license approvals vary along the electoral cycle and whether there is differential approval of licenses based on political rewarding considerations and political alliances, the next question is whether bureaucrats change the targeting of environmental license approvals during election years. Theoretically, I would expect that in years of municipal elections bureaucrats will target license approvals to municipalities where the mayor is a political ally of the governor while in gubernatorial election years, bureaucrats will target license approvals based on the vote distribution of the previous gubernatorial election. I test this by allowing the affiliation dummy to vary according to the mayoral election dummy while the governor winmargin varies according to the gubernatorial election dummy. I estimate the following equation:

$$\begin{aligned} \text{Lic approvals}_{it} = & f(\alpha_1 \text{Margin}_{it} + \alpha_2 \text{Affiliation}_{it} + \beta_1 M_t + \gamma_1 M_t \times \text{Affiliation}_{it} \\ & + \beta_2 G_t + \gamma_2 G_t \times \text{Margin}_{it} + \pi \text{Lic applications}_{it} + \mathbf{X}_{it}' \delta + \eta_i + \delta_t + \varepsilon_{it}). \end{aligned} \quad (4)$$

The signs of  $\gamma_1$  and  $\gamma_2$  allow us to test which type of municipalities are targeted during election years. A positive coefficient on  $\gamma_1$  suggest that central politicians help political allies in municipal election years. Furthermore, a positive coefficient on  $\gamma_1$  provides suggestive evidence that in gubernatorial election years, "core supporter" municipalities receive more license approvals.

In all the previously specified equations, the outcome variable "License approval" is non-negative and integer valued. Hence, I estimate all the equations using a count regression model. The most popular approach used in this literature is to assume a conditional mean function for the count that follows an exponential.<sup>24</sup> For the basic equation (2), for example, I specify the following conditional mean function,

$$\begin{aligned} E[L_{it} | G_t, M_t, \text{Lic applications}_{it}, \mathbf{X}_{it}', \eta_i, \delta_t] = \\ \exp(\beta_1 G_t + \beta_2 M_t + \pi \text{Lic applications}_{it} + \mathbf{X}_{it}' \delta + \eta_i + \delta_t), \end{aligned} \quad (5)$$

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<sup>23</sup>See Cole (2004) on the use of a similar model to test for the use of agricultural credit for political patronage in India.

<sup>24</sup>See Cameron and Trivedi (1998)

where  $L_{it}$  stands for Lic approvals $_{it}$ .

In a panel-data context, it is well-known that estimating equation (5) leads to biased estimates since the nonlinearity of the exponential function makes it impossible to differentiate out the fixed-effect  $\eta_i$ .<sup>25</sup> I use the Hausman, Hall, and Griliches (1984) transformation to obtain a multinomial distribution for Lic approvals $_{it}$ :

$$E[L_{it}|G_t, M_t, \text{Lic applications}_{it}, \mathbf{X}'_{it}, \eta_i, \delta_t, \bar{L}_i] = \frac{\exp(\beta_1 G_t + \beta_2 M_t + \pi \text{Lic applications}_{it} + \mathbf{X}'_{it}\delta + \eta_i + \delta_t)}{\sum_{\tau=1}^T \exp(\beta_1 G_\tau + \beta_2 M_\tau + \pi \text{Lic applications}_{i\tau} + \mathbf{X}'_{i\tau}\delta + \eta_i + \delta_\tau)} \bar{L}_i, \quad (6)$$

where  $\bar{L}_i = \sum_{\tau=1}^T L_{i\tau}$  is a measure of the number of environmental license approvals in municipality  $i$  for the entire period. Because the joint distribution conditional on the sums of its components does not depend on  $\eta_i$ , I can estimate  $\beta$  consistently using the quasi-maximum likelihood estimator (QMLE).<sup>26</sup> In order to obtain robust standard errors for the estimated coefficients, we use a robust asymptotic variance proposed by Wooldridge (1999).<sup>27</sup>

## 6.2 Results

### Do Environmental License Approvals Vary Over the Election Cycle?

This section examines whether the number of license approvals differ systematically between election and non-election years allowing for different indicators for gubernatorial and mayoral elections as specified in equation (2). The results are shown in Table 3 using the two type of environmental licenses as dependent variables. Columns (1) and (4) display the basic election cycle results without controls. They suggest that, on average, there are no systematic differences on the approval of environmental licenses between years of gubernatorial elections and non-election years (small and statistically insignificant coefficients). However, significant differences exist in years of municipal elections. The environmental agency approves, on average, 16 percent more licences to build new plants (column 1) and 15 percent more licenses to start operations (column 4) in mayoral election years compared to non-election years. Columns (2) and (5) control for municipal demographics, the

<sup>25</sup>See Honoré (2002) for a review of fixed-effect estimation in non-linear models.

<sup>26</sup>See Wooldridge (2002) for an exposition of the Poisson quasi-maximum likelihood estimator.

<sup>27</sup>The standard errors computed using this variance matrix are robust to arbitrary (conditional) serial correlation. Results using a bootstrap procedure to estimate standard errors yielded very similar results and are not reported here.

composition of industrial plants, and business cycle changes in municipalities. The coefficient on the mayoral election dummy remain highly significant and the point estimate is almost identical.

One might wonder whether the increase in the approval of licenses in election years is due to political influence or it is simply caused by an increase in the effort applied by environmental agencies in mayoral election years. One potential explanation could be that local agencies have more resources available in those years and therefore the increase in license approvals reflect budget variations. Ideally one would use data on the amount of resources transferred from the center to local environmental agencies to control for this possibility. However, data on environmental budgets is not available. Alternatively, I use data on the number of inspections made by the local environmental agency in each municipality as a proxy for the effort put by the environmental agency. Columns (3) and (6) in Table 3 control for the the number of inspections in each municipality. The results suggest that the increase in license approval in mayoral election years is not due to an increase effort put by the environmental agency. When I add the number of inspections, the coefficient on the mayoral election dummy for both type of licenses remain highly significant and almost identical to those previously estimated .

Overall, the results in Table 3 suggest that the approval of environmental licenses indeed follow the electoral cycle. Unfortunately, elections in all municipalities in Brazil occur simultaneously and I cannot distinguish aggregate shocks that might covary with the election cycle and affect the approval of environmental licenses with increases in approvals due exclusively to electoral motivations. In the following subsection, I investigate whether there is additional evidence that license approvals are decided based on political considerations. In particular, I use cross-section and time-series variation to investigate whether municipalities where mayors belong to the same political party as the governor receive more license approvals and whether these approvals vary according to electoral results from the previous elections.

## **License Approvals and Distributive Politics**

This subsection examines whether the approval of environmental licenses follow distributive politics motivations. While most of the literature on distributive politics focuses on discretionary welfare transfers, secondary policies such as environmental licenses provide a complementary mechanism by which incumbent politicians can affect welfare of voters in specific locations.

I start by estimating the model displayed in equation (3) where I keep the election year indicators

and add three variables aimed at capturing politically motivated approvals. First, I include an indicator variable of party alliance between the governor and the mayor. If bureaucrats target license approvals based on political considerations, I expect them to approve more licenses for firms located in municipalities politically aligned with the governor.<sup>28</sup> Second, I add the margins of victory (or loss) for mayors and the governor in the previous election. This aims at capturing the electoral motivations that drive distributive politics. As previously described, there are two main theories of distributive politics. Either incumbent politicians strategically target resources at districts where they won (or lost) the previous election by a small margin (“swing districts”) or they retribute to districts where they have “core supporters”, those where they obtained a large margin of victory at the previous election (Cox and McCubbins (1986), Dixit and Londregan (1996)). I test this hypothesis using two different specifications, one where I include the margin of victory (loss) and another where I use the absolute value of the margin of victory to measure how differences away from zero affect license approval.

The results are presented in Table 4. I do not find evidence that, on average, bureaucrats benefit municipalities where the mayor belongs to the same party as the governor. In all four specifications the coefficients on “Party affiliation” are not statistically significant. The coefficient on the margin of victory of the governor is negative and highly significant. It suggests that in locations where the governor obtained a majority of votes by a small margin, there is a larger number of environmental licenses approved. The coefficient of -0.009 for licenses to build plants in column (1) suggest that a decrease in one standard deviation in the margin of victory of the governor (s.d.=16.5) increase the approval of licenses by approximately 15 percent. That is, the tighter the victory of the governor in a given municipality, the larger is, on average, the approval of environmental licenses. The coefficient on the margin of victory for mayors, however, show the opposite sign. More licenses are approved in municipalities where the mayor won the previous election with a large margin. However this affect seems to depend on whether the mayor is a political ally of the governor. When I add an interaction of the mayor’s win margin with the party affiliation dummy in columns (2) and (4), the results suggest that when mayors are politically aligned, more licenses are approved in municipalities where the municipal race was tight.

Overall, the results suggest that, on average, the environmental agency approves more environmental licences in municipalities where the previous electoral race was tight. This results would

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<sup>28</sup>There is substantial evidence on the use of fiscal transfers as partisan politics in federal countries. See for example Bugarin and Ferreira (2006) for Brazil, Johansson (2003) for Sweden, and Porto and Sanguinetti (2001) for Argentina.

support a theory where more environmental licenses are approved in municipalities with “swing-voters”. However, this pattern of distributive environmental licenses might vary in election years. Incumbent politicians might adopt different strategies when elections come because as Dixit and Londregan (1996) suggest, “core supporters” need to be taken care in order to keep their party fidelity sustainable in the long-run. Hence, I investigate next whether differential patterns of license approvals emerge in election years compared to non-election years. I do so by estimating equation (4) where I allow the mayoral and gubernatorial election dummies to vary according with the partisan indicator and with the margin of victory measures.

The results are shown in Table 5. For each type of environmental license, I present results for three specifications. In all of them I control for the number of license applications, municipal characteristics, municipal fixed-effects, and a time-trend. The main difference among them is on the interaction terms. In columns (1) and (4) I interact the mayoral and gubernatorial election indicators with the party affiliation dummy. While I showed in Table 4 that partisan affiliation is not associated with license approvals, it might be that the differences occur between election and non-election years. I would expect that if the environmental agency favors municipalities based on partisan affiliation, they will approve more licenses for affiliated municipalities in mayoral election years. While the interaction term of “Mayoral election  $\times$  Party affiliation” is not statistically significant for the approval of licenses to build plants, it is highly significant and positive for licenses to start operations of new plants. The coefficient on column (4) suggests that there are 11 percent more licenses distributed to start operations of new firms in mayoral election years and there is an additional 9 percent increase in municipalities where the mayor belongs to the same party as the governor. The coefficients on the interaction with the gubernatorial election dummy is not significant, as expected. This is because in gubernatorial elections years, if there is targeted distribution, it is probably based on the past electoral performance of the incumbent governor and not on mayor-governor coalitions.

Columns (2) and (5) test this hypothesis by interacting the gubernatorial election dummy with the margin of victory (or loss) obtained by the governor in the previous election. The variable “Gubernatorial election  $\times$  Margin of victory governor” is negative and highly significant. This contrasts with the results in Table 2 and 3 where I do not find significant variations on gubernatorial election years. This result suggest a large degree of heterogeneity. In gubernatorial election years there are less licenses approved for municipalities where the governor loss the election while there



are significantly more licenses approved for municipalities where the governor obtained a large win margin in the previous election. The coefficient of 0.011 in column (2) suggests that a one standard deviation in the governor win margin (s.d.=16.5) increases the approval of licenses to build new plants by 18 percent. This effect is even larger for licenses to start operations of new plants. The coefficient of 0.019 in the bottom of column (5) suggest that an increase one standard deviation in the vote margin of the governor increases the approval of licenses to operate by approximately 30 percent.

In columns (3) and (6) I ask whether the increase in license approvals in municipal elections years also vary according to the popularity of the governor in the municipality. I ask whether agencies also increase the license approvals in mayoral election years in municipalities where the governor have a large number of “core supporters”. Instead of interacting the mayoral election dummy with the party affiliation dummy, I interact it with the margin of victory of the governor. I find that even in mayoral elections years the agency approves more licenses in municipalities where the governor enjoys a large proportion of supporters (won last election by a larger margin). However, the effect is small in magnitude. A one standard deviation increase in the margin only increases the number of approvals by 5 percent in municipal election years compared to non-election years.

Summing up, the results from Table 5 suggest two important findings. First, there are in fact electoral cycles in the approval of environmental licenses. However these cycles depend on whether the governor received a small or a large number of votes in a given municipalities. The environmental agency is more likely to increase the approval of licenses in gubernatorial election years for those municipalities where the governor enjoys a large number of “core supporters”. The second important finding is that in mayoral election years the environmental agency increases the approval of environmental licenses to start operations to firms located in municipalities where the mayor belongs to the same political party as the mayor. This suggests that partisan politics also plays an important role in the politics of environmental license approvals.

One question that emerges from the empirical findings is why would the environmental agency benefit firms located in municipalities where the mayor belongs to the same party as the governor? Grossman (1994) provides a model of intergovernmental grants taking into account the interaction between local and central politicians. Federal politicians transfer resources to state politicians and help them get re-elected. In return, local politicians use their power to increase the local support of

federal politicians. In the next subsection I investigate whether electoral support varies according to the re-election possibility of mayors. If the results are really driven by center politicians expecting a return from their political influence, then I should observe a larger approval of licenses for mayors that belong to the same party *and* can get re-elected to repay the favor with future votes.

### **Environmental Licenses, Distributive Politics, and Re-election Incentives**

In this subsection I use variation in binding term-limits across municipalities and over time to further investigate whether electoral politics play a role in the approval decision of environmental licenses. I test the hypothesis that a politician at the center, influences regulators to benefit local governments, if the benefited mayors can pay back with votes in the future.<sup>29</sup> In order to test this I need variation in the proportion of mayors who are going to be in power in the future to support the center politicians. I exploit the introduction of the re-election allowance in Brazil in 1997. A constitutional amendment allowed mayors serving during the 1997-2000 term to run for re-election in the 2000 election. While all these mayors faced re-election incentives from 1997 to 2000, only a subset of them effectively got re-elected. Hence, during the 2001-2004 term and in 2005, there is variation in the number of mayors serving in a first term and with the potential to get re-elected and mayors serving on a second-term facing a binding term-limit. If the environmental agency favors municipalities where mayors can get re-elected to pay back the political favor, I would expect to find significant differences in the election cycles of environmental license approvals by whether mayors belong to the same party as the governor and can get re-elected. I test this by estimating a modified version of equation (4) where I add a triple interaction between the municipal election year, the party affiliation indicator and an indicator as to whether the mayor can get re-elected.

The results are shown in Table 6. I follow the structure of Table 5 and present two specifications for each dependent variable. One where the gubernatorial election dummy is interacted with the affiliation indicator and another one where it is interacted with the margin of victory in the previous election. All four specifications control for the number of license applications, municipal characteristics, municipal fixed-effects, and a linear time-trend. The focus on this table is on

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<sup>29</sup>I assume that a politician in the center uses distributive politics to favor local politicians expecting a retribution based on votes for her next election. However, there might be other reasons why a politician at the center might favor local governments. First, local politicians might gather resources for campaign contributions. Second, the distribution of resources that need procurements to be executed and the kickback of deviated resources back to the center politician.

the coefficient of the triple-interaction “Mayoral election  $\times$  Party affiliation  $\times$  Re-election allowed”. In all four specifications this coefficient is positive and statistically significant suggesting that in municipal election years there are more licenses approved to firms located in municipalities where the mayor belongs to the same political party as the governor *and* can get re-elected. The coefficient of 0.13 in column (1) means that comparing only years of municipal elections, there are 13 percent more licenses approved to build plants in municipalities where the mayor belongs to the same party as the governor and the mayor can run for re-election. When I interact the gubernatorial election indicator with the governor margin of victory instead of the party affiliation indicator in column (2), the coefficient on the triple interaction remains significant at the 10 percent level and the point estimate is close to 0.13. Also, the coefficient on the interaction between governor election year and margin of victory is positive and highly significant suggesting that more licenses are approved to municipalities with larger support of the governor.

In columns (3) and (4) I show the results using the approval of licenses to start operations of new firms. The coefficient on the triple interaction is also positive, but now it is significant at the 95 percent level. Moreover, the point estimate is substantially larger. The point estimate of the triple interaction in column (3) is 0.296 suggesting that among years of municipal elections, there is an increase in 30 percent in the number of approved licenses for municipalities that mayor is from the same party as the governor and the mayor can get re-elected. The coefficient is very similar when I change the interaction of the governor election in column (4). The coefficient on the triple interaction remains significant at the 95 percent level. Moreover, the coefficient on the “Gubernatorial election  $\times$  Margin of victory governor” suggests that in fact the environmental agency favors in gubernatorial election years municipalities where the governor obtained a larger margin of victory in the previous election.

Summing up, the results in this subsection confirm that the approval of environmental licenses change in election years in a way that favors the central government politician. In municipal election years, the environmental agency target more approvals at municipalities where the mayor belongs to the same party as the governor and can run for re-election. I interpret this as evidence that only politicians that can “repay” the political favor in the near future are helped through environmental license approvals in election years.

### 6.3 Robustness of Findings

The results presented so far suggest that bureaucrats from the environmental agency implement environmental regulation in a way that favors the incumbent center politician and her local political allies. In this sub-section I examine whether the estimates are robust to alternative specifications. First, I estimate a model that control for potential confounding factors that can covary with the electoral cycle and with some political characteristics across municipalities. Second, I test whether the results are robust to alternative functional forms. I present results from OLS, Tobit and random effect negative binomial regressions and show that the results are robust to these alternative functional form specifications.

#### Testing for Compositional Confounds

The credibility of the results presented above rest on the assumption that unobservables that determine the approval of environmental licenses do not covary with the electoral cycle and with party affiliation, re-election incentives and margins of victory. I test the robustness of the results for potential confounding effects by adding, in the estimated model, interactions between municipal characteristics and the electoral years dummies. These interactions will pick up any differential changes in municipal characteristics that vary over the election cycle.

The results are shown in Table 7. For each dependent variable the table has three columns. The first two columns, replicate columns (1) and (2) in Table 6, but include the interactions. The third column also includes, in addition to all other interactions, the number of inspections and its interaction with the mayoral and gubernatorial election year dummies. This aims at accounting for any change in the effort of environmental regulation implementation between election and non-election years. For the first two columns, the point estimate on the triple interaction is similar to the previous results, but the standard errors are larger and the coefficient is no longer statistically different from zero at the 10 percent level (coefficients are 0.11 and 0.12 and standard errors increase to 0.079 and 0.071 respectively). In the specification in column (3), when I add the control for inspections and its interactions, the point estimate remains close to 0.12, but the standard error is lower and the coefficient is significant at the 10 percent level.

The coefficients on the number of approved licenses to operate plants, on the other hand, remain statistically significant at the 95 percent level in all specifications. The point estimate on the triple interaction decrease from 0.29 in Table 6 (columns (3) and (4)) to 0.24 in column (4) and 0.25

in column (5). When I control for the number of inspections and its interactions in column (6), the point estimate drops 0.23, but remains highly significant. Taken together, the results in Table 7 suggest that the estimated effect of electoral politics on the approval decision of environmental licenses is not driven by other changes in demographic or economic variables along the electoral cycle. Of course, I cannot rule out changes along unobservables. However, the robustness of the results to the use of fixed-effects and all the interactions allows me to be confident that political variables do indeed affect environmental license approvals.

### **Robustness for Alternative Functional Forms**

I next test for the robustness of the results for functional form in the estimated equations. Due to the count data nature of the number of environmental license approvals and the panel structure of the data, I chose a fixed-effect poisson model. However, the conditional mean of the count might follow a different specification. In table 8 I investigate whether the results shown in Table 6 are robust to alternative assumptions about the data generating process. I show the results of the triple interactions with three alternative specifications. I first estimate a model using OLS with municipal fixed-effects and clustering the standard-errors at the municipality to allow for an arbitrary robust specification in the error term. These results are shown in columns (1) and (4). The OLS suffers from two problems: one is the count nature of the data, but a second problem is that many municipalities have zero licenses approved. To account for this I show in columns (2) and (5) I show the results obtained from estimating a random effects Tobit model. Lastly, I keep the assumption about the count data, but instead of the poisson model, I estimate a negative binomial model with random effects. This last specification is shown in columns (3) and (6). Except for the first OLS specification, the coefficient on the triple-interaction is significant for all specifications.

## **7 Conclusion**

The appropriate implementation of public policies in a democracy depends on the incentives faced by politicians to choose policies and the incentives faced by bureaucrats to implement them. Political accountability through re-election creates incentives for politicians to act in voter's interests, but may also motivate them to choose policies that are excessively popular (Besley (2006)). Furthermore, if bureaucrats are politically controlled by politicians, they may implement inefficient policies motivated by electoral politics. However, the extent to which this "political capture" of bureaucrats

occur is an empirical question. This paper examines this by looking at electoral incentives faced by governors and mayors in São Paulo, Brazil and the implementation of environmental regulation. The large number of industrial plants and the decentralized implementation of environmental regulation in São Paulo makes it an appropriate place to test these ideas. Moreover, the variation in political institutions across a large number of municipalities and variation in re-election incentives induced by term-limits over time allow us to test how the implementation of regulation relates to political characteristics.

I look at bureaucratic decision-making by examining the approval of environmental licenses to firms that apply to build a plant or to start industrial activities in municipalities. I find suggestive evidence that bureaucrats are influenced by electoral interests. The approval of environmental licenses increase in election years the increase varies according to electoral interests. In years of mayoral elections, there are more licenses issued to plants aiming at starting operations in municipalities where the mayor belongs to the same political party as the governor. In gubernatorial election years, there are more licenses approved in municipalities where governors had a large margin of victory in the previous election. These results are consistent with models of partisan politics and models that explain distributive politics to “core supporters” (Cox and McCubbins (1986), Dixit and Londregan (1996), Grossman (1994)).

This paper contributes to the literature on political cycles and distributive politics in emerging democracies. However, instead of focusing on intergovernmental transfers, it highlights the use of secondary instruments as a way to affect economic activity and electoral outcomes. More broadly, my results contribute to an emerging literature that tries to understand how political institutions affect the implementation of public policies in developing countries.<sup>30</sup> It points out to the importance to better understand the effect of different political institutions on the relationship between politicians and bureaucrats.

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<sup>30</sup>See for example Olken (2005) and Pande (2003).

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Table 1: Summary Statistics

	Mean	Std. Dev.
<i>Municipal demographic characteristics</i>		
Population (in 1000)	58.88	424.53
Demographic density	0.28	1.12
Urbanization rate (%)	81.22	15.13
Number of industrial plants	122.64	1040.53
% plants in pollution intensive industries	19.97	16.13
Employed workers (in 1000)	13.22	133.05
<i>Political variables</i>		
Margin of victory mayors	17.12	16.16
Margin of victory governor	4.02	16.48
% Mayors same party as governor	30.83	46.18
% Local legislators in same party as mayor	26.56	13.55
% Gubernatorial election years	22.29	41.62
% Mayoral election years	22.29	41.62
% Mayors face term-limit in 2001-2005	29.29	45.52
<i>Environmental regulation</i>		
Approvals of licenses to build new plants	8.46	49.96
Applications for licenses to build plants	11.31	59.03
Approvals of licenses to start operations	9.34	51.54
Applications for licenses to start operations	11.37	60.45
Number of inspections	67.38	330.40

Notes: The sample consists of 5715 observations corresponding to municipalities in the state of So Paulo, from 1997 to 2005. Mayoral elections were held in 2000 and 2004 and gubernatorial elections were held in 1998 and 2002. Data obtained from CETESB, IBGE, RAIS, and TSE. See the text for a detailed description of variables and data sources.

Table 2: The Effect of License Approvals on Industrial Activity

	Dependent variable:					
	Industrial employment			Number of industrial plants		
	(1)	(2)	(3)	(4)	(5)	(6)
Approvals to operate plants t-1	86.543 [20.551]***	88.808 [21.334]***	17.398 [6.559]***	2.252 [0.544]***	2.3 [0.557]***	0.69 [0.129]***
Approvals to build plants t-1	124.887 [6.214]***	115.414 [10.094]***	39.868 [6.283]***	4.179 [0.196]***	3.999 [0.236]***	1.096 [0.164]***
Inspections t-1	-61.662 [7.163]***	-59.666 [6.073]***	2.657 [1.938]	-1.623 [0.184]***	-1.585 [0.164]***	-0.04 [0.039]
License applications t-1	Yes	Yes	Yes	Yes	Yes	Yes
Municipal demographics	No	Yes	Yes	No	Yes	Yes
Municipal fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Agency year fixed-effects	No	No	Yes	No	No	Yes
Observations	5715	5715	5715	5715	5715	5715

Notes: All regressions are estimated using weighted least squares with weights equal to the share of population in a municipality with respect to total population in a given year. Standard errors in brackets are clustered by the municipality. Significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. All regressions include lagged number of applications for licenses to operate new plants and licenses to build new plants and control for the following municipal demographics: log of population, population density, and the proportion or urban population. Specifications in columns (3) and (6) include unrestricted agency-year fixed effects. There are 35 local agencies in the state of São Paulo. The sample consists of municipalities in the state of So Paulo, 1997 to 2005.

Table 3: The Effect of Elections on the Approval of Environmental Licenses

	Dependent variable:					
	License approvals to build new plants			License approvals to start operations in new plants		
	(1)	(2)	(3)	(4)	(5)	(6)
Gubernatorial election year	0.015 [0.024]	0.015 [0.023]	0.015 [0.022]	-0.006 [0.018]	-0.005 [0.021]	0.001 [0.017]
Mayoral election year	0.157 [0.012]***	0.157 [0.012]***	0.162 [0.013]***	0.147 [0.014]***	0.135 [0.015]***	0.157 [0.013]***
Municipal fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipal controls	No	Yes	Yes	No	Yes	Yes
Number of inspections	No	No	Yes	No	No	Yes
Log-likelihood	-10094.38	-10084.54	-10075.22	-10202.86	-10011.31	-9842.53
Observations	5715	5715	5715	5652	5652	5652

Notes: All regressions are estimated using a conditional fixed-effect Poisson model. Robust standard-errors reported in brackets are estimated using Wooldridge (1999) method. Significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. Municipal controls include: the number of industrial plants, % of pollution intensive plants, log of population, demographic density, % of urban population, and total employment. All specifications also include the number of license applications, a constant and a linear time trend. The sample consists of municipalities in the state of So Paulo, 1996 to 2005. Gubernatorial election year equals one in 1998 and 2002, mayoral election year equals one in 1996, 2000, and 2004.

Table 4: The effect of elections and political characteristics on the approval of environmental licenses

	Dependent variable:			
	License approvals to build		License approvals to	
	new plants		start operations in new plants	
	(1)	(2)	(3)	(4)
Gubernatorial election year	0.003 [0.020]	-0.001 [0.024]	-0.024 [0.023]	-0.015 [0.022]
Mayoral election year	0.130 [0.012]***	0.150 [0.012]***	0.113 [0.016]***	0.128 [0.016]***
Party affiliation	0.039 [0.037]	0.043 [0.044]	-0.004 [0.059]	-0.021 [0.061]
Margin of victory governor	-0.009 [0.001]***		-0.007 [0.001]***	
Margin of victory mayor	0.003 [0.001]**		0.003 [0.001]**	
Margin of victory mayor $\times$ Party affiliation	-0.003 [0.002]*		-0.004 [0.003]	
Abs(Margin of victory governor)		-0.008 [0.002]***		-0.004 [0.002]**
Abs(Margin of victory mayor)		0.002 [0.001]		0.003 [0.001]**
Abs(Margin mayor) $\times$ Party affiliation		-0.003 [0.002]		-0.004 [0.003]
Municipal fixed-effects	Yes	Yes	Yes	Yes
Municipal controls	Yes	Yes	No	Yes
Log-likelihood	-9821.9556	-10023.736	-9886.012	-9977.7449
Observations	5715	5715	5652	5652

Notes: All regressions are estimated using a conditional fixed-effect Poisson model. Robust standard-errors reported in brackets are estimated using Wooldridge (1999) method. Significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. Municipal controls include: the number of industrial plants, % of pollution intensive plants, log of population, demographic density, % of urban population, and total employment. Margin of victory is the difference in the proportion of votes between the first and second places in the election. Party affiliation is a dummy that equals one when the mayor and the governor belong to the same party. All specifications also include the number of license applications, a constant and a linear time trend. The sample consists of municipalities in the state of So Paulo, 1996 to 2005. Gubernatorial election year equals one in 1998 and 2002, mayoral election year equals one in 1996, 2000, and 2004.

Table 5: The Effect of Elections, Party Affiliation and Margins of Victory on Environmental License

	Dependent variable:					
	License approvals to build new plants			License approvals to start operations in new plants		
	(1)	(2)	(3)	(4)	(5)	(6)
Gubernatorial election	0.008 [0.024]	0.015 [0.019]	0.012 [0.020]	-0.012 [0.024]	-0.017 [0.026]	-0.019 [0.027]
Mayoral election	0.155 [0.013]***	0.129 [0.012]***	0.142 [0.012]***	0.110 [0.020]***	0.094 [0.018]***	0.118 [0.016]***
Mayoral election $\times$ Party affiliation	0.007 [0.031]	0.005 [0.033]		0.089 [0.040]**	0.080 [0.042]*	
Gubernatorial election $\times$ Party affiliation	0.032 [0.052]			0.034 [0.070]		
Mayoral election $\times$ Margin of victory governor			0.006 [0.001]***			0.003 [0.002]*
Gubernatorial election $\times$ Margin of victory governor		0.011 [0.002]***	0.013 [0.002]***		0.019 [0.003]***	0.019 [0.003]***
Municipal fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipal controls	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-10083.56	-9755.065	-9727.162	-9993.256	-9716.538	-9717.334
Observations	5715	5715	5715	5652	5652	5652

Notes: All regressions are estimated using a conditional fixed-effect Poisson model. Robust standard-errors reported in brackets are estimated using (Wooldridge 1999) method. Significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. Municipal controls include: the number of industrial plants, % of pollution intensive plants, log of population, demographic density, % of urban population, and total employment. Margin of victory is the difference in the proportion of votes between the first and second places in the election. Party affiliation is a dummy that equals one when the mayor and the governor belong to the same party. All specifications also include the number of license applications, a constant and a linear time trend. The sample consists of municipalities in the state of São Paulo, 1996 to 2005. Gubernatorial election year equals one in 1998 and 2002, mayoral election year equals one in 1996, 2000, and 2004.



Table 6: The Effect of Elections, Party Affiliation and Term-Limits on Environmental License Approvals

	Dependent variable:			
	License approvals to build new plants		License approvals to start operations in new plants	
	(1)	(2)	(3)	(4)
Mayoral election	0.143 [0.038]***	0.149 [0.037]***	0.124 [0.038]***	0.133 [0.042]***
Gubernatorial election	-0.005 [0.023]	0.011 [0.019]	-0.036 [0.025]	-0.024 [0.025]
Mayoral election $\times$ Party affiliation	-0.089 [0.068]	-0.087 [0.067]	-0.140 [0.064]**	-0.134 [0.071]*
Mayoral election year $\times$ Re-election allowed	-0.010 [0.044]	-0.016 [0.042]	-0.024 [0.050]	-0.037 [0.051]
Mayoral election $\times$ Party affiliation $\times$ Re-election	0.132 [0.073]*	0.126 [0.074]*	0.296 [0.097]***	0.294 [0.098]***
Gubernatorial election $\times$ Party affiliation	0.023 [0.054]		0.025 [0.073]	
Gubernatorial election $\times$ Margin of victory governor		0.011 [0.002]***		0.019 [0.003]***
Municipal fixed-effects	Yes	Yes	Yes	Yes
Municipal controls	Yes	Yes	Yes	Yes
Log-likelihood	-9797.7133	-9719.1643	-9831.868	-9650.1735
Observations	5715	5715	5652	5652

Notes: All regressions are estimated using a conditional fixed-effect Poisson model. Robust standard-errors reported in brackets are estimated using Wooldridge (1999) method. Significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. Municipal controls include: the number of industrial plants, % of pollution intensive plants, log of population, demographic density, % of urban population, and total employment. Margin of victory is the difference in the proportion of votes between the first and second places in the election. Party affiliation is a dummy that equals one when the mayor and the governor belong to the same party. All specifications also include the number of license applications, a constant and a linear time trend. The sample consists of municipalities in the state of So Paulo, 1996 to 2005. Gubernatorial election year equals one in 1998 and 2002, mayoral election year equals one in 2000, and 2004.

Table 7: Testing for Compositional Confounds in the Triple-Interaction Regressions

	Dependent variable:					
	License approvals to build new plants			License approvals to start operations in new plants		
	(1)	(2)	(3)	(4)	(5)	(6)
Mayoral election	0.446 [0.134]***	0.402 [0.135]***	0.339 [0.140]**	-0.005 [0.197]	-0.012 [0.190]	-0.098 [0.184]
Gubernatorial election	0.094 [0.181]	-0.201 [0.175]	-0.376 [0.197]*	-0.415 [0.202]**	-0.901 [0.209]***	-0.895 [0.252]***
Mayoral election $\times$ Party affiliation	-0.084 [0.072]	-0.081 [0.063]	-0.084 [0.064]	-0.105 [0.065]	-0.109 [0.070]	-0.093 [0.073]
Mayoral election year $\times$ Re-election allowed	0.022 [0.044]	-0.021 [0.041]	-0.022 [0.041]	0.042 [0.054]	-0.011 [0.054]	0.005 [0.058]
Mayoral election $\times$ Party affiliation $\times$ Re-election	0.110 [0.079]	0.116 [0.071]	0.117 [0.069]*	0.241 [0.094]**	0.248 [0.094]***	0.229 [0.094]**
Gubernatorial election $\times$ Party affiliation	-0.006 [0.048]			0.000 [0.064]		-
Gubernatorial election $\times$ Margin of victory governor		0.012 [0.001]***	0.012 [0.001]***		0.019 [0.002]***	0.019 [0.002]***
Election dummies $\times$ municipal characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Election dummies $\times$ inspections	Yes	Yes	Yes	Yes	Yes	Yes
Municipal fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipal controls	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-10004.58	-9673.969	-9651.367	-9784.779	-9506.139	-9449.87
Observations	5715	5715	5715	5652	5652	5652

Notes: All regressions are estimated using a conditional fixed-effect Poisson model. Robust standard-errors reported in brackets are estimated using Wooldridge (1999) method. Significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. Municipal controls include: the number of industrial plants, % of pollution intensive plants, log of population, demographic density, % of urban population, and total employment. Margin of victory is the difference in the proportion of votes between the first and second places in the election. Party affiliation is a dummy that equals one when the mayor and the governor belong to the same party. All specifications also include the number of license applications, a constant and a linear time trend. The sample consists of municipalities in the state of São Paulo, 1996 to 2005. Gubernatorial election year equals one in 1998 and 2002, mayoral election year equals one in 2000, and 2004.

Table 8: Alternative Functional Forms for Estimating the Effect of Elections, Party Affiliation and Term-Limits on Environmental License Approvals

	Dependent variable:					
	Approvals to build plants new plants			Approvals to start operations in plants operations in new plants		
	OLS FE (1)	RE Tobit (2)	RE negative binomial (3)	OLS FE (4)	RE Tobit (5)	RE negative binomial (6)
Mayoral election	4.993 [1.402]***	4.369 [0.842]***	0.078 [0.046]*	2.707 [1.119]**	1.841 [0.704]***	0.158 [0.038]***
Gubernatorial election	-0.683 [0.208]***	-0.241 [0.259]	-0.009 [0.020]	-0.416 [0.200]**	-0.518 [0.220]**	0.023 [0.016]
Mayoral election $\times$ Party affiliation	-3.473 [1.727]**	-2.292 [1.202]*	-0.07 [0.077]	-1.865 [1.225]	-0.927 [1.018]	-0.087 [0.063]
Mayoral election year $\times$ Re-election allowed	-3.68 [1.364]***	-3.06 [0.893]***	0.017 [0.051]	-1.947 [1.011]*	-1.137 [0.749]	-0.019 [0.041]
Mayoral election $\times$ Party affiliation $\times$ Re-election	2.526 [1.601]	2.244 [1.330]*	0.224 [0.089]**	2.313 [1.213]*	1.88 [1.128]*	0.141 [0.072]**
Gubernatorial election $\times$ Margin of victory governor	0.054 [0.010]***	0.08 [0.015]***	0.017 [0.001]***	0.062 [0.020]***	0.094 [0.013]***	0.012 [0.001]***
Municipal fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipal controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5715	5715	5715	5652	5652	5652

Notes: Regressions in columns (1) and (3) are estimated using OLS with standard-errors clustered at the municipality level to account for potential serial-correlation. Regressions in columns (2) and (4) are estimated using a RE Tobit model while those in columns (3) and (6) are estimated using a RE negative binomial regression model. Standard errors in brackets are significantly different from zero at 90% (\*), 95% (\*\*) and 99% (\*\*\*) confidence. Municipal controls include: the number of industrial plants, % of pollution intensive plants, log of population, demographic density, % of urban population, and total employment. Margin of victory is the difference in the proportion of votes between the first and second places in the election. Party affiliation is a dummy that equals one when the mayor and the governor belong to the same party. All specifications also include the number of license applications, a constant and a linear time trend. The sample consists of municipalities in the state of So Paulo, 1996 to 2005. Gubernatorial election year equals one in 1998 and 2002, mayoral election year equals one in 2000, and 2004.

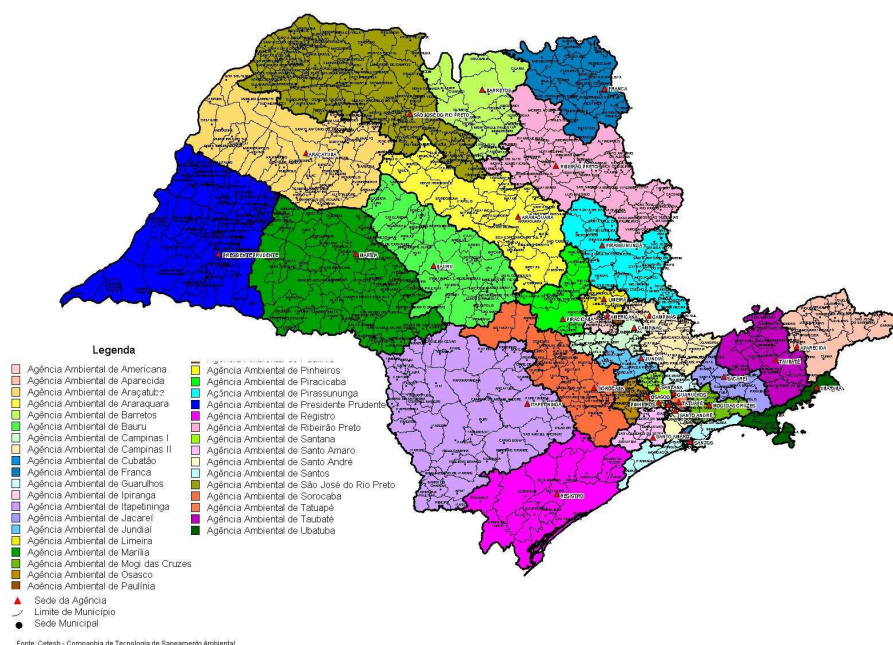


Figure 1: Map of São Paulo with the division of Cetesb regional offices. Source: Cetesb.