Faculdade de Economia,
Administração e Contabilidade
de Ribeirão Preto
Universidade de São Paulo

Texto para Discussão

Série Economia

TD-E 15 / 2011

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Does Oil Make Leaders Unaccountable?
Evidence from Brazil's offshore oil boom*

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This version: December 2010
First draft: May 2009

Abstract

We examine the political economy mechanisms that link resource abundance and economic development by analyzing the recent increase in Brazil's oil production and the large oil royalty payments made to municipalities. We explore a fixed geographic rule which determine who receive oil royalties and investigate how incumbents spend oil windfall and the impact of these rents on local elections. We show that oil windfall is associated with a large increase in the number of employees, but we don't find any significant impacts on education or in health supply. Royalty payments create a large incumbency advantage in the election that follows oil windfall boom, but this effect disappears in the medium-run. We also exploit the mechanisms through which mayors are able to remain in power only in the short-term. Our results are consistent with a learning story, in which voters are initially unaware about the huge increase in royalty rents. These rents were used to create more public jobs, which was interpreted by voters as a signal of incumbent's ability. Oil rents continued to increase along the years but were not translated into improvements in living standards, which lead voters to oust the incumbent. Thus, our results indicate that oil does not make leaders unaccountable and that a democratic system is crucial to avoid the negative effects of resource abundance. We show that elections, media presence and constraints on executive are institutions which play a role in restraining the irresponsible use of oil rents.

Key words: natural resources, elections, political accountability.
JEL: D72, D78, Q33.

*We are grateful to Juliano Assunção, Filipe Campante, Stephan Coate, Monica Martinez-Bravo, Roberto Moraes, Rohini Pande, Rodrigo Serra, Rodrigo Soares, James Snyder, Denise Terra and seminar participants at Harvard Development Lunch, MIT Political Economy Breakfast, IPEA, LACEA and NEUDC for helpful discussions and suggestions. I thank Nicole Saba for excellent research assistance. Joana Monteiro gratefully acknowledges the hospitality of Center for International Development at Harvard University and the financial support from Corporación Andina de Fomento (CAF) and CAPES.

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1 Introduction

For most developing countries, natural resource windfalls have had limited effects on long-run economic development (eg. Gabon, Nigeria, Venezuela). Several studies argue that this fact should be explained by the behavior of those who control the state (Ross (1999); Caselli & Cunningham (2009); Caselli (2006); Robinson et al. (2006)). In particular, a large literature argues that natural resource wealth impairs democracy, perpetuates autocratic regimes, and induces misgovernance (Barro (1999); Jensen & Wantchekon (2004); Ross (2001), Tsui (2010)). However, the negative effects of oil abundance on democracy have been recently challenged by studies which shows that the effects vary across regions and time (Dunning (2008); Ross (2009); Haber & Menaldo (2010)). Two main problems make the existing evidence far from conclusive. First, resource endowment is usually measured by production, which is endogenous to country level of development and institutions, being hard to interpret the results as causal estimates of the effect of resource abundance. Second, there is few micro evidence on how oil abundance affects political incentives, constraints, and competition faced by incumbent politicians which can elucidate why effects vary so much across regions.

This paper examines whether oil booms affect local democracy in Brazil's municipalities. Specifically, we study how electoral outcomes, the behavior of politicians in power, electoral competition and political selection change as municipalities are endowed with a fiscal windfall from oil boom. We do so by using variation across municipalities benefited from Brazil's recent oil production[1] boom and new rules for distributing oil royalties[2] to drilling regions. Over the last twelve years, oil output in Brazil more than doubled from 307 to 663 million barrels in 2008. Moreover, royalty payments increased from 5 to 10 percent of the production value and were indexed to oil international price. Hence, royalty payments made to municipalities increased by twenty-seven-fold in real terms from R$ 167 million in 1997 to R$ 4.7 billion in 2008, creating several "new" oil-rich municipalities. For a comparison, the FPM, the main federal transfer to municipalities in Brazil, increase by one-fold in the period. Municipalities lucky enough to be in front of an offshore oil field according to the geographic lines were disproportionately benefited and received a huge windfall, although the local economic impact of oil activity in their territory is arguably limited. To have an idea of the size of the budget impact, the top beneficiaries on average saw their municipal budget be increased by three-fold in real terms between 1997 and 2000, and then had it doubled from 2000 and 2004.

We begin our analysis by investigating how municipalities spend oil windfall. We show that municipalities report to have increased all their expenses and did not change much their budget composition. Oil windfall is associated with a large increase in the number of employees, which

[1] We use the term oil to denote oil and natural gas production since oil corresponds to the bulk of oil and gas production.

[2] We use the denomination royalty loosely throughout the paper to refer to royalties plus special quotas ("participações especiais". ANP calls the sum of both payments as "participações governamentais".

particular increased from 1999 to 2006. We don't find any significant impacts on education nor in health supply. The analysis of royalty impact on local politics shows that royalty payments create a large incumbency advantage in the short-run. In 2000, the first election after the boom, when all mayors could run for reelection, a one-standard-deviation increase in royalty value increase reelection chances by 16 percentage points, which implies a increase of 32 percent in reelection chance. However, this effect disappears in the medium run since there is no incumbency advantage in 2004 and 2008. We then analyze political competition and selection and show that the limited impact on these outcomes indicates that the incumbency advantage estimated for 2000 should be explained by the behavior of who are in power rather than through a decrease in political competition or by changes on the pool of candidates. We follow by analyzing the timing and composition of the increase in public employment, which is the main destination of royalty revenues according to our results. We show that public employment increased in particular between 1998-2000 and 2002-2004, but the enlargement of public sector in the two years before the election explains reelection only in 2000. This result supports an information story as long as we believe that voters interpret the increase in public employment as a signal of incumbent's ability only in 2000 and information about oil windfall increases over time. We show evidence that confirms these hypotheses by arguing that the pattern of public employment increase is not compatible with a clientelistic story. In addition, we provide indications that the awareness level about oil windfall increased over the years and that mayors from municipalities with local media presence have more difficulty getting reelected in 2008.

Taken together, these results do not indicate that oil makes leaders unaccountable. Although oil windfall creates a large incumbency advantage in the election after the boom, voters reward incumbents by reappointing them to office as long as they are not completely informed of the size of the extraordinary revenue and see increases in public employment as an indication of mayor's ability. In the medium run, as information about the resources increases and a larger public sector does not translate into more public goods and services, citizens oust the incumbent and select new candidates. Thus, our results indicate that a democratic system is crucial to avoid the negative effects of resource abundance and that institutions such as elections, media presence and constraints on executive power play an important role in restraining the irresponsible use of oil revenues.

To the best of our knowledge, this is the first empirical paper that focus on understanding the political economy effects of natural resource abundance on a democratic context, where elections should make politicians accountable and political competition can balance incumbent's power. The literature so far has focus on understanding regime changes (Dunning (2008); Haber & Menaldo (2010)), how natural resource abundance can bring political instability (Caselli (2006)) or can help autocratic rulers to perpetuate in power (Acemoglu et al. (2004)). Our paper is directly related to two theoretical works that analyze the mechanisms through which the natural resource abundance can affect politicians incentives in a democratic context. Caselli & Cunningham (2009) argue that

revenue effect occur through two main channels: by increasing the value to stay in power and by raising competition over power. Robinson et al. (2006) show that incumbent politicians can use revenues from natural resources to spend in patronage in order to influence future election.[3] Therefore, our work is an empirical test for both models.

In addition, our work contributes to the literature by providing better estimates of the political economy effects of oil booms. Our empirical strategy presents several innovations. First, because most of oil production is offshore and oil revenue is distributed according to a fixed geographical rule, we can use it as exogenous windfall to incumbent. We also instrument royalty revenue by oil output in order to explore only the variation that comes from production and price shocks. Second, we analyze oil royalties paid by Petrobras and other multinational companies to the Federal Government, which, in turn, redistribute them to municipalities. This allow us to circumvent the potential endogeneity in the decision to extract oil since we compare municipalities that do not influence production decisions. Moreover, by using variation across local governments within a country, we keep constant all the variation in macro institutions that might also affect long-term economic growth. Finally, since royalty payments increased considerably during the last decade, we have enough temporal variation in the data which allows for the estimation of fixed effect regressions. Therefore, by using panel-data for municipalities we are able to control for all potential geographical characteristics that are likely to affect resource availability, economic growth potential, and political outcomes.

This paper relates to a recent empirical literature that aims to understand political economy effects of resource windfalls. Vicente (2010) examines the effect of oil discovery announcements in São Tomé and Principe on measures of perceived corruption. Brollo et al. (2010) investigate the effect of federal transfers on reelection outcomes, political selection and corruption in Brazilian municipalities. They look at different types of federal transfers to municipalities and also show that they increase election outcomes, but, contrary to us, find an impoverish in the pool of candidates.[4] Litschig & Morrison (2010) estimate that higher federal transfers in Brazil lead to higher spending and educational outcomes, which therefore improve incumbent party reelection probability. Our findings also complement a literature on voters' rationality. In particular, our work is related to Wolfers (2007) who present a model where voters cannot discern between incumbent's competence and luck. We find results in line with his work, which shows that governors in oil-producing states are likely to be reelected following a rise in oil prices, while their counterparts in the rust-belt

[3]There are at least two other types of mechanisms put forward in the existing literature to explain the political economy of the resource curse. One line of research argues that an increase in the stock of natural resources induces rent-seeking which distorts the incentives for productive investment (Baland & Francois (2000); Lane & Tornell (1996); Tornell & Lane (1999); Torvik (2002)). A second group is described in Gylfason (2001) and Leamer et al. (1999) who argue that politicians in resource rich environments do not have incentives to spend in education. The lack of human capital accumulation reduces long-run growth.

[4]However, the mechanism highlighted in their work is different from ours. Their model states that an incumbency advantage arises due to an impoverish in the pool of candidates, while in our model there is an incumbency advantage because voters are unable to assess royalty value.

are likely to be ousted. However, his analysis does not allow a comparison between short and medium-term effects.

Finally, this study complements recent papers that use geographical variation in oil availability within countries to examine the effects of oil abundance on long-run economic development and the quality of government. Michaels (2009) uses geological variation in oil abundance in U.S. counties to investigate the effects of oil specialization. He finds that the development of oil sector increased education and income per capita without causing ill effects on industrialization or inequality. More related to this study is Caselli & Michaels (2009) who use variation in oil abundance among Brazilian municipalities to assess the effects of resource abundance on local economic activity, public spending, public good provision, and living standards. They find only modest effects on non-oil GDP, public good provision, no significant improvements in living standards, leading them to conclude that most of oil royalties received by municipalities go missing. This work differs from Caselli & Michaels (2009), however, on the focus placed on the political economy mechanisms that link resource booms to long-run development. We also employ a different empirical strategy by focusing on municipalities located on the Brazilian coast and exploring within variation in addition to use oil production value as an instrument for royalty revenue. Finally, we look at a different time period and analyze what happened in three political mandates, which allows us to understand short and medium-term effects of royalty shocks.

The remainder of the paper is organized as follows. Section 2 describes the institutional background. Section 3 explains the methodology and section 4 describes the data used. Section 5 presents the empirical findings. Finally, section 6 concludes the paper.

2 Institutional Background

Brazil has extracted oil since 1939, but oil production became important only in the mid-1970s, when oil fields in Campos Basin, on the coast of Rio de Janeiro, were discovered and the increase in international oil prices made offshore production viable.[5] The industry prospects improved during the 1980s when the first giant oil fields were found as shown in Figure 1.[6] An important industry upturn occurred in 1997, with the enactment of Law no. 9478, named the Oil Law, which phased out the state oil extraction monopoly.[7] Oil output increased and more than doubled between 1997 and 2008, reaching 663 million barrels in 2008. Figure 2 shows that offshore oil output drove this increase, by tripling from less than 200 million barrels a year in 1994 to 600 million barrels in 2008,

[5]The most notable oil fields discovered in mid-1970s were Garoupa (1974), Namorado (1975), Badejo (1975), Enchova (1976), Bonito (1977) e Pampo (1977). The first offshore well drilled in the country was in Sergipe in 1968. Bregman (2006)

[6]In 1984, Petrobras discovered Albacora, the first giant oil field in deep waters, which consolidated Campos Basin as the main production zone in the country.

[7]From 1953 to 1997, only Petrobras, the Brazilian state-company, produced oil in Brazil. The new rules exposed Petrobras to international competition but the company is still by far the largest player in Brazil's oil market.

while onshore output was stable around 65 million barrels a year in this period.

Ten states produce oil in Brazil but production is highly concentrated in Rio de Janeiro, which is responsible for 92% of offshore or 82% of Brazilian oil output. Looking within the states, 53 municipalities have onshore oil wells and 73 are classified as producing municipalities because they face offshore oil fields (see below for a formal description of "facing" municipalities). The industry which supports offshore activities is concentrated in one city, Macaé, which is located in the north of the state of Rio de Janeiro.[8]

Oil companies must pay up to 10 percent of output value in royalties to federal, state and local governments. The legislation that determines the value and the beneficiaries of royalty revenue was modified several times. Onshore royalties were introduced in 1953 and were paid to states and municipalities. Offshore royalties were created in 1969, but only benefited the federal government. In 1985, during the re-democratization period and following a political movement to decentralize fiscal revenues, Law 7.453/85 was enacted and offshore royalties began to be paid to states, municipalities and the Navy.[9] In this decision, one key issue was to determine which municipalities were affected by offshore oil production. Politicians chose a geographic criteria and classified municipalities into four groups: producing municipalities, secondary zones, neighboring municipalities and non-affected municipalities. In 1986, Decree 93.189/86 classified as 'producing municipalities' those that lie in front of an oil well according to orthogonal and parallel lines to the Brazilian coast. These lines were not the object of political bargain since, by law, they were designed by the National Bureau of Statistics (IBGE) based on the geodesic lines orthogonal to the Brazilian coast which are used as reference in nautical letters. Figure 4 illustrates the criteria for the coast of Rio de Janeiro.[10]

The main modification in the oil royalty rule occurred with the enactment of Oil Law in 1997. This law increased royalty payments from 5 to 10 percent of the output value and indexed the reference price to the oil international price. In addition, the Law created special quotas ("participações especiais") or extra payments received from highly productive oil fields.[11] The second parcel of 5% of royalty payments followed a different rule than the previous one and benefited even more producing municipalities (see Annex for details).[12] The new legislation was followed by the upward trajectory of international prices and two large Brazilian Real devaluations. All these facts

[8]Macaé was selected by Petrobras in the 1970s as the base for offshore activities due to its geographic proximity to Campos Basin.

[9]This Law only entered into effect in 1986, after being regulated by Law 7.525/86 and Decree 93.189/86. Law 7.453/85 was proposed by Senators Nelson Carneiro (PMDB - RJ) and Passos Pôrto (PDS - SE), whose aim was to introduce offshore royalties by following the same rule which was used for onshore royalties. For details on the political bargains made to approve Laws 7.453/85 and 7.525/86 see Serra (2005).

[10]There was another modification in the rule in 1989. Law 7.990/89 included municipalities with transportation facilities from and to oil sites in the list of benefited municipalities.

[11]The special quotas were paid for the first time in 2000 and about 30 municipalities received it in 2008.

[12]Serra(2005) argues that the new rule for royalty payments was not the object of much debate during the approval of the Oil Law because this Law was dealing with more important topic by that time, the phase-out of the state monopoly in oil production.

together induced an enormous increase in royalty payments from R$ 190 million in 1997 to R$ 10.9 billion in 2008.

Taken together, royalty payment rules imply that local governments are the main beneficiaries of oil windfall. In 2008, municipalities directly received 34 percent of royalty payments, followed by states, which received 30%, the Ministry of Science and Technology (16%), the Ministry of Navy (12%) and a special fund (8%).[13] This level of decentralization of natural resource compensation is not observed in other countries (Serra, 2005).

These rules also imply that geographic location is the main determinant of who receives what and how much of the oil windfall each municipality gets. The largest share of royalty revenue that goes to municipalities is paid to 'producing municipalities" because they are considered the ones most affected by oil production. In addition, the proximity to these municipalities determines the status of 'neighboring cities". However, the amount paid to each municipality depends not only on geographic position, but also on population and the location of production plants, pipelines and transportation facilities (see Annex for details on the payment rule).

Every month an oil windfall is paid to the Brazilian Treasury, which in turn distributes it to the beneficiaries. Municipalities are free to allocate this income, with two restrictions. They cannot use this rent to hire public employees on a permanent basis, nor can they pay debts with it.[14] The Tribunal de Contas of each state (TCEs) is the institution in charge of auditing the allocation of royalty revenues. This windfall can be invested in different types of public goods and services. Local governments in Brazil are the main providers of basic education and basic health services. In addition, they are responsible for local transportation and infrastructure. Security, however, is supplied by state governments and few Brazilian municipalities have a local police.

The first political mandate under analysis, from 1997 to 2000, was marked not only by the extraordinary increase in royalty revenue but also by the Reelection amendment, which was enacted in June 1997 and allowed mayors to be reelected once. This period is of special interest because mostly of the revenue shock was arguably unanticipated and all the mayors could run for reelection.

Figure 3 presents a graph which illustrate the timing of the local elections, the reelection amendment and the enactment of Oil Law. We also show the evolution of royalty payments made to municipalities, which increased by twenty-seven-fold in real terms from R$ 167 million in 1997 to R$ 4.7 billion in 2008.

[13] Actually, the value received by local governments is even greater because they indirectly receive 80% of the special fund and 25% of the payments that go to state governments. This implies that municipalities receive 47.6 percent of royalty revenue. In our analysis, we only take into account the direct payments to municipalities.

[14] The only exception is a debt with the Federal Government, which can be paid with this income.

3 Empirical Strategy

Our main objective is to understand oil revenue impact on local economies. Specifically, we want to estimate:

$$y_{it} = \rho R_{it} + X_{it}\beta + c_i + \lambda_t + u_{it} \tag{1}$$

where y_{it} denotes municipality i outcome at year t (e.g. public employment and wages, educational and health supply measures), R_{it} indicates royalty value paid to municipality i at time t, X_{it} is a vector of municipality characteristics that vary over time such as population, c_i is a municipality fixed effect, λ_t is a year fixed effect and u_{it} is a random shock.

However, oil windfall is not exogenous to local economies because it depends on the geographic proximity to an oil field, population and the location of oil facilities. The main concern is related to the location of oil plants and facilities which may vary over time and are not perfectly observed by us. In order to deal with this potential problem, we follow Caselli & Michaels (2009) and apply an instrumental variable approach, using the following equation as a first stage equation:

$$R_{it} = \gamma_1 Z_{it} + X_{it}\gamma_2 + c_i + \lambda_t + \epsilon_{it} \tag{2}$$

where Z_{it} denotes oil production value and ϵ_{it} indicates non-observable characteristics that explain royalty payments, such as oil producing plants.

The validity of this approach depends on two main assumptions: (i) Z_{it} has a significant effect on R_{it} and (ii) the only impact of Z_{it} on Y_{it} is through R_{it} (the exclusion restriction). The first assumption is guaranteed by the royalty rule, which generates a strong first stage, as a fraction of oil output is paid in royalties to municipalities where drilling is done. In addition, the rule allocates offshore output among municipalities according to lines that lie parallel and orthogonal to the Brazilian coast, creating a geographic instrument. Figure 5 shows the map of the Brazilian coast with producing and non-producing municipalities and the location of oil fields. We believe that this figure makes explicit the fact that, conditional on being on the coast, the status of 'producing municipality' is quite random.

However, Figure 5 also highlights that benefited municipalities are not evenly distributed in Brazil, instead, they are mainly on the Brazilian coast. If coastal municipalities are systematically different from other Brazilian municipalities, and indeed they are, a simple comparison between benefited and non-benefited municipalities may have biases. To account for this problem, we restrict our analysis to coastal municipalities in producing states. This provides a sample of 159 municipalities distributed among the states of Ceará, Rio Grande do Norte, Alagoas, Sergipe, Bahia, Espírito Santo, Rio de Janeiro, São Paulo e Paraná.[15] In addition, we exclude the top 1 percent

[15] Although the state of Amazonas also produces oil, we exclude it from the analysis because it only has onshore production. Santa Catarina also produces oil but its output is small, intermittent and attributed to just two municipalities, which led us to exclude it from the sample.

of municipalities in royalty distribution in order to deal with outliers, which implies excluding two municipalities from the sample (Quissamã and Rio das Ostras).[16] As robustness checks, we replicate most of the results in the annex using two alternative samples and show that our findings are, in most cases, not sensitive to sample selection. We use a full-sample that includes all the 2,157 municipalities from the nine producing coastal states and in a third sample we restrict our analysis to the 124 onshore and offshore producing municipalities.[17]

The second main assumption in the identification strategy (the exclusion restriction) requires that oil output does not generate any direct effect on outcome variables, for instance, through economic impacts or income effects. We believe that this is plausible because 90% of oil is produced offshore in Brazil and services and industrial plants that support offshore production are concentrated in one city (Macaé).[18] Although we cannot test this assumption, we provide evidence in the empirical results that oil production does not have any economic effect on local economies other than through the municipal budget.

Therefore, our main empirical specification employs a panel IV strategy, described by equations (1) and (2). Table 1 shows the first-stage regression for the three samples used in this work. The F-statistics is greater than 230 for all samples, confirming that we have a strong first stage relationship. X The existence of term-limits in Brazil led us to use a different strategy when analyzing political outcomes. The fact that mayors cannot run for two subsequent reelections implies that reelection estimates are conditional on mayor being in the first-term. Hence, the sample of municipalities changes every election, which makes the within estimates hard to interpret. We, therefore, run the following equations to estimate royalty effect on political outcomes:

$$y_{it} = \rho_t R_{it} + X_{it}\beta + \lambda_t + u_{it} \tag{3}$$

$$R_{it} = \gamma_1 Z_{it} + X_{it}\gamma_2 + \lambda_t + \epsilon_{it}$$

The main difference is that this strategy does not use municipal fixed effects but control for geographic characteristics such as latitude, longitude, altitude, distance to the state capital, dummy for state capital, population, population density and dummy for coastal municipality. We also let the coefficient of royalty payments, ρ, vary per election in order to understand oil windfall impact in each election. X Our approach is different from the one used in Caselli & Michaels (2009) in several ways. First, we focus on offshore production variation by looking only at coastal municipalities. The next section presents summary statistics that show that this sample gives us a better control group than the one that uses all municipalities. Second, our analysis covers a different period.

[16] Some results are quite sensitive to the exclusion of these two cities because they are huge outliers. Quissamã received 86% more royalty payments per capita than the third municipality in the rank and 160% more than the fifth municipality, while Rio das Ostras earned 64% more than the third municipality and 128% more than the fifth in the list of most benefited municipalities in per capita terms.

[17] We also exclude Quissamã and Rio das Ostras from these alternative samples to guarantee comparability.

[18] In the empirical section, we run the regressions with and without Macaé and the results do not change.

We explore annual variation of royalty payments between 1997 and 2008, the period when the oil boom was most remarkable. In addition, we were able to construct royalty payments and oil output series for 1996-1998, which allow us to understand royalty effects before the boom. In turn, Caselli & Michaels (2009) analyze variation on outcome data mainly from 1991 and 2000, having few outcomes whose values were gathered more recently. Third, our analysis of the impact of royalty revenue on public goods supply and municipal expenses explore a within-variation in addition to the IV strategy, leading to more clean estimates. Finally, our unit of analysis is the municipality rather than the AMC ('área minima de comparação). In Brazil, the fact that many municipalities split during the 1990s led to the creation of the AMC concept, which aggregates municipalities according to their original political borders and allows comparisons across decades. While this is an easy way to deal with municipal divisions, the results generated by this strategy do not have a clear economic interpretation. The main concern is related to public budget analysis and the size of municipal civil service. For instance, consider a municipality which was split in three during the 1990s. AMC measures compare the municipal budget of one municipality in 1991 with the sum of three municipal budgets in 2000. The problem is that all municipalities have a minimum structure and the sum of three budgets is probably larger than a hypothetical one that would include the three. We don't need to rely on AMC analysis because municipality divisions are not a concern in the sample and period under analysis (1997-2008),[19] which allow us to understand the impact of royalties on municipalities, which is the actual political division.

Finally, there is a possible concern related to the endogeneity of oil output Z_{it}. One may argue that municipalities can try to influence oil output from each oil field in order to influence the amount of royalties they receive. We believe that this possibility is highly unlikely in the Brazilian context. Production and investment are carried out by Petrobras and other multinational companies, respond to long-term decisions and involve budgets in the billions of dollars. It seems highly unlikely that tiny municipalities and local politicians can influence multinational companies' plans, and there is no anecdotal evidence in support of this idea. In the empirical section, we provide direct evidence that endogeneity of oil output due to local political influence is not a concern in the context under analysis.

4 Data

We use several data sources in this study. Agência Nacional de Petróleo (ANP) is the main source of information for the oil sector in Brazil and provides data on oil output, oil fields location and royalty payments to municipalities from 1999 to 2008. We complement this data with information

[19] Ten among the 159 coastal municipalities were installed in 1997 and have their first election in 1996, so we have all outcome information for them. Six municipalities in the states under analysis were created in 2001 but just one, Jequiá da Praia in Alagoas, is on the coast. This municipality is not included in the sample.

on oil output from the Oil and Gas Journal (Oil & Special (1999)).[20] The December editions of this magazine report oil output per oil field in Brazil and other countries from 1991 to 1997. This allows us to construct the series of oil output and to recover royalty payments data for the 1990s. As a result, we have oil output and royalty payments series from 1995 to 2008, which let us understand how municipalities were affected by oil windfall before and after the boom in royalty payments promoted by the Oil Law. This is the first work that provides oil data at the municipal level for the 1990s. In the Annex we explain in details how we built oil production annual values, how we linked oil output to specific municipalities and how we recovered royalty payments series. We double checked our calculation and we show that the 1994-1997 royalty series constructed based on Oil and Gas Journal data is almost equal to the one provided by ANP at the state level (correlation 0.9997).

Electoral information for 1996, 2000, 2004 and 2008 local elections comes from Tribunal Superior Eleitoral (TSE). We then construct measures of electoral competition and performance such as vote shares, effective number of political parties and margin of victory. In addition, TSE also provide us with a list of candidates and parties elected in 1992, which allows us to construct 1996 party reelection variable.[21]

In order to understand whether oil windfall improves living standards, we gathered information on how municipalities spend their budget and on local public goods provision. Data on public finance, including revenues and expenses, are available from Brazil's National Treasury through the 'Finanças do Brasil' (FINBRA) database from 1997 to 2008. Educational outcomes are provided by Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP) from 1996 to 2006. The number of municipal health clinics and hospitals are available at DATASUS's site for the periods of 1998-2002 and 2006-2008. Information on municipal public employees for the 1996-2008 period was gathered from the Social Security Registry of all formal workers in Brazil (RAIS), and collected by the Brazilian Ministry of Labor. We also use RAIS to obtain information on private employees, total payroll and number of firms per sector in order to estimate oil windfall effects on economic activity. This analysis is also complemented with information on municipalities' GDP available from the IBGE for the period 1999-2007.

The analysis to identify endogeneity issues is based on geocoded information regarding when and where oil fields were discovered in Brazil. We gathered this data from ANP's Exploration and Production Database (Banco de Dados de Exploração e Produção de Petróleo - BDEP). Finally, we got complementary information to account for differences in municipal characteristics that may confound the results. Since oil output is concentrated in the Brazilian coast, we gathered data on municipalities' geographic position to use as controls in the regressions that do not use municipal fixed effects. IPEA provides information on geographic characteristics such as latitude, longitude,

[20] We are grateful to Gabriela Egler for showing us this data and making it available to us.

[21] There is no available information for 1996 election in Espírito Santo state and most of Rio Grande do Norte municipalities.

altitude and distance to the state capital. We also use demographic characteristics such as percentage of urban households, infant mortality and percentage of illiterate population available from the 1991 and 2000 population census as controls in some regressions and to understand differences among municipalities before the oil boom. In addition, we use the IBGE inter-census population estimates to obtain yearly data on municipal population, which are used in all regressions. All monetary variables used throughout the analysis have been deflated using IPCA index and represent real values on 2008 prices. In the annex, we provide the sources of all variables.

Finally, we collected several pieces of information to understand the mechanisms which explain reelection results. To gather information on voters' awareness about oil windfall, we performed a websearch on two newspapers to look for news about 'petroleo' (oil), 'royalties' and 'municipios' that were published in each year from 1998 to 2008. We performed the search for O Globo and Folha de São Paulo.[22] In addition, we got data on local media presence from Donos da Midia, a NGO who built a database which contain the names of all radio, televisions and newspapers which disclose local content. The Donos da Midia database contains information for 2,686 Brazilian municipalities, which include 77 municipalities (out of 157) from our main sample. This data is for 2007. In order to shed light on law enforcement, we got information from Tribunal de Contas do Rio de Janeiro, which is the institution responsible for auditing royalty revenues allocated by Rio de Janeiro's municipalities. They provide us with information on which municipalities were audited between 2003 and 2008. The objective of the audits under analysis is to verify whether the municipality has any irregularities with respect to municipal public employment.

Table 2 shows summary statistics for royalty payments in each political mandate. There were 103 oil producing municipalities in 1997 and this number increased to 123 in 2008 as new oil fields entered into production. These municipalities received on average R$ 133 per capita per year in the 1997-2000 electoral mandate, which was equivalent to 9% of their municipal revenue or to 2 percent of Brazil's per capita income in 2000. Royalty payments increased more than three-fold on average in the period under analysis, reaching R$ 478 per capita per year in the 2005-2008 period, or 15 percent of municipal revenue. Producing municipalities are concentrated on the Brazilian coast, which is the location of 58 percent (71 out of 123) of oil producing municipalities. This group receives larger royalty payments (R$ 697 per capita per year in 2005-2008) because they face highly productive offshore oil fields. There are more 2,000 municipalities in the nine oil producing states and some of them also receive royalties because they are neighboring municipalities or have oil facilities. However, the amount received by this group is quite small, being about R$ 10 per capita per year or 0.6 percent of municipal revenues in 2005-2008 period.

Table 3 provides information on how oil producing and non-producing municipalities differ in terms of municipal characteristics. Columns (1) and (2) show that producing municipalities had worse economic indicators than non-producing municipalities in 1991. Producing municipalities had

[22]These are the only two newspapers we were able to search by key word and data in the internet.

a higher percentage of urban population, larger illiterate population, lower household per capita income, higher poverty rate, lower human development index, higher infant mortality and lower percentage of households with water pipes. More importantly to our analysis, the evolution of these variables between 1991 and 2000 show that they follow more or less the same growth pattern, but producing municipalities experienced a larger population growth and a lower reduction in mortality rates. We also see striking differences between political characteristics in 1996 and geographic characteristics. There are more producing municipalities close to the sea, to the equator, to state capitals and in low altitudes, which reflect the fact that most of producing municipalities are on the Brazilian coast.

These differences led us to concentrate our analysis on municipalities on the Brazilian coast. Columns (4) and (5) compare average characteristics from producing and non-producing municipalities on the Brazilian coast. Most of the differences previously observed disappear. These two groups of municipalities were very similar in 1991, with the only exception that producing municipalities were slightly more unequal. These municipalities also followed a similar trend between 1991 and 2000. The only difference found is that producing municipalities made more progress in reducing poverty and experienced a lower increase in income inequality. Table 3 also shows that political and geographic characteristics are not statistically different between producing and non-producing municipalities on the coast. The similarity of observable characteristics between coastal municipalities that produce and do not produce oil make us confident about using coastal municipalities as our main sample.

5 Results

We begin the empirical analysis by doing two validation tests. We provide evidence that endogeneity in oil output is not a concern in the context under analysis. We present the timing of oil discoveries and the relation between having a oil field discovered in its boundaries and municipal political alignment. In addition, we show evidence that oil production does not have any economic effect on local economies rather than through the public sector, which support our empirical strategy.

We then investigate how oil windfall is spent and show that municipalities report to have increase all their expenses. Oil windfall is associated with a large increase in the number of non-tenured employees, which particular increased from 1999 to 2006. No significant impacts on education nor on health supply were found.

We then turn to the main objective of this paper which is to understand the oil windfall effects on local politics. We show that there is a large incumbency advantage in the election that follows the oil windfall boom, but this effect disappears in the medium run. We analyze political competition and selection and show that they are not impacted by oil royalties. We follow by investigating why there is an incumbency advantage just in the short run. We investigate the timing and composition of the enlargement of the public sector and show that employment increased mainly in the first two

political mandates, but only in the first one voters rewarded incumbents that increased the public sector by reappointing them to office. Finally, we explore whether an information story is plausible in the context under analysis. We provide evidence on voters' awareness level about oil windfall over the years and on the role of local media in promoting political accountability.

5.1 Validation Tests

5.1.1 Determinants of Oil Discovery and Production

As briefly discussed in the Empirical Strategy, there are few reasons to believe that local municipalities have the capacity to influence Petrobras and other multinational company plans on where and when to drill an oil field. Figure 1 shows that the largest oil fields in terms of 2008 oil output were discovered in the mid-1980s and in 1996. Therefore, for mayors to influence drilling locations in order to receive more royalties it would require that the same political groups had been in power in oil-rich municipalities for more than 10 years (from mid-1980s to 2000s) and that mayors from oil-rich areas could anticipate or influence the enactment of the Oil Law in 1997, which was responsible for the major increase in royalty revenue. Although both facts seems unlikely, Table 4 provides direct evidence that mayors indeed do not influence discoveries and output from oil fields. We explore the association between the timing of discoveries and initial production of new oil fields and municipalities political alignment. Each observation is one municipality. The sample covers the period from 1993 to 2008 and includes all Brazilian municipalities that have at least one oil field (onshore or offshore) discovered within its boundaries in any moment in time. In column 1, the dependent variable is equal to one if an oil field within a municipality's borders was discovered in the respective year, while in column 2 the dependent variable indicates whether oil began to be extracted in the respective year. The regressions include a dummy indicating whether the party in power in the municipality is from the same political coalition of the federal government, party dummies, year and city effects. We see that the fact that the party in power in the municipality is from the same federal government political coalition is not associated with the municipality having an oil field discovered within its borders or with the year oil field entered into production. In addition, we see that few, if any, parties have a higher or lower probability than PT (the Workers Party, which governed the country from 2003 to 2010, and the omitted party in this regression) of influencing the timing of oil production. Finally, columns 3 and 4 look at the time gap between discovering the oil field and beginning its production and confirm that there is no indication of municipal political influence on oil production decisions.[23]

[23]The sample used in columns 3 and 4 is smaller because regressions are conditioned on the municipality having an oil field discovered between 1993 and 2008

5.1.2 Impact on Economic Activity

One of the main hypotheses in our empirical strategy is that oil output does not affect municipal outcomes through other channels than the public budget. We believe that this assumption can be supported because 90% of oil produced in Brazil comes from offshore wells and most of municipalities which face oil fields does not suffer any externality from oil output. Table 5 presents evidence on that direction by showing oil output effects on population and different variables of economic activity. The results presented in columns 1-10 are from panel regressions that include municipal and year effects as controls. With exception of column 1, all measures are in per capita terms. We present the results for three samples. Panel A includes all municipalities from the nine producing states. Panel B shows our preferred specification that includes coastal municipalities from nine producing states, while panel C sample is composed only of oil producing municipalities.

Table 5 shows that oil output is associated with population changes in the sample which include all municipalities from producing states. However, this result is not robust to the use of other samples which do not show any impact of oil windfall on population. This difference among samples probably reflects the fact that oil producing municipalities are concentrated on the Brazilian coast, which historically have larger population growth, and reinforce the importance of focusing on the coastal municipalities sample. Columns 2-5 reveal that oil output does not affect the number of firms in any sector in benefited municipalities. Columns 6-8 indicate that oil output does not impact the number of private employees nor the private companies payroll. However, we find a positive impact on public payroll, reinforcing the idea that oil output effect occurs mainly through the public sector. Finally, columns 9-10 show the effect of oil output on municipal GDP per capita. We see that oil production is associated with an increase in total GDP per capita (column 9). However, this result should be interpreted with caution. Municipal GDP in Brazil is not directly computed. The National Bureau of Statistics (IBGE) computes the state GDP and then divides each sector's GDP among municipalities according to reference variables (variáveis de rateio). The key issue in our analysis is that the reference variable used to divide mineral industry GDP is precisely the royalty rule. Hence, the estimated association between oil output and industry GDP is tautological. To assess whether oil output affects municipal economic activity, it is more informative to look at non-industry GDP, which we measured by subtracting industry GDP from total GDP. Column 10 indicates that there is no effect on this variable. Table 5 also shows that the results are robust to alternative samples. As an additional exercise, we checked that the results are robust to the presence of Macaé on the sample, the municipality that concentrates oil facilities for offshore production (results not shown and available upon request).

Our findings complement Caselli & Michaels (2009) paper, which shows that oil windfall does not affect municipal non-industry GDP pc. We extend this evidence by showing that oil windfall does not affect other variables of economic activity, such as number of firms, private payroll and number of private employees.

5.2 How Municipalities Allocate Royalty Revenue?

5.2.1 Municipal Budget

We now turn to assess how oil windfall impacts municipal budget and how municipalities report spending this money. Table 6 shows how oil windfall impacts municipal revenue. Panel A indicates the royalty effect on components of municipal revenue measured in R$ per capita, while Panel B shows the impact of oil windfall on each expense as a share of total revenue. The results are from panel-IV regressions that cover the period from 1997 to 2008 period and use municipal and year effects as controls. This analysis includes only municipalities that report the most revenues and expenses, which results in a smaller sample than in other exercises. In column 1 we see that each Real per capita received as royalty payment generates 1.13 Reais in total revenue. Column 2 indicates that an increase in tax revenue can explain approximately half of this 0.13 additional cents.[24] A one-standard-deviation increase in oil windfall is associated with an increase in R$ 0.03 per capita in tax revenue, which represents a 14 percent increase in this revenue. This result indicates that one of the problems of resource abundance pointed out by the literature - the reduction in the incentive to tax - is not present in the Brazilian context. Panel B shows that this increase in tax revenue was only sufficient to keep the share of tax revenue on total budget. The other remaining cents (0.07 out of 0.13) of additional impact on total revenue should be a result of the additional transfers that oil-producing municipalities receive from the state and federal governments (see footnote 13).

Columns 3 and 4 look at the effects of royalty revenues on two other federal transfers. FPM stands for "Fundo de Participação dos Municipios" and it is the most important transfer to municipalities in Brazil, while FUNDEF is the acronym for Fundo de Desenvolvimento da Educação Fundamental (Basic Education Development Fund) and is a fund to finance education.[25] The idea is to understand whether the federal government tries to offset royalty payment by reducing other transfers. Columns 3 and 4 indicate that this does not occur since oil windfall is not associated with changes in both transfers. Naturally, we estimate a reduction of both transfers as a share of total budget since they do not increase while the total budget is boosted by royalty revenues.

Table 7 investigates how municipalities report to allocate revenue. Each column presents the coefficients from panel IV regressions of different types of expenses on royalty payments instrumented by oil output. Column 1 shows that for every Real received, 63 cents are allocated in current expenses,[26] while 23 cents are used for investments and 1 cent for debt amortization, but this last effect is not statistically different from zero. From the 63 cents used for current expenses, 19 cents or 30 percent is allocated to payroll and other direct labor costs, and 20 cents are spent with other types of labor and service hiring (see columns 3 and 4). These results indicate that

[24] The two main taxes under municipal authority are the property tax (IPTU) and a service tax (ISSQN).

[25] FUNDEF is composed by municipal, state and federal contributions whose resources are redistributed to municipalities according to the number of school enrollments to finance education expenses. In 2007, FUNDEF was replaced by FUNDEB.

[26] These include all direct and indirect labor cost, interest payments and other current expenses

oil-rich municipalities apply equivalent amount of resources on payroll and on "other labor and service contracts", which include consulting services, outsourced services and labor hired on a temporarily basis than on payroll. We interpret this result as a reflection of law restrictions to the use of royalty revenues, which do not allow municipalities to use royalty revenue to hire public employees on a permanent basis. A way to circumvent this restriction is to hire people through other means. When we disaggregate "other labor and service contracts" by its components,[27] we see that the bulk of this expense is used to pay for outsourced services provided by companies (results not shown and available under request). This budget line can include several expenses, including two famous expenses in oil-rich municipalities: free live concerts and labor hiring through NGOs. Both expenses are usually cited by the media in scandals about the use of public funds in oil-rich municipalities and have been object of police investigation.[28] Panel B shows the impact of oil windfall on each expense as a share of total revenue. We see that oil revenues do not affect much the composition of public budget. Payroll expenses were slightly reduced as a proportion of total budget while investments suffered a small percentage increase.

Columns 6 to 10 offer another way to look at budget allocation by examining the destination of expenses. We observe that local governments report spending similar amounts in all areas, with the exception of transportation. Expenses with administration and planning are the main destination of oil revenues, receiving 21 cents of every Real received as royalty payments, followed by housing and urbanization (18 cents), health and sanitation (17 cents), education and culture (16 cents) and transportation (2 percent but not statistically different from zero). This implies that the areas that receive the largest improvements are housing and urbanization (41 percent increase in expenses for each standard-deviation increase in royalty revenue), followed by administration and planning (33%), health and sanitation (30%) and education and culture (19%). As a share of total expenses, Panel B indicates that education and health expenses were slightly reduced, while housing and urbanization increased a little.

Although this analysis so far offers insight into how municipalities apply oil windfall, we cannot use it as strong evidence of public goods provision. We have two main concerns with these data. First, the simple report that the municipality spent resources on a service does not necessary imply that the service was delivered in an efficient way. Our second concern is related to the fact that data on municipal public finance are self-declared by municipalities to the Brazilian National Treasury and some municipalities do not report their finances every year.[29] Campos dos Goytacazes, the

[27] Consulting services, outsourced services and labor hired on a temporarily basis (locação de mão-de-obra + contrato por tempo determinado).

[28] In 2008, the federal police arrested 14 people in Campos dos Goytacazes charged with fraud in public procurement of hire outsourced services. In particular, two companies received about R$ 15 million to organize live concerts in the city with non-famous singers. In addition, Campos dos Goytacazes' mayor between 2005 and 2008 is charged of using NGOs and Foundations to divert more than R$ 200 million by hiring 16,000 outsourced employees. See `http://oglobo.globo.com/pais/mat/2008/05/30/ministerio_publico_federal_pede_justica_afastamento_dos_17_vereadores_de_campos-546596081.asp`

[29] Caselli and Michaels (2009) use 2001 values to impute the missing observations for 2000 in order not to lose many

largest recipient of royalty revenues in absolute terms, for instance, only disclosed information on its public expenses on 2000 and 2006.[30] If oil benefited municipalities have a higher probability of not disclosing their public accounts, this can limit the capacity of these data to inform how municipalities are investing royalty revenues. Indeed, a regression of the probability of declaring FINBRA on a dummy on whether the municipality is an oil producing site (onshore or offshore) shows that producers's municipalities have a 4.5 percentage point lower probability of disclosing their public accounts (results not shown).[31]

With these caveats in mind, we turn to look to de facto public good provision.

5.2.2 Public Employment

A major destination of public expenses is the payroll. In order to shed light on public employment trends, Figure 6 shows the evolution of the median number of municipal employees per 1000 habitants in coastal producing and non-producing municipalities from 1997 to 2008. We see that although the median levels in the two groups of municipalities are quite similar in 1997 and 1998, they began to diverge in 1999, exactly when municipalities were most affected by the the large boost in royalty payments caused by the Oil Law.[32] Both groups increased substantially the number of public employees, but producing municipalities began to increase municipal public employment earlier and did it at a faster pace.

Table 8 examines whether the largest increases in municipal public employment occurred in municipalities benefited by the highest increases in royalty payments. It shows the results of IV regressions covering 1997-2008 period and use population, municipality and year effects as controls. In column 1, the dependent variable is the number of municipal employees per 1,000 habitants on September 30th. We use the employment level on September 30th because this is the record available closest to the election, which takes place every four years in the first weekend of October.[33] Column 1 shows that for each R$ 1,000 per capita received, municipalities hire more 7.22 public

municipalities. We do not perform any imputation. We do not need it because we use several years of data, and we do not think this is appropriate as municipalities can allocate their budget in different ways from one year to another.

[30]The only record for "other labor and service contracts" is from 2006. In this year, this municipality spent R 387 million with these contracts, which corresponds to 31 percent of its total expenses or 122 percent of its payroll.

[31]This result is not robust to the inclusion of municipalities fixed effects.

[32]Although Oil Law was enacted in June 1997, decree 2.705/98 which detailed the rules for paying the new parcel was just enacted in August 1998. The incremental part of royalty payments was paid for the first time in October 1998 because royalties are due two months after production. This information was provided by ANP technicians.

[33]The RAIS database includes the information on the employment level on December 31st but also discloses monthly hirings and firings. We calculate the level on September 30th as EmploymentLevel9/30 = EmploymentLevel12/31 - (HiringOctNovDec - FiringOctNovDec). In addition, we did a correction in this measure to account for huge variations in reported employment levels in certain years. Since we believe that these drastic variations are misreports, we replaced by missing any record that reports an annual decrease of more than 75% in the number of employees followed by an increase of more than 200% in the following year. As a result, we lose 60 observations out of 1864 in the sample that includes only coastal municipalities. We performed this correction because we don't want artificial jumps in employment level to affect within-estimates. However, the result is robust to the use of corrected or uncorrected measure.

employees per 1,000 habitants. This result is highly statistically significant (standard error=1.44) and quite important in economic terms. It implies that municipalities hired more 3.4 employees per 1000 habitants for every standard-deviation increase in royalty revenues, which is equivalent to an annual average growth of 10 percent in the number of public employees. Alternatively, this means that oil-rich municipalities on average multiplied the number of employees by more than two-fold in the twelve years under analysis. In the annex Table 18, we show that this estimation is robust to alternative measures of public employees, to different samples and to the inclusion of outliers. In particular, the estimate for the royalty impact on municipal employment is quite similar if we use the 'Perfil dos Municípios Brasileiros: Gestão Pública" database, a survey carried out by IBGE that investigates various aspects of the public administration, such as budgetary and planning procedures, and the number of public employees.[34]

Note that municipalities are forbidden to use royalty income to hire employees on a permanent basis. However, it is widely believed in Brazil that a large share of royalty revenues was used to hire employees.[35] In practice, municipalities have several options for hiring more employees: they can reallocate expenses in order to use the regular budget to pay for hirings, they can bring in temporarily employees or they can hire people indirectly, by establishing contracts with companies which hire people in their place (see footnote 28 on corruption scandals related to this last point). Since the data on Ministry of Labor only consider direct employees, these results should be viewed as a lower bound for the effects on royalties on public employment.

Column 2 in Table 8 shows the results of a regression which assesses whether oil windfall affected municipal public sector wages between 1999 and 2008.[36] In order to account for differences in price levels among municipalities, we use the ratio between the average wage in public sector and the average rate in the private sector as a measure. The average of this variable is 1.17 in Brazil for the period from 1999 to 2008, indicating that public employees earn, on average, 17 percent more than private sector employees.[37] Column 2 shows that oil windfall raises the relative public-private wage, which increases by 0.06 for each R$ 1000 per capita received. However, this estimate is quite noisy (standard error=0.06) and is not statistically different from zero.

In column 3 to 5 we shed light on the composition and quality of the payroll increase. Columns 3 and 4 divide the number of employees between those with and without tenure. Column 3 indicates that the effect on the number of employees with tenure is small and not statistically different from zero. Column 4 shows that most of new employees (96% percent) were hired on a temporary-basis and don't have tenure. A one-standard-deviation increase in royalty payments is associated with

[34]This research was carried out in 1999, 2001, 2002, 2004, 2005, 2006 and 2008.

[35]See, for instance, an article at Estado de São Paulo: "Lucro com petróleo banca farra de contratacões em municípios" (Oil revenues support excessive employment in municipalities), at `http://www.estadao.com.br/estadaodehoje/20080414/not_imp156256,0.php`

[36]This measure is not available for 1997 and 1998.

[37]The relative wage suffered a huge increase in the period under analysis. In 1999, the first year in our sample, the relative wage in Brazil was 0.95. In 2008, this ratio jumped to 1.35.

the hiring of more 6.9 employees without tenure per 1000 habitants, which represents an average annual increase of 58 percent. Both results are consistent with the fact that, by law, municipalities cannot use oil windfall to hire employees on a permanent basis.

Column 5 shows the results of a regression that uses the percentage of public employees with a college degree as a dependent variable. The point estimate is negative and indicates that in oil-rich municipalities, a one-standard-deviation increase in royalty revenue promotes a decrease of 1 percentage point in the percentage of public employees with a college degree. However, this estimate can only be distinguished from zero at a 13 percent confidence level. In order to understand the significance of this result, it worth mentioning that the public sector in all Brazilian municipalities suffered a boost in the period under analysis. Between 1999 and 2008, municipal employment in per capita terms increased 64 percent (from 22 to 36 employees per 1000 habitants). There was also a major improvement in the average educational level: the percentage of employees with college degrees changed from 7 percent to 25 percent. What our results indicate, therefore, is that oil-rich municipalities experienced a even starker growth in public sector and that, even though they also improved the educational level of its employees, they did so at a more reduced level than other Brazilian municipalities. We cannot tell whether this difference is a consequence of intentional decisions by public authorities to hire people with low levels of education or whether it is a consequence of a supply constraint in the number of habitants with college degrees in oil-rich municipalities.[38]

In sum, the results present on Table 8 indicate that oil windfall is associated with a huge expansion in the public sector and that the majority of new employees don't have tenure.

5.2.3 Education and Health Supply

Table 9 looks at the impact of oil windfall on education outcomes. In all regressions, royalty value is instrumented by oil output and population, and we use year and municipal dummies as controls. In Panel A we look at the contemporaneous effect of royalty payments, while in Panel B we use a 2-year lag in order to account for the fact that some investments might take longer to take effect. Column 1 investigates whether the oil windfall was used to increase the number of professionals in education services. We see that oil windfall is associated with an increase in the number of professionals who work at schools. Panel A indicates that municipalities hire more 0.46 education professionals per 1000 habitants for every standard-deviation increase in royalty payments, which represents an increase of 5 percent. This effect is even larger if we estimate the impact of royalty payments received two years earlier. Panel B indicates that a one standard-deviation increase

[38] A supply constrain may emerge in two cases. If fewer people in oil-rich municipalities have college degrees, local governments would not be able to hire enough highly-skilled people. However, this does not seem to be the case since educational levels in oil-rich municipalities are higher than those in non-recipients in the year 2000 (4.31 years of schooling in comparison with 4.07). But even with better levels of education in oil-rich municipalities, a supply constraint would emerge if the additional public sector demand is more than the additional level of people with a college degree.

in royalty payments is associated with 1.1 more education professionals two years later, which is equivalent to a 12 percent increase.

In the remaining columns of Table 9, we regress school enrollment, three indicators of education supply (number of school per habitants between 5 and 19 years old, percentage of teachers with college degree and number of school hours per day) and two indicators of education performance (percentage of students with slow school progress and school dropout) on royalty revenue per capita. For most of the indicators, the period of analysis is from 1996 to 2006, but we analyze shorter periods for some outcomes due to data constraints. Neither Panel A nor Panel B shows that oil windfall improves any of the education outcomes under analysis.

Overall, Table 9 indicates that oil windfall increases the number of education professionals, corroborating the previous results that oil royalties increase the number of public employees, but has negligible effects on other education outcomes that indicate education supply and performance. Our results are in accordance with Caselli & Michaels (2009) paper, which finds that the only effect of oil windfall on education outcomes is through the increase in the number of teachers. We use a different database and find a similar result.

Turning to health outcomes, Table 10 looks at whether oil windfall is associated with an increase health resources. In this Table, we exclude the three largest beneficiaries of royalty revenues.[39] Again, Panel A looks at the contemporaneous effect of royalty payments, while in Panel B we use a 2-year lag in order to account for the fact that some investments might take some time to take effect. Column 1 indicates a positive impact on the number of health professionals per 1000 habitants. A one standard-deviation increase in royalty payments is associated with 0.35 more health professionals if we use the contemporaneous value of the royalty value (Panel A) or with 0.56 more employees if we consider a 2-year royalty lag (Panel B). This represents a considerable boost in the number of health employees, since these estimates imply an annual increase of 22 percent and 35 percent in the number of health professionals, depending on the royalty measure we use. Columns 2 and 3 investigates whether the increase in health expenses shown in Table 7 were accompanied by more health clinics or hospitals administered by local governments. We don't have a complete series for the period under analysis and these regressions cover data from 1998 to 2002 plus 2006 and 2008.[40] Both Panel A and Panel B show that oil windfall is not associated with increases in the number of health clinics or hospitals per 100,000 habitants.

[39] A closer look at the data reveals that Quissamã and Carapebus promoted a substantial increase in the number o health clinics between 1998 and 2000. These municipalities are the first and third largest beneficiaries of royalty revenues. Since their performance is sufficient to drive all the results we decided to exclude the top three royalty beneficiaries in this exercise rather than the top two.

[40] We add two databases to construct number of clinics and hospital series. Data from 1998 to 2002 is from Cadastros Extintos do SUS, while data from 2006 and 2008 was gathered from CNES database. Results for number of hospitals should be interpreted with caution because it is not clear that this variable is comparable in both series.

5.3 How Oil Royalties Affect Local Politics?

5.3.1 Reelection Effects

Table 11 assesses the effects of oil revenue on election outcomes. Panel A looks at mayor reelection in each election after the oil boom (2000, 2004 and 2008) and considers only municipalities where the mayor is in her or his first term and, hence, can run for reelection.[41] The dependent variable is an indicator variable equal to one if the incumbent mayor was reelected. All regressions use oil output as an instrument for royalty payments, and use state fixed effects and municipal characteristics as controls (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). We estimate a large significant effect for 2000, which indicates that a one-standard-deviation increase in royalty value increases reelection chances by 16 percentage points, which implies a increase of 32 percent in reelection chance. The point estimates for 2004 and 2008 are also positive but cannot be distinguished from zero. Note that most of the mayors from oil-rich municipalities were reelected in 2000, which implies that they faced term limits in 2004. Therefore, the test for 2004 may lack power since only 24 oil-rich municipalities were first term mayors in 2004.

In Panel B we repeat this econometric exercise, but use as the dependent variable a dummy indicating whether the political party was reelected. In addition to check the robustness of our results, the use of party reelection allows us to incorporate the 1996 election in the analysis and understand what was happening in these municipalities before the oil windfall boom. In this exercise, municipalities are on the sample no matter whether the mayor is in the first or second-term.[42] [43] The results using party reelection as a dependent variable reassure that oil windfall creates an incumbency advantage in 2000 and also indicate an increase in reelection probability in 2004. The estimated coefficient presented in column 1, Panel B, indicates that an increase of one standard-deviation in royalty payments raises party reelection chances by 20 percentage points in 2000 and in 16 percentage points in 2004. This implies that on average party reelection probability increased by 69 percent in oil-rich municipalities in 2000 and 50 percent in 2004. We also find no effects for party reelection in 1996, when most of the municipalities were already receiving royalties but at much lower levels. This result is very important because it supports the idea that local politics were affected only when royalty values reached a substantial amount, as happened from 1999 onwards, and confirms that our analysis covers the period when most effects occurred.

Table 19 in Annex shows that these findings are robust to alternative samples. No matter whether we consider coastal municipalities, all the 2,151 municipalities from the nine oil producing

[41] Note that in 2000 all mayors were in their first term since this was the first election for which reelection was allowed.

[42] The sample is composed of 119 municipalities rather than 157 in 1996 because there is no available information on the 1996 election for Espírito Santo state and for most of the Rio Grande do Norte municipalities.

[43] For municipalities created between 1993 and 2001, we use information on the party in power in the original municipality to construct party reelection.

states or the 124 onshore and offshore producing municipalities, we estimate that both mayor and party reelection increase in 2000. The effects for 2004 are always positive but only statistically significant in some samples, which reinforce the idea that the test for 2004 may lack power. Most importantly, we estimate no oil windfall impact on mayor and party reelection in 1996 and 2008 elections, which confirms the finding that oil windfall creates an incumbency advantage only in the short run.[44]

The comparison between mayor and party effects also deserves some comments. Mayors can run for reelection under a different political affiliation than the one under which they got into power, so party estimates can be an underestimate (overestimate) of mayors' incumbency advantage in the case that mayors are more (less) associated than parties with benefits of royalty revenues. Our results indicate that oil windfall impact is larger in party reelection than on mayor reelection and that parties were able to incorporate the incumbency advantage when mayors faced term limits.

5.3.2 Political Competition and Selection

Some studies have addressed the theoretical channels through which resource abundance can affect political competition. Caselli & Cunningham (2009) argue that resource revenue can increase competition over power because the value of attaining office and capturing oil revenue increase to all individuals and this may affect the entry of challengers and the effort they put on the process. On the other hand, resource revenues also increase the value of staying in power and can give means for incumbents to influence elections. Potential opponents can estimate the advantage of the incumbent and refrain from running for office, reducing political competition. Therefore, the effects on political competition is a matter of empirical investigation. In our context, this channel may explain our reelection results if we estimate a reduction in political competition in 2000 and/or an increase in 2008.

We assess whether oil windfall affects political competition in Table 12. We use three measures of political competition: the number of candidates running for mayor, the number of effective candidates and the incumbent's margin of victory. While the first variable gives us an indication of pre-election competition, the other two variables show how competitive each election was by taking into account the vote-shares. We regress each dependent variable on royalty payments per capita instrumented by oil output per capita, and use as controls the state fixed effects and municipal characteristics (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). To

[44] We also test royalty impact on mayor reelection using alternative econometric specifications. We use a panel for the 2000, 2004 and 2008 elections and let the royalty coefficient vary per election. No matter if we use municipal fixed effects or not, we estimate a positive and statistically significant effect for 2000 and 2004 and none for 2008. In addition, we use the share of royalty payments in total municipal revenue as an alternative measure of royalty payments. We estimate that an increase in oil windfall equivalent to 10 percent of municipal revenue raises mayor reelection probability by 26 percentage points in 2000 and 22 percentage points in 2004 (results not shown and available upon request).

compare our reelection results, in all regressions we consider only municipalities where the mayor is in his or her first term.

The point estimate shown in column 1 indicates that oil revenues reduced political competition in 2000, but the effect is too noisy and cannot be distinguished from zero. Column 2 shows that oil windfall is associated with a reduction in the number of political candidates in 2004. A one-standard-deviation increase in royalty revenues decreases the number of candidates by 8 percent in 2004. We don't find a statistically significant effect for 2008. Panels B and C look at post-election competition. Panel B shows that a one-standard-deviation increase in royalty payments is associated with a decrease in the effective number of candidates in 5 percent in 2000 and in 12 percent in 2004. No effect was found for 2008. Panel C indicates that royalty payments dramatically increase the incumbent's margin of victory in 2000. A one-standard-deviation increase in royalty payments doubled the incumbent's margin of victory in 2000 (7 points increase in incumbent's vote share). Overall, the results shown in Panels A-C indicate that there is a negative association between oil revenues and post-election political competition in 2000 and 2004 and no effect in 2008. More importantly, the fact that we don't find effects on pre-election competition in 2000 and 2008 indicates that the incumbency advantage cannot be explained by fewer candidates running for mayor.

Panels D-F look at political selection by analyzing changes in the opponents' average characteristics. The link between oil windfall and political selection can be considered under a citizen-candidate framework, where any citizen can enter the electoral race if the benefits of entry exceed the costs (Osborne & Slivinski (1996)). Oil revenues can induce the entry of citizens with high opportunity cost, since it may increase the rewards from office.[45] We try to assess this channel by considering the opponents' average education and previous experience. In Panels D and E , we regress opponents' average years of schooling and the percentage of candidates with college degree on royalty payments using the same econometric specification used in Panels A-C. We find no effects of oil windfall on opponents' education in all the three elections under analysis. Finally, Panel F shows royalty effect on the percentage of candidates that had a highly skilled occupation before running for mayor. We coded as highly-skilled any occupation that requires a college degree or is associated with civil service. We see that oil revenue is not associated with changes in this variable.

Overall, Table 12 indicates that the incumbency advantage estimated for 2000 should be explained by the behavior of those in power rather than through a decrease in political competition or by changes on the pool of candidates.

[45]These rewards from office are not necessary private rents and can include ego-rents and present and future financial compensations.

5.3.3 Why There is an Incumbency Advantage Only in the Short Run?

We now turn to understand the mechanisms which can explain reelection results. We analyze whether the increase in public employment and/or an information story can explain our results.

Timing and Composition of Public Employment

We showed above that oil windfall is associated with a large boost in the public sector. In order to understand whether this fact can explain the incumbent's electoral advantage, we need to understand in which political mandate this increase was most remarkable. Table 13 investigates this issue by analyzing the variation of the number of employees in the two years before each election. Each column shows the coefficients of a regression that include two years of data - the election year and 2 years before - and use as controls the population, municipal fixed effects and year dummies and instrument royalty value by oil output. We analyze royalty impact on three measures of employment: total employment, non-tenured employment and percentage of non-tenured employees. Employment data refers to September 30th of each year, which is the register closest to the election.[46] We consider just the municipalities whose mayors are in the first term to be able to understand electoral motivation but the results are similar with we include the 157 municipalities. Column 1 shows that an one-standard-deviation increase in royalty revenues between 1998 and 2000 is associated with 2.2 additional employees per 1000 habitants, which is equivalent to an increase of 9 percent. Columns 2 and 3 indicates that this increase was driven mostly by tenured employment. The number of non-tenured employees decreased 22 percent for every standard-deviation increase in royalty revenues between 1998-2000. Alternatively, the percentage of non-tenured employees decreased by 6 percentage points in the same period. Columns 4-6 indicates that the boost in the public sector was even larger in the second political mandate under analysis. Between 2002 and 2004, a one-standard-deviation increase in royalty revenues raised the number of employees in 5 per 1000 habitants, which represents an increase of 15 percent (column 4). However, the composition changed toward more non-tenured employees, which constitute the majority of vacancies filled in this period. A one-standard-deviation increase in royalties between 2002 and 2004 is associated with an increase of 5 percentage points in the share of non-tenured employees in the total employment (see column 6). Finally, Table 13 indicates that no new jobs were created between 2006 and 2008 due to an increase in oil windfall. These results confirm the trends we see on Figure 6: total public employment in oil-rich municipalities began to increase in 1999 and followed an upward trend until 2006 and stabilized in 2007 and 2008. In addition, Figure 7 shows that in 1999 and 2000, there was a marked change in employment composition, when tenured employment suffered a huge boost and non-tenured jobs decreased. In 2001-2004, the increase in public employment was led by new non-tenured jobs.

Table 13 shows that the incumbency advantage more or less followed increases in public employ-

[46] Elections take place every four years in the first weekend of October.

ment. The enlargement of public sector can explain reelection results as long as the municipalities that experienced the largest increases in the public sector were the ones whose voters reappointed the mayor for office with a higher probability. Table 14 investigates that question. For each election year, we regress a variable indicating whether the mayor was reelected on the two-year variation of the total number of employees per capita (columns 1, 4 and 7), on the two-year variation of number of non-tenured employees per capita (columns 2, 5 and 6) and on the variation of the proportion of non-tenured employees (columns 3, 6 and 9). All employment measures are instrumented by the two-year variation of oil output. We observe that each employment per 1000 habitants created between 1998 and 2000 caused by oil output variation is associated with an increase of 5 percentage points in reelection probability. However, the composition of public employees does not affect mayor reelection. We also see that more public employment is not associated with reelection in 2004 or in 2008. These results indicate that employing more people was an effective strategy to attract votes in 2000 but not in 2004 and 2008.

These election and employment results are compatible with three alternative stories. The first one is that voters have preferences for a large public sector but there is a limit on how much the mayor can enlarge it. Once you reach that limit, mayors cannot keep hiring people, and thus lose the election. Indeed, there are several laws in Brazil that limit mayors ability to keep hiring people. First, 'Lei de Responsabilidade Fiscal' determines that municipal and state governments cannot spend more than 60 percent of the net current revenue on payroll.[47] Second, the royalty law does not allow the use of royalty revenues to hire employees on a permanent basis. Finally, the government can hire new employees on a temporary basis just to perform very special duties, such as to combat epidemics and carry out the census.[48] Therefore, the fact that we find that public employment does not increase between 2006 and 2008 can be a result of law enforcement. We analyze this issue by gathering information on which municipalities were audited by Tribunal de Contas of Rio de Janeiro state from 2003 and 2008. The audits under analysis had the specific aim of investigating public employment irregularities. In Table 15, we regress the number of employees per capita on royalty revenues, a dummy variable indicating whether the municipality was audited in the current or previous year and an interaction variable of auditing dummy and the amount of royalties received on that year. We also include the geographic controls and instrument royalty value and the interaction variable by oil output and oil output interacted with the auditing dummy. We observe that in 2004, an increase in royalty revenues is associated with a large increase in public employment but no differential effect is found for municipalities which were audited in 2003 and/or 2004. However, in 2008, the interaction variable has a negative and significant effect of similar magnitude of royalty effect. This implies that the audit process was effective in 2008 in restraining public employment increases, since municipalities that received royalties and were audited in 2007 and/or 2008 did not increase the number of employees, while the other non-audited

[47] Lei Complementar n 101, 4 de maio de 2000.
[48] Lei n 8.745, 9 de dezembro de 1993

oil-rich municipalities enlarged the public sector in that year. Therefore, Table 13 cannot allow us to disregard the idea that public employment halted its increase due to constraints on the executive branch, and this caused the loss in incumbency advantage.

The second alternative story is the clientelistic story, as rationalized by Robinson & Verdier (2003) and Robinson et al. (2006) models. The argument in Robinson & Verdier (2003) is that offers of employment in the bureaucracy is a credible policy to obtain political support because optimal employment contracts concede rents to workers due to moral hazard and employment in the bureaucracy is an attractive way for politicians to generate rents.[49] Therefore, our results could simply indicate that as long as incumbents exchange jobs for political support, they can get reelected. Once they stop doing it, they are ousted from power. Although it is difficult to assess the clientelistic story, the analysis of composition of public employment can shed light on it. The clientelism story sketched in Robinson & Verdier (2003) is consistent with an increase in non-tenured employment since according to their model it is crucial for mayors to be able to fire workers, otherwise voters' promise of political support would not be credible. Table 14 indicates that it is the total number of employees rather than the number of non-tenured employees that guaranteed electoral success in 2000. In addition, the most remarkable increase in the number of non-tenured employees occurred in the second political mandate under analysis (2001-2004), when most of the mayors from oil-rich municipalities faced term limits and when we don't estimate a positive association between more employment and higher reelection probability. Table 16 confirms this argument. We show the increase in public employees per political term, splitting the sample in 2004 and 2008 by whether the mayor is in a first or second term. We see that the increase in public sector in 2004 happened in both types of municipalities, while in 2008 oil windfall is not associated with more public employees in both groups. In order to support the clientelistic story, we would need to see an increase in public employment just in municipalities where the mayor is in his first term.

The third story supported by our results is an information one, where voters do not perfectly assess the amount that the municipality receives as oil royalties. Voters can only observe the amount of public goods provided and they know that this depends on the total revenue and on the incumbent's ability, which is not observed. Therefore, oil windfall allows the incumbent to signal a higher ability and voters respond by reappointing the mayor for office. This incumbency advantage can persist as long as voters interpret public employment as a signal of mayor's ability and are sufficiently unaware about the royalty revenue. Once voters become more informed, the difficulty in signaling higher ability reduces the incumbency advantage as well as the incentive to provide more public goods, and mayors end up diverting more funds. The idea that public employment

[49]There is a large number of papers which relate patronage and resource-rich economies. Collier (2007), for instance, points out that "patronage politics can be a more cost-effective use of public money to attract votes than the provision of public goods, yet it is too expensive to be feasible". Therefore, we could see more patronage practices in resource-rich economies just because resource wealth provides funds to bribe voters.

can be interpreted by voters as a public good rather than a political favor is supported by the results from Table 14. However, to support an information story we still need to provide evidence that voters are not fully informed about oil windfall. In addition, we need to show that voters' awareness increased throughout the years. Unfortunately, we don't have any objective measure of voters' information about oil windfall that varies over time, but we circumvent this caveat with alternative evidence.

Information

We believe that the characteristics of Brazilian oil production and royalty distribution rule challenge voters' assessment of royalty value. The lion's share of oil production in Brazil is located offshore and the inland basis is concentrated in one municipality (Macaé). Therefore, voters would be unaware of this oil windfall unless this revenue is made public by the media, politicians or informed citizens. Even more difficult for voters to assess is the exact amount received. Royalty payments depend on the international oil prices, the exchange rate, the production and quality levels of each oil well and their proximity to oil fields. Therefore, royalty revenue varies a great deal across municipalities and over the years and voters need to update their information frequently. Although they can do that by assessing the ANP website, there is evidence that, in the first years of oil boom (at least), the awareness level was quite low. A survey carried out on September 2002 in Campos dos Goytacazes, the largest beneficiary of royalty revenues, indicates that 58 percent of the respondents were not familiar with the term royalties.[50] For those who knew the meaning of royalties, 56 percent pointed out that they didn't know how the revenue was invested.

However, we believe that voters' awareness has increased along the years and with the increase in oil windfall. In municipalities where this money represents a key part of the total budget, informed citizens, the media, political challengers and think tanks improved their technologies to disclose information to the average citizen. Local initiatives to disclose information on royalty values have come out since 2004, at least in the most benefited municipalities. The InfoRoyalties website was created in June 2004 by a local research center in order to deliver information on royalty payments and their use. Regional blogs have been posted in order to freely discuss local politics and public budget.[51]

Two other facts suggest that voters awareness has increased over the years. One is related to voters' and politicians' capacity to predict royalty payments. Although most of the municipalities under analysis have produced oil since the mid-1980s, the stake that they get from this production increased dramatically with the Oil Law in a way that was difficult to anticipate. Figure 8 shows the actual and predicted value of royalty payments for 1997-2000, 2001-2004 and 2005-2008 periods.[52]

[50]Survey of 1,400 respondents detailed at UCAM, Petroleo, Royalties e Regiao, Boletim, Ano 1, Numero 1, Setembro/2003.

[51]Roberto Moraes blog is a case in point. Posted for the first time in August 2004, it has drawn more than 1.4 million readers since then and had an active role in the 2004 and 2008 election debate.

[52]To predict 1997-2000 royalty payments, we first used the royalty payments average annual growth rate from 1994

This figure shows that the values received in 1999 and 2000 were much larger than what was possible to predict based on previous revenues. Therefore, it was harder for both politicians and voters to estimate royalty revenues. However, for the periods of 2001-2004 and 2005-2008, the previous revenue growth rate was a much better proxy of the following years payments. What we want to emphasize with Figure 8 is that it became easier over the years to predict royalty payments.

In addition, in 2007, a particular event increased the information provided regarding royalty payments. In November, Petrobras announced the discovery of Tupi, a giant oil field equal to all Norway's reserves. As noted by Economist (2007), Tupi was the world's second largest strike in 20 years. Two other announcements followed Tupi in early 2008, and the Federal government launched a huge propaganda campaign about what were termed 'pre-sal discoveries', which promised to put Brazil among the five largest oil producers in the World. The promise of a huge windfall spurred politicians to debate the royalty rule, which until then was considered undebatable by the Federal government.[53] A special concern is to increase the number of beneficiary states and municipalities, since the current rule determines that the state of Rio de Janeiro and its municipalities received 43 percent of all oil royalty payments in 2008. In order to follow and stimulate this discussion, newspapers have produced many articles about royalty payments, their beneficiaries and their use. Figure 9 shows the number of articles with the words 'petróleo" (oil), 'royalties" and 'municípios" (municipalities) published by year since 1998 by Folha de São Paulo and O Globo, two Brazilian major newspapers.[54] We see that the average number of articles were about ten until 2006. In 2007, the year of the first major discovery announcement, the number tripled to 30 and in 2008, an election year, 100 news articles were published about the topic. We believe that this graph indicates that more information was provided to voters in 2008 than in previous elections.

Another way to investigate whether information play a role in voters' decision is to explore variation in media coverage across municipalities. Table 17 shows the effect of the presence of media with local content on the 2008 reelection outcome. We regress mayor reelection on royalty payments, a variable indicating whether the municipality has local media and an interaction variable of royalty payments and a media dummy. We also include the geographic controls and instrument royalty value and the interaction variable by oil output, and oil output interacting with the media dummy. Along the columns, we vary the measurement of media presence among local radio, television and newspaper.[55] These regressions only include the 77 municipalities (out of 157) for which the measures of media presence are available. We observe that mayors from oil-rich municipalities have

to 1996 to calculate $PredictedRoyalties_{1997} = Royalties_{1996} * (1 + AverageGrowth1994 - 1996)$. We then used the formula $PredictedRoyalties_{t+1} = PredictedRoyalties_t * (1 + AverageGrowth1994 - 1996)$ where $t = 1997, 1998, 1999$. We follow the same procedure to predict royalty payments for 2001-2004 using the 1997-2000 average real growth rate; and to predict 2005-2008 payments based on the 2001-2004 average real growth rate.

[53] See `http://oglobo.globo.com/pais/noblat/post.asp?cod_post=80899`

[54] Information for O Globo is only available from 2003 onwards. We are still trying to obtain the same information from other newspapers from the beneficiary states.

[55] In column 1, we use the number of local radio stations rather than an indicator variable for whether the municipality has a local station because almost all municipalities have at least one local radio.

a lower probability of getting reelected when there is a local TV or a local newspaper. Although we don't have information on the content disclosed by these medias, the fact that they are local imply that they have a higher probability of disclosing information on local issues than other state or national medias. The size of royalty payments in oil-rich municipalities budget and the threat of losing this revenue turn royalty revenues into an important topic for discussion. Unfortunately, we just have data on local media presence for 2008, which does not allow us to understand how their impact changed over time which is crucial to understand the differential effect of royalty rents on the 2000 and 2008 elections. However, Table 17 supports the idea that information is crucial for political accountability in oil-rich municipalities.

6 Conclusions

In this paper we empirically assess the political mechanisms which explain how natural resource booms affect economic development. We do that by studying the recent boom of oil production in Brazil and the distribution of oil royalties to municipalities. We first investigate how municipalities spend oil windfall. Municipalities use oil windfall to increase the public sector but does not promote large improvements in health and education supply. The only impacts on these two areas that we find is on the number of health and educational professionals. Our estimates indicate an annual average growth of 10 percent in the total number of public employees, which imply that oil-rich municipalities on average multiplied the number of employees by more than two-fold in the twelve years under analysis. We also show that oil production does not have any economic effect on local economies rather than through the municipal budget.

We then analyze how royalty payments affect local politics. We provide evidence that royalty payments create an incumbency advantage in the election that follows oil windfall boom. We estimate that a one-standard-deviation increase in royalty value raised reelection chances by 16 percentage points in 2000 (an increase of 32 percent in reelection chance). However, we show that this effect disappears in the medium run, by estimating no incumbency advantage in 2004 and 2008. We also show that the incumbency advantage estimated for 2000 and 2004 should be explained by the behavior of those who are in power, since oil revenues do not impact political selection in any election or pre-election competition in 2000.

We follow by investigating why voters reelected the incumbents only after the beginning of oil boom. We analyze whether the enlargement of public sector can explain reelection results. In particular, we investigate when the boost in public sector occurred and whether the municipalities that experienced the larger increases in the public sector are the ones whose voters were more likely to reappoint their mayor for office. We show that municipalities increased the number of public employees mainly in the 1997-2000 and 2001-2004 political mandates, but while the first increase was based on more tenured employees, the expansion of the municipal public sector in the second political mandate under analysis relied on non-tenured jobs. The efficacy of this strategy as a way

to obtain political support changed over time. Only in 2000 did voters reward the incumbents who created more jobs.

These results are consistent with the following learning story. In 1997-2000 municipalities were surprised by a huge increase in royalty rents. These rents were used to create more public jobs and to substitute non-tenured employment for tenured ones. Voters interpreted public sector enlargement in 2000 as a signal of future improvements in public service provision and reappointed the mayors for office. Oil rents continued to increase along the years but were not translated into improvements in living standards, which led voters to understand that even mayors who promoted increases in public employment were not able politicians and to vote them down. This information story is supported by evidence which indicates that voters' awareness level increased over time and by the result that local media exerted a pressure on mayors from oil-rich municipalities, who had more difficult in getting reelected. We also consider alternative stories. We disregard a clientelistic story due to the pattern and timing of public employment increase, which indicate that non-tenured employment does not impact reelection and that second-term mayors also hire employees. However, the result that audits stopped the increase in public employment does not allow us to rule out the idea that constraints on the executive branch restrained the enlargement of the public sector and this caused the loss in incumbency advantage.

This paper contributes to the literature by testing for the first time the political economy impacts of resource booms on a democratic context and by exploring how the effects vary in the short and medium run. In addition, this study is an empirical test to several papers. Our findings support some of the theoretical mechanisms present by the literature but contradicts others. We find support for the idea that natural resources increase public employment as suggested by Collier (2007). However, our results are not consistent with the mechanisms sketched in Robinson et al. (2006) model, in which politicians distribute public employment in exchange for political support. We don't find evidence that resource abundance increases competition over power as stated by Caselli & Cunningham (2009) nor that it reduces the incentive to tax as proposed by Collier (2007). Our results also do not support a resource curse story since living standards did not deteriorate.

Taken together, our results indicate that oil does not make leaders unaccountable, and that a democratic system is crucial to avoid the negative effects of resource abundance. Elections, media presence and constraints on executives are all institutions that play a role in restraining the irresponsible use of oil revenues. However, these institutions were not sufficient to guarantee prosperity since our results indicate that Brazilian oil-rich municipalities missed a great opportunity to develop.

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Annex

A Royalty Rule

Oil producers in Brazil must pay 10 percent of the production value as royalties to different government bodies. The rule to distribute oil royalties is determined by two main pieces of legislation and depends on whether the oil is produced onshore or offshore.

5 percent parcel

Law 7.990/89 and Decree 01/91 determine the distribution of the first 5 percent of royalty payments. For onshore production, royalty distribution is straightforward: municipalities where the well is located receive 20% of royalty payments.

The distribution of royalties from offshore production follows a more complex rule. Municipalities affected by oil output receive 30 percent of total royalty payments from offshore wells. The production of the whole state is added up and divided among municipalities which are classified into three categories: (A) main production zone, (B) secondary production zone and (C) neighboring municipalities.

The main production zone comprehends municipalities which are in front of oil wells or which have in their territory three or more oil plants. The criteria to determine which municipality is 'facing' each oil well are based on parallel and orthogonal lines extracted from nautical letters. Main producing zone municipalities receive together 60% of royalty payments due to municipalities. The distribution of royalty payments within this group follows a population size rule. The National Bureau of Statistics (IBGE) is responsible to disclose municipality population every year, which is used to define the participation coefficient for each population range. This participation coefficient aims to attribute greater shares for larger municipalities but do not follow a linear rule. The law also guarantees that municipalities which concentrate production facilities should receive at least one third of the share distributed to municipalities in the main production zone. Hence, the share that each municipality in the main zone receive depends on its location, population and oil producing plants and the ones from its neighbors.

The secondary production zone receives 20% of royalty payments due to municipalities and is composed by municipalities which are crossed by pipelines. The neighboring municipalities receives the remaining 10% of municipal share. A municipality is classified in this group if it borders the main producing zone or if it is from the same mesoregion of main production zone municipalities. The mesoregion is a geographic classification established by IBGE and is not related to royalty payments or oil output. The distribution within these zones also takes into account the population size rule.

Therefore, the share of royalties that municipality i receives from offshore production is :

$$royalties_i = \tag{4}$$

$$municshare_{Ais} * 0.6 * 0.3 * 0.05 * OutputState \ if \ i \in A = MainProductionZone$$

$$municshare_{Bis} * 0.2 * 0.3 * 0.05 * OutputState \ if \ i \in B = SecondProductionZone$$

$$municshare_{Cis} * 0.1 * 0.3 * 0.05 * OutputState \ if \ i \in C = NeighbMunicipalities$$

where $municshare_{jis},\ j \in \{A, B, C\}$ is the municipal share of municipality i from state s. This share depends on municipality population and the number and population of other municipalities in the same group at the same state such that $\sum_i municshare_{jis} = 1$ for each state.

The royalty rule also guarantees 10% of royalty payments to municipalities which have facilities to support transportation to and from oil sites. This share is equally distributed among all the municipalities in Brazil who have this kind of facility, but it considers in different groups municipalities with facilities which support onshore fields and the ones that support offshore fields.

Second 5 percent parcel

The Oil Law (9.478/97) enacted in 1997 and regulated by Decree 2.705/98 increased royalty payments from 5% to up to 10% but determined different criteria to distribute the second parcel of royalty payments.[56]

In relation to onshore royalties, few changes were introduced. Municipalities where the oil field is located receives 15% of its royalty payments (0.15 x 0.05 x OutputField).[57]

In turn, the rule to distribute royalties from offshore fields was dramatically simplified. 22 percent of the second parcel of royalty payments from offshore production is paid to municipalities located in front of the field. The criteria to determine which municipality is 'facing' each field are also based on the same parallel and orthogonal lines to the Brazilian coast. A combination of both lines creates the 'facing quotas', which are the percentage of each oil field located in front a each municipality. Hence, the amount that each coastal municipality receives from offshore production is equal to (FacingQuota x 0.22 x 0.05 x OutputField).

Finally, the second parcel of royalty rule also distributes 7.5% of royalty payments to municipalities which have facilities to support transportation to and from oil sites. But in this case, the distribution within this group considers the amount of oil transported by each facility.

B Oil Data

B.1 Oil output

The Brazilian Oil National Agency (ANP) is the main source of information on oil sector in Brazil. Since August 1998, it discloses monthly data on oil and gas production and prices by oil field. This

[56] The size of the second parcel varies with exploration risk involved in the oil field under contract and range from 1 to 5 percent.

[57] The change of nomenclature from well to field is not accidentally. Law 9.478/97 use the field as a reference rather than the well

information allows us to calculate oil output from 8/1998 to 12/2009 for each oil field by using the formula Output = OilPrice x OilProduction + GasPrice x GasProduction.

Data from the 1991 to 1997 were gathered at the December editions of Oil and Gas Journal. From 1991 to 1997, the magazine reported the average number of barrels of oil produced daily by each oil field. We measure the annual production by multiplying the average daily production by 365. However, this Journal does not provide information on prices, which are necessary to calculate production value. We rely on ANP (2001a) to calculate implicit prices by using the information on total royalty payments and total production. The price per barrel was obtained by using the formula: price=royalties /(0.05 x OutputBarrels). We did not compute prices from 1991 to 1993 since this was a high inflation period, what dramatically challenge the calculation of monetary values. We are confident about using this average price per year for the whole country because oil price was controlled by the state and did not fluctuate with exchange rate and international price before Oil Law was enacted in 1997. A final calculation was necessary to obtain 1998 annual production values since Oil and Gas Journal did not disclose information per oil field for that year. We rely on ANP information from August to December (the first ones available) to calculate 1998 production value as 12/5 x (OutputAugDec).

The next step was to associate oil fields with municipalities in order to obtain production values per municipality. We localized the onshore fields by using GIS information provided by ANP's Exploration and Production Database (Banco de Dados de Exploracão e Producão - BDEP). An onshore oil field is assigned to one municipality if its boundaries falls within a municipality border. In the case of oil fields whose boundaries cover more than one municipality, we distribute the production by considering the percentage of the area of the oil field located on the municipality. In the case of offshore production, we assigned oil fields to each municipality by using the list of facing quotas disclosed by ANP.The facing quotas are monthly disclosed by ANP at `http://www.anp.gov.br/?pg=14431` under the name 'Confrontação Month Year.pdf'.

We should note that we were not able to find the location of all oil fields listed on Oil and Gas Journal on DBEP or ANP database. The fields we didn't localize are responsible for less than 1 percent of total production in a given year and could not have their production assigned to a specific municipality only to the state.[58]

In order to double check our calculation, we added municipal oil output by state and year and compared these number to the ones disclosed at ANP (2001a). The series from 1994 to 1997 constructed based on data provided by Oil and Gas Journal are almost the same to the one informed by ANP at state level (correlation 0.9997), which support the quality of the data provided by the Journal. For the period from 1998 to 2008, our series also match almost perfect to the one disclosed

[58]The production of all non-localized fields represents 0.17 percent of total production in 1994, 0.83% in 1995, 0.67% in 1996, 0.15% in 1997. In most of the cases, they are small oil fields which should have been phased-out due to low production. The largest producing fields not identified are fields which are by the time in their early phases of production and therefore hadn't had a name but rather a code. We weren't able to match these codes with the new names.

by ANP (2001a).

B.2 Royalty payments

Data on royalty payments made to each municipality are disclosed monthly by ANP from 1999 to 2008 at `http://www.anp.gov.br/?pg=9080`. Data from 1994 to 1998 were calculated by us by following in detail the rule described in ANP (2001b) and relying on the information on production value per municipality (calculated as described above using data from Oil and Gas Journal).

Note that from 1994 to 1997, only the first 5% parcel of royalties was paid. The second parcel of royalties began to be paid on October 1998.[59] Hence, the main task to compute royalty payments for this period is to replicate the first parcel rule. We describe that first.

The computation of onshore oil royalties is the easiest part. By using GIS database provided by BDEP, we could match municipal borders with oil field borders and attribute to each municipality 0.2 x 0.05 x ShareFieldMunicipality x OutputField.[60].

For offshore oil royalties, the task is more cumbersome. In order to calculate royalties from 1994 to 1998, we need not only the information on producing municipalities but also the list of municipalities which have three or more oil plants (classified as being part of main producing zone), the ones crossed by pipelines (secondary zone), the neighboring municipalities and the ones from the same mesoregion to a municipality in the main producing zone.

Since no list was found for the 1990s, we rely on ANP (2001b) which provide information for 2000 and assume that the same municipalities were affected by oil output in the 1990s. According to ANP (2001b), eight municipalities are classified in the primary zone in 2000 because they have three or more producing plants. They are: São Sebastião do Passé (BA), Paracuru (CE), São Mateus (ES),Macaé (RJ), Guamaré (RN), Itajaí (SC), Aracaju (SE) e Cubatão (SP). We compose the list of main producing zone municipalities by listing these municipalities and the the ones facing oil fields under production during the 1990s, which are determined in accordance to 'facing quotas' list[61] Royalty payments to each municipality within this group were calculated using equation 4, taking into account that Macaé (RJ) and Cubatão (SP) concentrated oil facilities and deserves at least 33 percent of royalty payments to main producing zone in their respective states.

ANP (2001b) also reports that there were ten municipalities in 2000 crossed by pipelines which

[59] Although Oil Law was enacted in June 1997, decree 2.705/98 which detailed the rules for paying the second parcel was just enacted in August 1998. The second parcel of royalty payments was paid for the first time in October because royalties are due two months after production. This information was provided by ANP technicians.

[60] This calculation requires a simplification because the law determines the payment according to oil well rather than the field. For fields entirely within one municipality border, that is not a problem. For fields which extend from more than one municipality, one may think the use of ShareFieldMunicipality as assessing the probability that the well is located within the municipal border.

[61] Note again that the law states that distribution should follow well location rather than the field, which is the unit of analysis in our dataset. We don't believe, however, that this is a major limitation since we can think about the use of these 'facing quotas' as assessing the probability that the well is located in front a specific municipality, which is equal to the share of that field in front of the municipality.

compose the secondary zone: Fortaleza (CE), Cachoeiras de Macacu (RJ), Duque de Caxias (RJ), Guapimirim (RJ), Mage (RJ), Rio de Janeiro (RJ), Silva Jardim (RJ), Praia Grande (SP), São Paulo (SP), São Vicente (SP). The distribution of royalties to these municipalities also follows the population size rule[62] and equation (4).

The list of neighboring municipalities is determined by using mesoregion codes provided by IBGE. Based on this list, we distribute royalty payments within this group taking into account the population size rule and equation (4). Note that municipalities can receive royalties for more than one reason. For instance, a municipality can receive royalties because it has transportation facilities and because it is a neighboring municipality. Hence, we calculate all these quotas independently for each municipality and each year and then add them up.

Finally, we need to determine the list of municipalities with facilities which support transportation from and to oil sites. This again was extracted from ANP (2001b). In 2002, 57 municipalities had facilities which support onshore production and each of them receive (1/57)*0.1*0.05.ProductionValueOnshoreBrazil. In turn, 15 municipalities have transportation facilities to and from offshore site and each receive (1/15)*0.1*0.05.ProductionValueOffshoreBrazil (see ANP (2001b) for the list of municipalities).

After concluding the computation of the first parcel of royalties, we still need to input the second parcel of royalty payments for 1998. Onshore producing municipalities received additional 0.15 x 0.05 x ShareFieldMunicipality x 3/12 x ProductionValueField1998, while offshore producing municipalities received 0.22 x 0.05 x ShareFieldMunicipality x 3/12 x ProductionValueField1998, where 3/12 stands for three months in that year. We were not able to compute royalties relative to the second parcel for municipalities with transportation facilities. We didn't find information on the volume handled by each facility, which would be necessary to distribute royalties. We don't believe this is a major problem because we are losing just three months of payments.

B.3 Other data

Other variables used in this paper were gathered from different sources as following described.

Electoral information. We use Tribunal Superior Eleitoral (TSE) microdata for 1996, 2000, 2004 and 2008 local elections that is provided by TSE under request. TSE also sent us a list of candidates and parties elected in 1992, which allows us to construct 1996 party reelection variable.

Municipal finance. Data on public finance, including revenues and expenses, are available from Brazil's National Treasury through 'Finanças do Brasil' (FINBRA) database from 1997 to 2008 at `http://www.tesouro.fazenda.gov.br`. Some municipalities do not declare FINBRA every year and sometimes do not provide all the information requested. We use only data from municipalities which report most of revenues and expenses but we do not perform any correction for the years that municipalities did not declare. Hence, our analysis of municipal finance is based on an unbalanced

[62]The population size rule can be found at ANP (2001b).

panel.

Public employees. Data on the number of municipal public employees, their composition and wages were gathered from Registro Anual de Informaes Sociais (RAIS), a database that comprises all formal workers in Brazil. The Brazilian Ministry of Labor (MTE) collects that information and disclose it in Cd-Roms, which are available upon request.

Economic activity. RAIS provides information on private employees, total payroll and number of firms per sector. Municipal GDP is available from IBGE for 1999-2007 period at `http://www.ibge.gov.br/home/estatistica/economia/pibmunicipios/2006/default.shtm`.

Educational data. Educational outcomes are provided by Instituto Nacional de Estudos e Pesquisas Educacionais Ansio Teixeira (INEP) at `http://www.inep.gov.br` from 1996 to 2006.

Health supply. The number of municipal health clinics and hospitals are available at DATASUS's site (See `http://www.datasus.gov.br`). Cadastros Extintos do SUS discloses information for 1998-2002 period, while Cadastro Nacional de Estabelecimentos de Saude (CNES) publish data for 2006-2008. We named health clinics the sum of 'unidades basicas de saude' and 'postos de saude'. Hospital units include 'Ambulatório de Unidade Hospitalar Geral' and 'Ambulatrio de Unidade Hospitalar Especializada' in CNES database and 'Hospital Dia', 'Hospital Geral' and 'Hospital Especializado' in Cadastros Extintos do SUS database. We considered only health units managed by the local government.

Geographic characteristics. We gathered data on municipalities' geographic characteristics such as latitude, longitude, altitude and distance to the state capital at IPEADATA site (`http://www.ipeadata.gov.br`). IPEA also provides 1991 and 2000 population census variables such as population density, percentage of urban households and average years of schooling.

Population estimates. Inter-census population estimates are available at `http://www2.datasus.gov.br/DATASUS/index.php?area=0206`.

Table 1: First-stage

Dependent variable:	Royalty per capita		
	All municipalities	Coastal municipalities	Producing municipalities
	(1)	(2)	(3)
Oil output per capita	0.028	0.028	0.027
	(0.002)***	(0.002)***	(0.002)***
Constant	0.000	0.036	0.027
	(0.002)	(0.016)**	(0.023)
Observations	25857	1882	1486
R^2	0.602	0.686	0.678
Municipalities	2157	157	124
F-stat	252.7	234.0	241.9

Notes: The results presented in columns 1-3 are from regressions that cover the period from 1997 to 2008 and include municipal and year effects as controls. Column 1 includes all municipalities from the nine oil producing states. Column 2 includes municipalities on the coast of the nine producing states, while column 3 sample is composed only by oil producing municipalities (offshore and onshore). Royalty and oil output data are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors clustered at the municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence. F-stat is the Kleibergen-Paap Wald rk F statistic for a weak instrument test.

Table 2: Royalty Summary Statistics

	All oil producing municipalities	Oil producing municipalities on the coast	Non-producing municipalities
	(1)	(2)	(3)
Number of municipalities			
1996	103	56	2,050
2000	106	60	2,053
2004	106	60	2,053
2008	123	71	2,036
Average royalties per capita (R$)			
1997-2000	133	189	2
2001-2004	375	545	6
2005-2008	478	697	10
Royalty standard-deviation (R$)			
1997-2000	346	451	22
2001-2004	838	1,070	44
2005-2008	1,026	1,300	61
Royalties / Municipal revenue			
1997-2000	9.0%	10.9%	0.2%
2001-2004	15.4%	18.0%	0.4%
2005-2008	14.6%	18.0%	0.6%

Notes: This table reports the number of municipalities, average per capita royalty payments, royalty standard deviation and the share of oil royalties on municipal revenue for the three political mandates under analysis and for three group of municipalities. Column 1 includes all oil producing municipalities in Brazil that produce onshore and/or offshore oil. Column 2 is a subgroup of column 1 and includes all oil producing municipalities located on the Brazilian coast. Column 3 contains municipalities that do not produce oil and are located in one of the nine oil producing states in Brazil under analysis (CE, RN, AL, SE, BA, ES, RJ, SP and PR).

Table 3: Municipal Characteristics

	All municipalities in oil producing states			Coastal municipalities in oil producing states		
	Oil producers	Non-producers	Dif.	Oil producers	Non-producers	Dif.
	(1)	(2)	(3)	(4)	(5)	(6)
Number of municipalities	103	2050		56	103	
Socio-demographic characteristics						
Level 1991						
Population	68,214	37,138		104,911	138,673	
% urban population	0.65	0.56	***	0.68	0.63	
Average years of schooling	3.16	3.07		3.49	3.35	
% of illiterate (pop > 25 years)	0.41	0.37	**	0.37	0.39	
Household income per capita	105	136	***	125	137	
Poverty rate	65	55	***	60	58	
Gini index	0.53	0.52	*	0.54	0.52	**
Human Development Index	0.58	0.61	***	0.6	0.6	
Infant mortality	0.09	0.07	***	0.08	0.08	
% of households w/ electricity	0.81	0.77		0.82	0.78	
% of households w/ water pipes	0.48	0.59	***	0.53	0.53	
Variation between 1991-2000						
Population	0.21	0.1	***	0.28	0.29	
% urban population	0.15	0.21		0.09	0.18	
Average years of schooling	0.43	0.43		0.42	0.46	
% of illiterate (pop > 25 years)	-0.29	-0.29		-0.31	-0.32	
Household income per capita	0.34	0.38		0.37	0.41	
Poverty rate	-0.16	-0.18		-0.19	-0.14	*
Gini index	0.06	0.08		0.06	0.12	***
Human Development Index	0.17	0.15	*	0.16	0.18	
Infant mortality	-0.31	-0.37	***	-0.33	-0.33	
% households w/ electricity	0.19	0.26	*	0.21	0.2	
% households w/ water pipes	0.66	1.65		0.67	0.79	
Level 1997						
Num of public employees (1000 hab)	24.1	23.8		21	20.7	
Revenue net of royalties (R$ pc)	708	686		831	689	
% educ. expenses on total budget	0.27	0.27		0.27	0.25	
% health expenses on total budget	0.15	0.17	**	0.14	0.16	
Political characteristics (1996)						
Party reelection	0.27	0.21		0.27	0.18	
Number of candidates	3.81	2.99	***	4.09	4.35	
Effective number of candidates	2.43	2.22	***	2.45	2.42	
Margin of victory	0.14	0.17	*	0.14	0.18	
Candidates's aver. years of schooling	12.1	11.7		11.9	11.8	
% candidates with college degree	0.37	0.37		0.37	0.35	
Geographic Characteristics						
Latitude	-11.4	-17.3	***	-13	-14.8	
Longitude	38.5	44.7	***	39.5	40	
Altitude	48.4	432.6	***	22.3	20.2	
Distance to state capital	100.9	260	***	105.5	119.2	

Notes: This table presents a comparison of the mean socio-demographic, political and geographic characteristics of oil producing and non-producing municipalities. Columns 1-2 compare all municipalities from the nine oil producing states under analysis (CE, RN, AL, SE, BA, ES, RJ, SP and PR) and columns 4-5 compare municipalities on the coast of these states. Column 3 (6) indicates whether the difference between columns 1-2 (4-5) is significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 4: Political Alignment and Timing of Oil Field Discoveries and Initial Output

	Year of discovery	Year of initial output	Gap between initial output and discovery (days)	Gap between initial output and discovery (years)
	(1)	(2)	(3)	(4)
Municipality aligned with federal government	-0.010 (0.014)	0.002 (0.017)	82.3 (403.0)	0.14 (1.00)
Party: PRB	-0.001 (0.043)	-0.087 (0.042)**		
Party: PDS/PP/PPB	-0.027 (0.031)	-0.008 (0.034)	-49.2 (549.3)	0.20 (1.36)
Party: PDT	-0.017 (0.036)	-0.055 (0.037)	706.2 (504.6)	2.07 (1.23)*
Party: PTB	-0.017 (0.040)	-0.043 (0.033)	59.8 (475.6)	0.48 (1.16)
Party: PMDB	-0.033 (0.034)	-0.045 (0.033)	133.9 (442.7)	0.96 (1.08)
Party: PL/PR	-0.025 (0.033)	-0.010 (0.044)	266.0 (488.3)	0.99 (1.11)
Party: PPS	0.031 (0.063)	0.045 (0.050)	420.3 (475.8)	1.03 (1.29)
Party: PFL/DEM	-0.008 (0.033)	-0.009 (0.031)	-5.8 (468.8)	0.22 (1.13)
Party: PMN	0.102 (0.102)	-0.006 (0.062)	532.3 (453.3)	1.53 (1.22)
Party: PRN	0.235 (0.186)	-0.018 (0.038)	-475.3 (508.6)	-1.25 (1.32)
Party: PSB	-0.064 (0.039)	-0.046 (0.039)	-684.5 (547.6)	-1.55 (1.37)
Party: PSD	0.007 (0.056)	0.006 (0.039)	-52.5 (508.6)	0.25 (1.32)
Party: PV	-0.049 (0.032)	-0.190 (0.034)***		
Party: PSDB	-0.002 (0.030)	-0.012 (0.031)	-260.4 (470.0)	-0.44 (1.19)
Party: PT do B	-0.041 (0.032)	-0.075 (0.042)*		
Observations	2155	2155	69	69
R^2	0.042	0.038		
Municipalities	133	133	43	43

Notes: This table reports regression coefficients of the timing of oil field discoveries and initial production on municipal political alignment. In column 1, the dependent variable is equal to one if an oil field within municipality borders was discovered in the respective year, while in column 2 the dependent variable indicates whether oil began to be extracted on the respective year. Columns 3 and 4 dependent variables are the time gap in days and years, respectively, between discover the oil field and beginning its production. All regressions cover the period 1993-2008 and include a dummy indicating whether the party in power in the municipality is from the same political coalition of the federal government, party dummies, and year effects. Columns 1 and 2 also include municipal fixed effects. The omitted party is PT, the Workers Party and the one which run the federal government between 2003 and 2010. In columns 1 and 2, the sample comprises all Brazilian municipalities who had at least one oil producing field within their borders (onshore or offshore) between 1993 and 2008. Regressions present in columns 3 and 4 include only municipalities who had an oil field discovered within their borders in the respective year between 1993 and 2008. Robust standard errors clustered at the municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 5: Oil Output Impact on Economic Activity

	Log population	Total	Number of firms pc: Manu-facturing	Number of firms pc: Trade	Services	Number of private employees pc	Public payroll pc	Private payroll pc	GDP pc	Non-industrial GDP pc
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A - All municipalities in oil producing states										
Oil output pc	0.0169	1.229	-0.073	-0.054	0.973	0.098	0.398	0.141	0.512	-0.004
	(0.00821)**	(1.510)	(0.079)	(0.519)	(1.032)	(0.114)	(0.108)***	(0.135)	(0.034)***	(0.007)
Observations	25857	25857	25857	25857	25857	21556	21556	21556	19399	19399
R^2	0.176	0.353	0.090	0.492	0.214	0.068	0.458	0.058	0.150	0.114
Municipalities	2157	2157	2157	2157	2157	2157	2157	2157	2157	2157
Panel B -Coastal municipalities										
Oil output pc	0.0009	2.452	0.124	1.049	0.969	0.161	0.279	0.212	0.502	-0.008
	(0.0056)	(1.741)	(0.099)	(0.639)	(1.117)	(0.130)	(0.074)***	(0.151)	(0.036)***	(0.010)
Observations	1882	1882	1882	1882	1882	1569	1569	1569	1412	1412
R^2	0.496	0.288	0.081	0.355	0.198	0.072	0.367	0.063	0.456	0.108
Municipalities	157	157	157	157	157	157	157	157	157	157
Panel C -Oil producing municipalities										
Oil output pc	0.0037	2.263	0.097	0.795	1.032	0.155	0.291	0.189	0.497	-0.006
	(0.0058)	(1.592)	(0.095)	(0.563)	(1.030)	(0.127)	(0.083)***	(0.146)	(0.036)***	(0.012)
Observations	1486	1486	1486	1486	1486	1239	1239	1239	1115	1115
R^2	0.510	0.359	0.151	0.398	0.172	0.128	0.402	0.091	0.523	0.107
Municipalities	124	124	124	124	124	124	124	124	124	124

Notes: Panel A regressions include all municipalities from the nine oil producing states under analysis. Panel B includes municipalities on the coast of the nine oil producing states, while panel C sample is composed only by oil producing municipalities. All regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). The results presented in columns 1-5 are from regressions that cover period 1997-2008. Columns 6-8 include 1999-2008 years, while columns 9-10 cover 1999-2007 period. All regressions include municipal and year effects as controls. All measures are in per capita terms. Robust standard errors clustered at the municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 6: Municipal Revenue

	Total revenue pc	Tax revenue pc	FPM transfers pc	FUNDEF transfers pc
	(1)	(2)	(3)	(4)
Panel A - R$ per capita				
Royalties pc	1.13	0.06	-0.01	-0.01
	(0.04)***	(0.01)***	(0.01)	(0.01)
Observations	1620	1619	1620	1354
R^2	0.73	0.12	0.63	0.63
Municipalities	157	157	157	157
Y mean	1.23	0.20	0.22	0.16
Panel B - Share of total revenue				
Royalties pc		0.0005	-0.04	-0.03
		(0.0051)	(0.01)***	(0.01)***
Observations		1619	1620	1354
R^2		0.08	0.44	0.23
Municipalities		157	157	157
Y mean		0.14	0.25	0.15

Notes: This table reports the effects of royalty payments on public revenues in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). These regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras) and include only municipalities reporting most revenues and expenses. In all regressions, royalty value is instrumented by oil output and population, and use year and municipal effects as controls. All regressions cover 1997-2008 period. In Panel A, the dependent variables are measured in R$ 1000 per capita and, in Panel B, they are computed as a share of total revenue. Royalty data are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. On column 3, FPM stands for Fundo de Participação dos Municipios . FPM is the most important transfer to municipalities in Brazil. FUNDEF on column 4 is the acronym for Fundo de Desenvolvimento da Educação Fundamental (Basic Education Development Fund) and is composed by municipal, state and federal contributions, whose resources are redistributed to municipalities according to the number of school enrollments to finance education expenses. In 2007, FUNDEF was replaced by FUNDEB. Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 7: Municipal Expenses

	Current expenses pc	Payroll pc	Other labor and service pc	Invest-ment pc	Debt amortization pc	Administration and planning pc	Education and culture pc	Health and sanitation pc	Housing urbanization pc	Transport-ation pc
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A - R$ per capita										
Royalties pc	0.63	0.19	0.20	0.23	0.01	0.21	0.17	0.17	0.18	0.02
	(0.13)***	(0.04)***	(0.04)***	(0.04)***	(0.01)	(0.06)***	(0.02)***	(0.04)***	(0.03)***	(0.02)
Observations	1620	1619	934	1620	1469	1620	1620	1620	1620	1620
R^2	0.61	0.40	0.41	0.22	0.17	0.18	0.57	0.59	0.28	0.04
Municipalities	157	157	154	157	157	157	157	157	157	157
Y mean	1.04	0.48	0.41	0.16	0.02	0.27	0.35	0.24	0.18	0.02
Panel B - Share of total revenue										
Royalties pc	-0.05	-0.06	-0.00	0.02	-0.00	0.00	-0.03	-0.01	0.02	-0.00
	(0.02)***	(0.01)***	(0.01)	(0.01)**	(0.00)	(0.01)	(0.01)***	(0.00)**	(0.01)*	(0.00)
Observations	1620	1619	934	1620	1469	1620	1620	1620	1620	1620
R^2	0.09	0.10	0.07	0.11	0.11	0.06	0.18	0.22	0.01	0.11
Municipalities	157	157	154	157	157	157	157	157	157	157
Y mean	0.86	0.39	0.28	0.12	0.02	0.21	0.31	0.19	0.14	0.02

Notes: This table reports the effects of royalty payments on public expenses in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). These regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras) and include only municipalities reporting most revenues and expenses. In all regressions, royalty value is instrumented by oil output and population, and use year and municipal effects as controls. All regressions cover 1997-2008 period. In Panel A, the dependent variables are measured in R$ 1000 per capita and, in Panel B, they are computed as a share of total revenue. Current expenses include all direct and indirect labor cost, interest payments and other current expenses. Payroll expenses include direct labor expenses, payroll taxes, outsourced labor and other labor expenses, and do not include pensions. Other labor and service contracts include consulting services, outsourced services and labor hired on a temporarily basis (locação de mão-de-obra + contrato por tempo determinado). Payroll (column 2) and other labor and service contracts (column 3) are subdivisions of current expenses (column 1). Royalty data are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 8: Public Employment

	Number of employees	Relative public/private wage	Number of employees with tenure	Number of employees without tenure	Percentage of employees with college degrees
	(1)	(2)	(3)	(4)	(5)
Royalties pc	7.22	0.06	0.44	6.94	-0.02
	(1.44)***	(0.06)	(2.81)	(2.71)**	(0.01)
Observations	1807	1547	1807	1807	838
R^2	0.47	0.35	0.25	0.09	0.31
Municipalities	157	157	157	157	157

Notes: This table reports the effects of royalty payments on municipal public employment in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). These regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). In all regressions, royalty value is instrumented by oil output and population, year and municipal effects are used as controls. All employment variables are measured in per 1000 habitants. Columns 1, 3 and 4 cover 1997-2008 period and regression in column 2 includes 1999-2008 years. The dependent variable in column 5 is from the "Perfil dos Municípios Brasileiros: Gestão Pública" database and cover 1999, 2001, 2002, 2004, 2005, 2006 and 2008. The number of employees in column 1, 3 and 4 relates to all employees hired by the local municipality on September 30th. The relative public-private wage is the ratio between public and private sector wages. Columns 3 and 4 are subdivisions of column 1. Royalty payments are the value received in the contemporaneous year, are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 9: Education Supply

	Education professionals per 1000 hab (1999-2008)	Schools per young habitants (1999-2006)	Enrollment per young habitants (1999-2006)	Number of teachers with college degree (1996-2006)	School hours per day (1996-2006)	% of students with slow school progress (1996-2006)	School dropout rate (1996-2005)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Royalties pc	0.96	-0.00	10.92	-3.06	-0.04	0.02	-1.03
	(0.47)**	(0.16)	(18.99)	(3.30)	(0.03)	(1.40)	(1.04)
Observations	1524	1255	1255	1521	1706	1552	1550
R^2	0.19	0.12	0.03	0.51	0.09	0.70	0.27
Municipalities	157	157	157	157	157	157	157
Royalties pc	2.17	0.07	25.60	-0.40	-0.02	-0.78	-2.47
(2 years lag)	(0.82)***	(0.16)	(24.18)	(4.93)	(0.03)	(1.92)	(1.54)
Observations	1524	1255	1255	1521	1696	1552	1540
R^2	0.20	0.12	0.04	0.51	0.08	0.70	0.27
Municipalities	157	157	157	157	157	157	157

Notes: This table reports the effects of royalty payments on education supply in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). Panel A reports the contemporaneous effect of royalty payments on different education outcomes as indicated in each column, while Panel B reports the effect of the amount received two years before. Education professionals include all public employees hired by the municipality who work at schools. The data are from RAIS database and refers to employment level on December 31st. Schools per young habitants and enrollment per young habitants are, respectively, the number of schools and enrollment in elementary school divided by the number of habitants between 5 and 19 years-old. Dropout rate refers to the average rate of student who drop out the school during the school year. The period covered in each regression varies as indicated in the columns due to data availability. Regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). In all regressions, royalty value is instrumented by oil output and population, and use year and municipal effects as controls. Royalty and oil data are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence. Robust standard errors clustered by municipalities are reported in parentheses.

Table 10: Health Supply

	Health professionals per 1000 hab	Municipal clinics per 100,000 hab	Municipal hospitals per 100,000 hab
	(1)	(2)	(3)
Royalties pc	0.70	-2.47	-0.59
	(0.18)***	(2.92)	(0.62)
Observations	1514	1207	1207
R^2	0.38	0.07	0.04
Municipalities	156	156	156
Royalties pc (2 years lag)	1.11	1.04	-0.58
	(0.39)***	(1.99)	(0.66)
Observations	1514	1207	1207
R^2	0.37	0.07	0.02
Municipalities	156	156	156

Notes: This table reports the effects of royalty payments on health supply in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). Panel A reports the contemporaneous effect of royalty payments on different health outcomes as indicated in each column, while Panel B reports the effect of the amount received two years before. Health professionals include all public employees hired by the municipality who provide health services. The data is from RAIS database and refers to employment level on December 31st. Health clinics are the sum of 'unidades basicas de saude' and 'postos de saude'. Hospital units include 'Ambulatório de Unidade Hospitalar Geral' and 'Ambulatório de Unidade Hospitalar Especializada' in CNES database and 'Hospital Dia', 'Hospital Geral' and 'Hospital Especializado' in Cadastros Extintos do SUS database. We considered only health units managed by the local government. Regression presented in column 1 uses annual data from 1999 to 2008, while regressions presented in columns 2 and 3 are based on annual data from 1998 to 2002 plus 2006 to 2008. The regressions exclude the three largest beneficiaries of royalty revenue (Quissamã, Rio das Ostras and Carapebus). In all regressions, royalty value is instrumented by oil output and population, year and municipal effects are used as controls. Royalty and oil data are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 11: Mayor and Party Reelection

	1996	2000	2004	2008
	(1)	(2)	(3)	(4)
	A-Dependent variable: Mayor reelection			
Royalties pc		0.59	0.17	0.07
		(0.15)***	(0.18)	(0.14)
Municipalities		157	79	117
	B-Dependent variable: Party reelection			
Royalties pc	1.28	0.72	0.32	-0.00
	(1.53)	(0.16)***	(0.14)**	(0.05)
Municipalities	119	157	157	157

Notes: This table reports the effects of royalty payments on mayor and party reelection in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). Regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). All regressions use oil output as an instrument for royalty value and control for population, state fixed effects and municipal characteristics (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). Each column indicates one election year: 1996, 2000, 2004 and 2008. Panel A dependent variable is a dummy variable indicating whether the mayor was reelected. Regressions on Panel A consider only municipalities where the mayor is in his first term. Panel B dependent variable is a dummy variable indicating whether the party was reelected. For municipalities created between 1993 and 2001, we use information on the party in power in the original municipality to construct party reelection. The sample in column 1, panel B, is smaller because there is no information on 1996 election for Espírito Santo state and for most of Rio Grande do Norte's municipalities. We use the contemporaneous value of royalty rents and oil output. Both are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 12: Political Competition and Selection

	2000	2004	2008
	(1)	(2)	(3)
	A-Dependent variable: Number of candidates		
Royalties pc	-0.47	-0.65	0.27
	(0.38)	(0.32)**	(0.56)
Municipalities	157	79	114
	B-Dependent variable: Effective number of candidates		
Royalties pc	-0.45	-0.56	-0.05
	(0.18)**	(0.22)***	(0.17)
Municipalities	157	79	114
	C-Dependent variable: Incumbent margin of victory		
Royalties pc	0.26	-0.03	0.06
	(0.07)***	(0.08)	(0.07)
Municipalities	127	61	83
	D-Dependent variable: Opponents' years of schooling		
Royalties pc	0.68	0.63	0.77
	(1.37)	(0.88)	(0.64)
Municipalities	155	78	117
	E-Dependent variable: Opponents' college degree		
Royalties pc	0.06	0.16	0.12
	(0.16)	(0.12)	(0.10)
Municipalities	155	79	117
	F-Dependent variable: Opponents' highly-skilled occupation		
Royalties pc	-0.00	-0.02	0.13
	(0.20)	(0.10)	(0.11)
Municipalities	154	77	117

Notes: This table reports the effects of royalty payments on political competition and selection in municipalities located on the coast of the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR). Regressions exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). All regressions use oil output as an instrument for royalty value and control for population, state fixed effects and municipal characteristics (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). Each column indicates one election year: 2000, 2004 and 2008. All regressions consider only municipalities where the mayor is in his first term. Panel A dependent variable is the number of candidates who run for mayor. Panel B dependent variable is the effective number of candidates who run for mayor, which is computed by dividing one by the Herfindahl index. Panel C dependent variable is the incumbent's margin of victory, which is the difference in vote-share between the incumbent who is running for reelection and the closest opponent. Panel C considers only municipalities whose mayors ran for reelection. Panel D-F considers opponents' average characteristics. College degree indicates the percentage of candidates with a college diploma. Highly-skilled occupation in column F refers to the percentage of candidates that have a highly-skilled occupation before running for mayor. We use the contemporaneous value of royalty rents and oil output. Both are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Robust standard errors are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 13: Public Employment by Political Mandate

	Total	Non-tenured	% non-tenured	Total	Non-tenured	% non-tenured	Total	Non-tenured	% non-tenured
	1998-2000			2002-2004			2006-2008		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Royalties pc	10.33	-10.37	-0.27	10.63	10.56	0.11	-2.01	1.90	0.05
	(4.49)**	(3.31)***	(0.11)**	(1.47)***	(1.51)***	(0.05)**	(2.60)	(2.47)	(0.05)
Observations	274	274	274	146	146	146	232	232	232
Municipalities	137	137	137	73	73	73	116	116	116

Notes: This table reports the effects of royalty payments on municipal public employment by political mandate. The dependent variable is the total number of public employees per 1000 habitants in columns 1, 4 and 7; total number of non-tenured employees per 1000 habitants in columns 2, 5 and 8; and the percentage of non-tenured employees on total employment in columns 3, 6 and 9. All employment measures are from September 30th of the years indicated in the columns. All regressions consider only municipalities where the mayor is in his first term. Royalty payments are the value received in the contemporaneous year, are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Population, municipal fixed effects and year dummies are included as controls and royalty value is instrumented by oil output. We consider only municipalities from the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR) and exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 14: Public Employment and Reelection

Dependent variable:	Mayor reelection 2000			Mayor reelection 2004			Mayor reelection 2008		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total employees pc	0.05			-0.01			-0.07		
	(0.03)*			(0.02)			(0.04)		
Non-tenured employees pc		-0.08			-0.00			-0.38	
		(0.07)			(0.01)			(1.09)	
% of non-tenured employees			-4.85			-0.25			19.77
			(7.31)			(0.73)			(52.23)
Observations	137	137	137	73	73	73	116	116	116
F-stat	3.423	1.431	0.358	7.476	13.78	6.055	2.973	0.111	0.110

Notes: This table reports regressions coefficients of a dummy variable indicating whether the mayor was reelected on two-year change of municipal employment instrumented by two-year change of oil output per capita. These regressions use as controls state fixed effects and municipal characteristics (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). The sample used include only municipalities whose mayor is on his first term. We consider only municipalities from the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR) and exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). Robust standard errors are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence. F-stat is the Kleibergen-Paap Wald rk F statistic for a weak instruments test.

Table 15: Auditing

Dependent variable:	Number of employees pc	
	2004	2008
	(1)	(2)
Royalties pc * audit	2.72	-21.58
	(23.69)	(5.70)***
Royalties pc	25.11	23.97
	(12.65)**	(5.47)***
Audit	-3.77	17.50
	(4.61)	(6.89)**
Observations	88	88
F-stat	37.41	87.00

Notes: This table reports the effects of royalty payments and audits on municipal public employment. The dependent variable is the total number of public employees per 1000 habitants on September 30th of the years indicated in the columns. Audit is a dummy variable indicating whether the municipality was audited by TCE-RJ in the current and/or previous year. These regressions use as controls municipal characteristics: population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital. We instrument royalty value and the interaction variable by oil output and oil output interacted with the auditing dummy. Royalty payments are the value received in the contemporaneous year, are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. The sample includes only Rio de Janeiro municipalities. Robust standard errors are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence. F-stat is the Kleibergen-Paap Wald rk F statistic for a weak instruments test.

Table 16: Public Employment and Electoral Incentives

Dependent variable:	Number of employees pc				
	First term 1998-2000	First term 2002-2004	Second term 2002-2004	First term 2006-2008	Second term 2006-2008
	(1)	(2)	(3)	(4)	(5)
Royalties pc	10.33	10.63	8.36	-2.01	-0.21
	(4.49)**	(1.47)***	(2.91)***	(2.60)	(0.23)
Observations	274	146	154	232	76
R^2	0.12	0.18	0.27	0.18	0.25
Municipalities	137	73	77	116	38

Notes: This table reports the effects of royalty payments on municipal public employment by political mandate. The dependent variable is the total number of public employees per 1000 habitants on September 30th of the years indicated in the columns. First term (second term) indicates municipalities where the mayor is in his first term (second term). Royalty payments are the value received in the contemporaneous year, are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. Population, municipal fixed effects and year dummies are included as controls and royalty value is instrumented by oil output. We consider only municipalities from the nine oil producing states (CE, RN, AL, SE, BA, ES, RJ, SP and PR) and exclude the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras). Robust standard errors clustered at municipality are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence.

Table 17: Media Presence

Dependent variable:	Mayor reelection in 2008		
Media variable:	Number of local radio stations	Local TV	Local newspaper
	(1)	(2)	(3)
Royalties pc * Media	-0.02	-0.26	-0.29
	(0.02)	(0.16)*	(0.19)
Royalties pc	0.18	0.19	0.17
	(0.15)	(0.15)	(0.18)
Media	0.04	0.09	0.06
	(0.03)	(0.23)	(0.20)
Observations	77	77	77
R^2	0.17	0.17	0.17
F-stat	8.041	9.482	7.015

Notes: This table reports the effects of royalty payments and local media presence on mayor reelection. The dependent variable is a dummy indicating whether the mayor was reelected in 2008. In column 1, media is the number of local radio stations. In column 2, media is a dummy variable indicating whether the municipality has a television channel with local transmission, while column 3 media variable is a dummy indicating whether the municipality has a local newspaper. These regressions use as controls state fixed effects and municipal characteristics (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). We instrument royalty value and the interaction variable by oil output and oil output interacted with media dummy. Royalty payments are the value received in the contemporaneous year, are measured in R$ 1000 per habitant and are deflated by the consumer price index, representing 2008 values. The sample includes only 77 municipalities out of the 157 coastal municipalities for each the media information is available. Robust standard errors are reported in parentheses. Significantly different than zero at 99 (***), 95 (**), 90 (*) percent confidence. F-stat is the Kleibergen-Paap Wald rk F statistic for a weak instruments test.

Table 18: Robustness of Public Goods Results

	(1)	(2)	(3)	(4)
Sample	Coastal municipalities	All municipalities	Oil producing municipalities	Coastal municipalities
Outliers	No	No	No	Yes
Public Employment				
Number of employees on 9/30	7.24	11.23	7.62	4.60
(RAIS corrected)	(1.44)***	(2.30)***	(1.67)***	(1.07)***
Number of employees on 9/30	6.74	10.84	7.09	4.32
(RAIS uncorrected)	(1.42)***	(2.21)***	(1.69)***	(1.04)***
Number of employees on 12/31	6.41	9.90	7.35	4.27
(RAIS corrected)	(1.70)***	(2.58)***	(2.07)***	(0.98)***
Number of employees on 12/31	5.92	9.53	6.85	3.99
(RAIS uncorrected)	(1.63)***	(2.48)***	(2.00)***	(0.94)***
Number of employees with	0.44	2.70	-0.19	0.32
tenure on 9/30	(2.81)	(2.85)	(3.01)	(1.90)
Number of employees without	6.94	8.55	7.82	4.32
tenure on 9/30	(2.71)**	(3.03)***	(3.13)**	(1.76)**
% of employees	-0.02	-0.02	-0.01	-0.02
with college degree	(0.01)	(0.01)	(0.01)	(0.01)**
Number of teachers 31/12	0.91	1.44	1.44	0.06
	(0.47)*	(0.54)***	(0.55)***	(0.83)
Number of physicians 31/12	0.70	0.77	0.51	0.33
	(0.18)***	(0.17)***	(0.21)**	(0.27)
Number of employees	6.87	7.85	6.54	5.44
(MUNIC)	(1.94)***	(2.08)***	(1.85)***	(1.12)***
Relative wage	0.06	0.07	0.03	0.09
	(0.06)	(0.06)	(0.07)	(0.04)**
Education supply				
Schools per	0.08	0.50	0.18	0.09
young habitants	(0.16)	(0.15)***	(0.16)	(0.04)**
School enrollment per *	25.76	22.94	40.99	9.23
young habitants	(24.18)	(22.66)	(26.73)	(12.67)
Num of teachers with	-0.36	5.81	8.09	0.30
college degree	(4.93)	(4.77)	(6.01)	(1.18)
Hours of school per day	-0.02	-0.06	-0.05	-0.03
	(0.03)	(0.06)	(0.06)	(0.01)***
% of students with slow	-0.80	-5.24	-0.40	-0.06
school progress	(1.93)	(2.01)***	(1.96)	(0.57)
School dropout	-2.46	-3.08	-0.85	-1.20
	(1.54)	(1.32)**	(1.68)	(0.50)**
Health supply				
Municipal clinics per 100,000 hab	1.51	0.20	0.05	-0.14
	(1.82)	(1.93)	(2.23)	(1.16)
Municipal hospitals per 100,000 hab	-0.51	0.33	-0.38	-0.54
	(0.59)	(0.50)	(0.59)	(0.35)

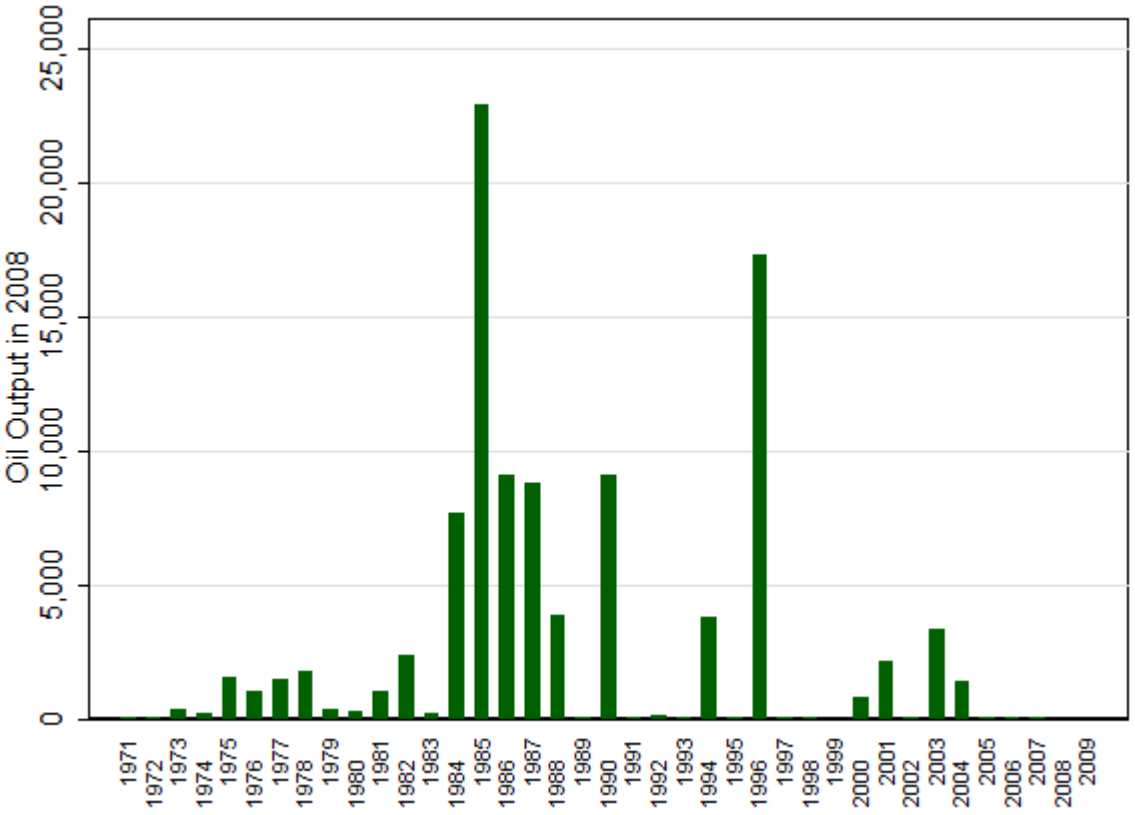
Notes: Each entry is the coefficient and correspondent robust standard-error of regressing the dependent variable indicate in the line on royalty revenue. All regressions use annual data and control for population, municipal and year effects. Each column indicates a different sample as explained in the top of the table. In all regressions, royalty value is instrumented by oil output. We use the contemporaneous value of royalty payments in public employment regressions and the 2-year lag in the education and health supply regressions. Outliers refer to the municipalities on the top 1% of royalty distribution (Quissamã and Rio das Ostras).

Table 19: Robustness of Reelection Results

	Coastal municipalities	All municipalities	Oil producing municipalities
	(1)	(2)	(3)
Panel A - Mayor reelection			
Royalties pc 2000	0.59	0.26	0.47
	(0.15)***	(0.13)*	(0.25)*
Obs	157	2151	124
Royalties pc 2004	0.17	0.32	0.53
	(0.18)	(0.19)*	(0.26)**
Obs	79	1236	65
Royalties pc 2008	0.07	0.04	0.06
	(0.14)	(0.08)	(0.18)
Obs	117	1608	91
Panel B - Party reelection			
Royalties pc 1996	1.28	0.90	0.86
	(1.53)	(1.04)	(1.47)
Obs	119	1867	99
Royalties pc 2000	0.72	0.68	0.62
	(0.16)***	(0.15)***	(0.27)**
Obs	157	2151	124
Royalties pc 2004	0.32	0.32	0.22
	(0.14)**	(0.11)***	(0.21)
Obs	157	2151	124
Royalties pc 2008	-0.00	0.00	0.02
	(0.05)	(0.05)	(0.07)
Obs	157	2151	124

Notes: Each entry is the coefficient and correspondent standard-error of a regression of mayor reelection (Panel A) and party reelection (Panel B) on royalty value per capita instrumented by oil output per capita. Each line refers to a different election year and each column indicates a different sample as explained in the top of the table. All regressions control for population, year effects, state fixed effects and municipal characteristics (population, urbanization rate, population density, distance to the state capital, altitude, longitude, latitude, area, a dummy for whether the municipality is a state capital). Regressions on Panel A consider only municipalities where the mayor is in his first term.

Figure 1: Oil Field Output in 2008 by Year of Field Discovery



Notes: This graph shows the distribution of 2008 oil output based on the year that the oil field was discovered (indicated on the x-axis). Oil output is measured in R$ million.

Figure 2: Oil Production 1994-2008

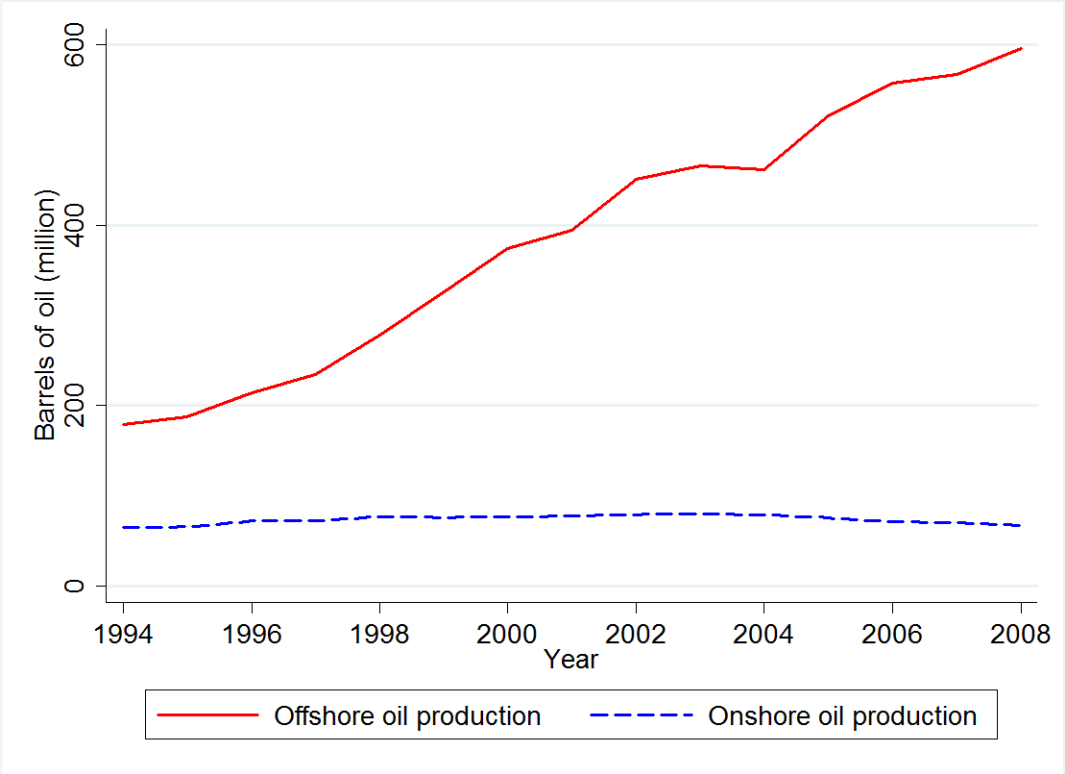
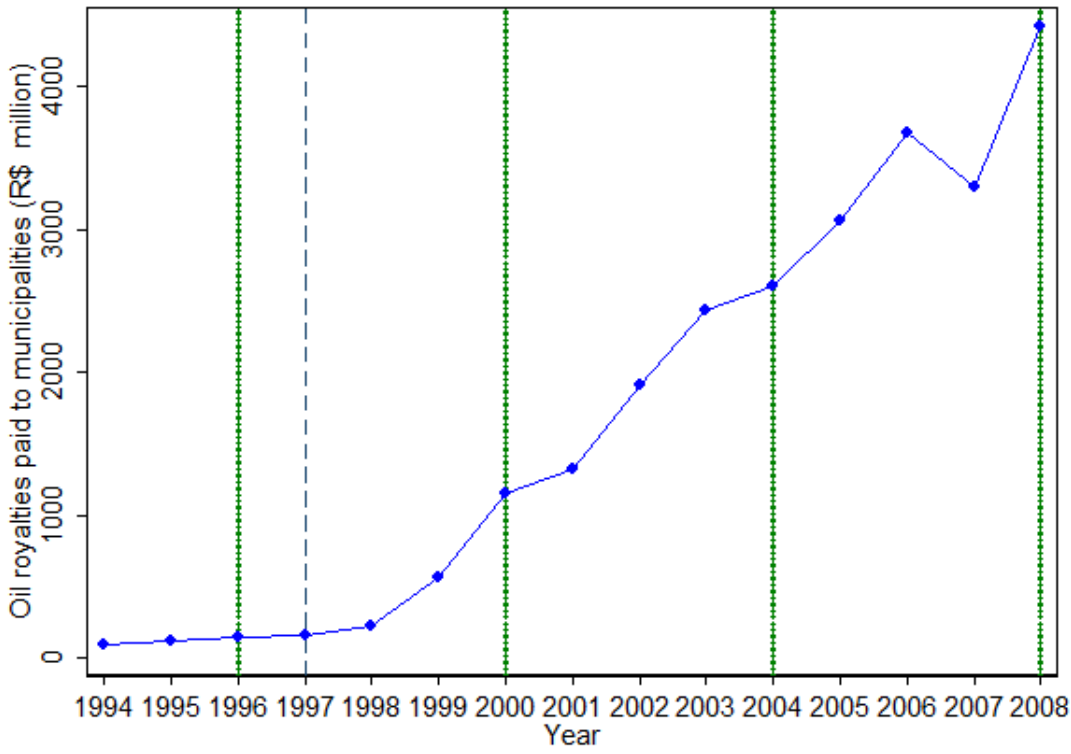
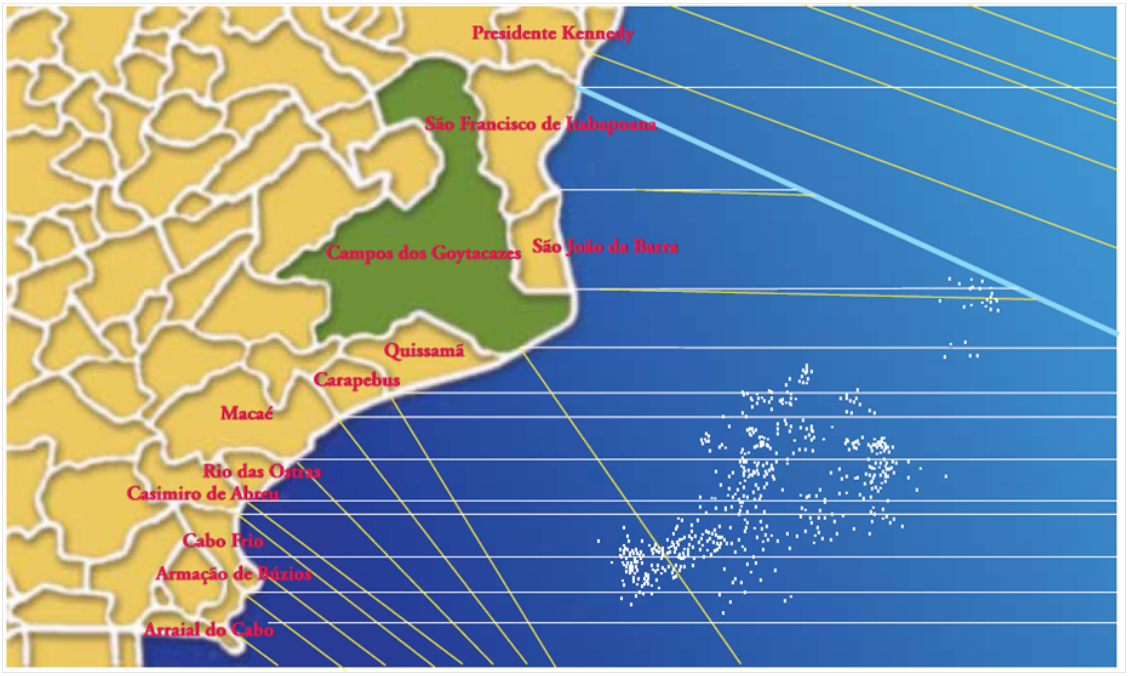


Figure 3: Royalty Payments to Brazilian Municipalities 1994-2008



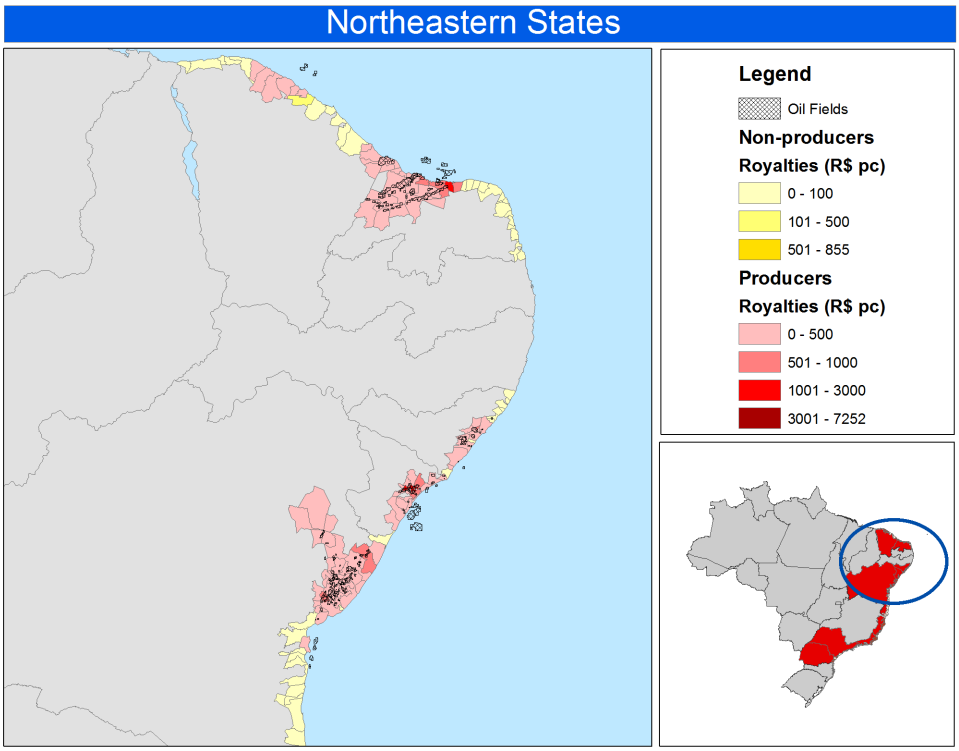
Notes:
This figure show the evolution of royalty payments to municipalities from 1994 to 2008. Royalty payment unit is R$ million and corresponds to 2008 real value. The solid vertical lines indicate municipal election years. The dash vertical line indicates the year of enactment of Oil Law.

Figure 4: Orthogonal and Parallel Lines on Rio de Janeiro Coast



Notes: This figure shows the orthogonal and parallel lines that lies on the coast of the state of Rio de Janeiro. These lines are the criteria used to determine which municipalities face oil fields. The dots indicate oil wells. Source: ANP (2001b). Guia dos Royalties de Petróleo e do Gás Natural.

Figure 5: Location of Producing and Non-producing Municipalities



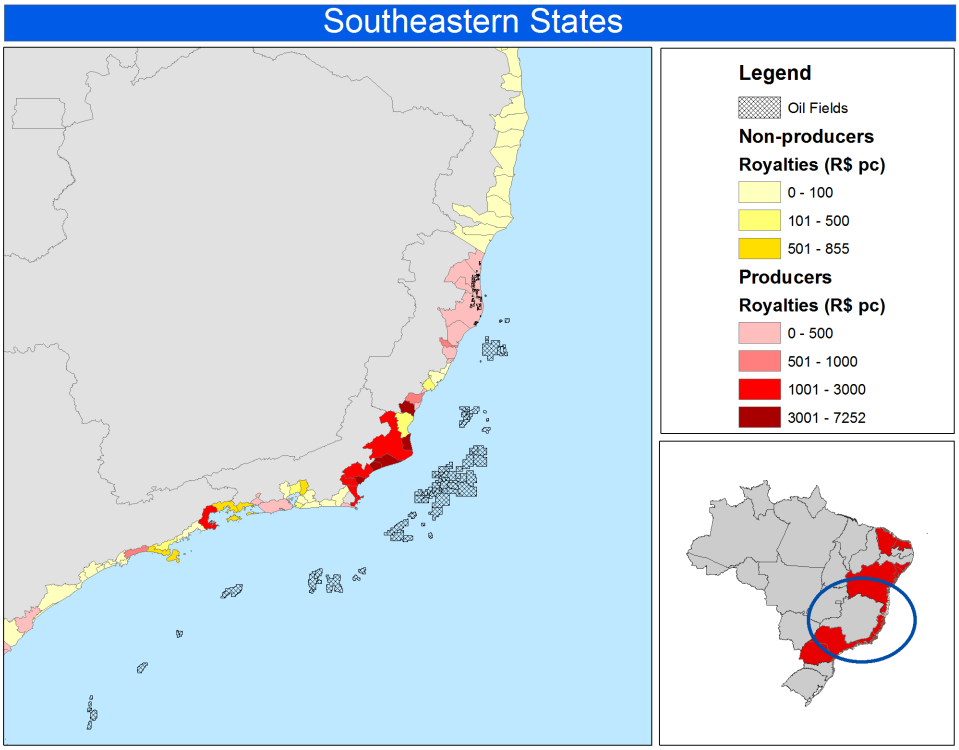
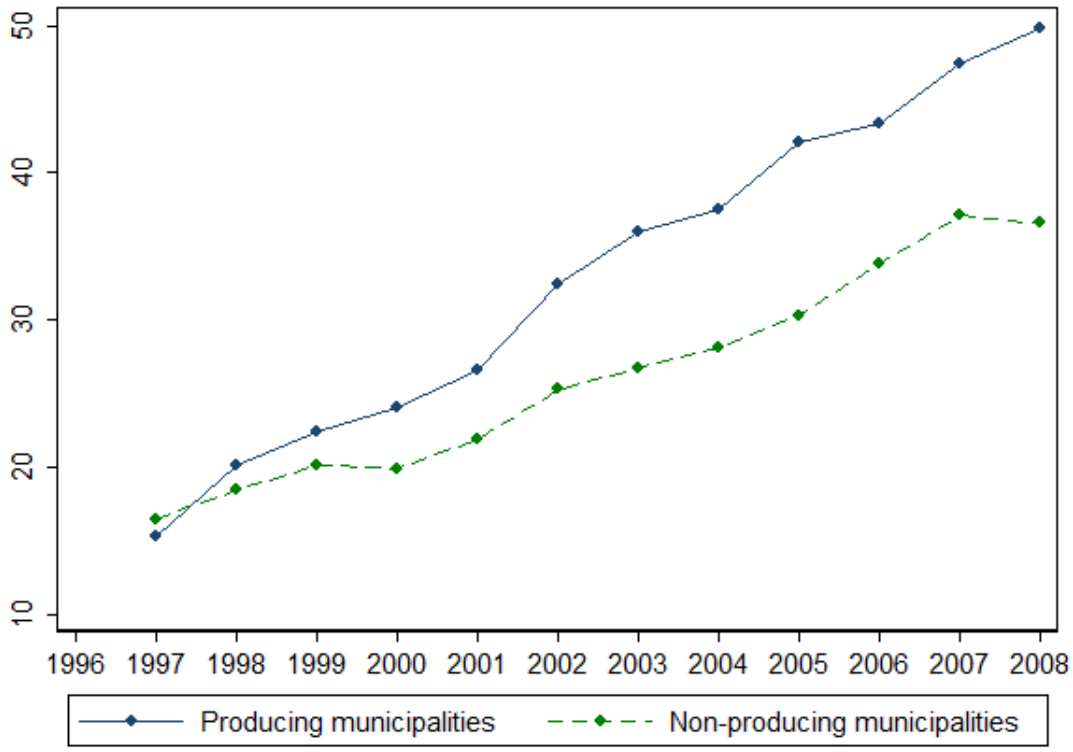
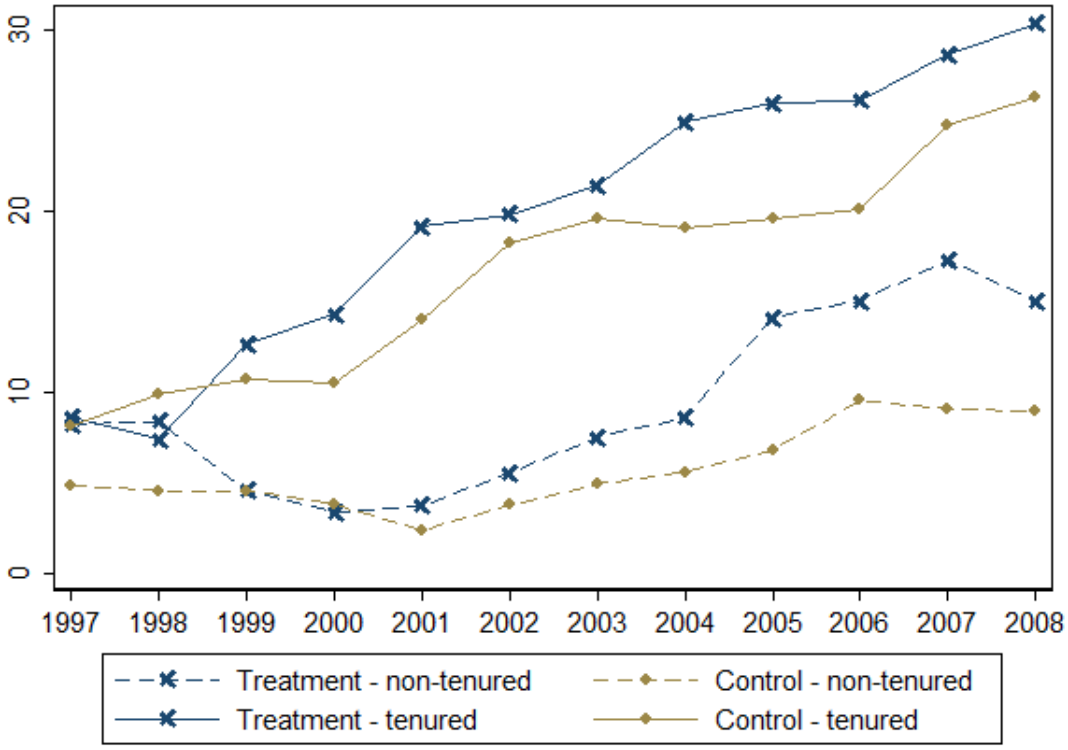


Figure 6: Municipal Employees in Oil Producing and Non-producing Municipalities 1997-2008



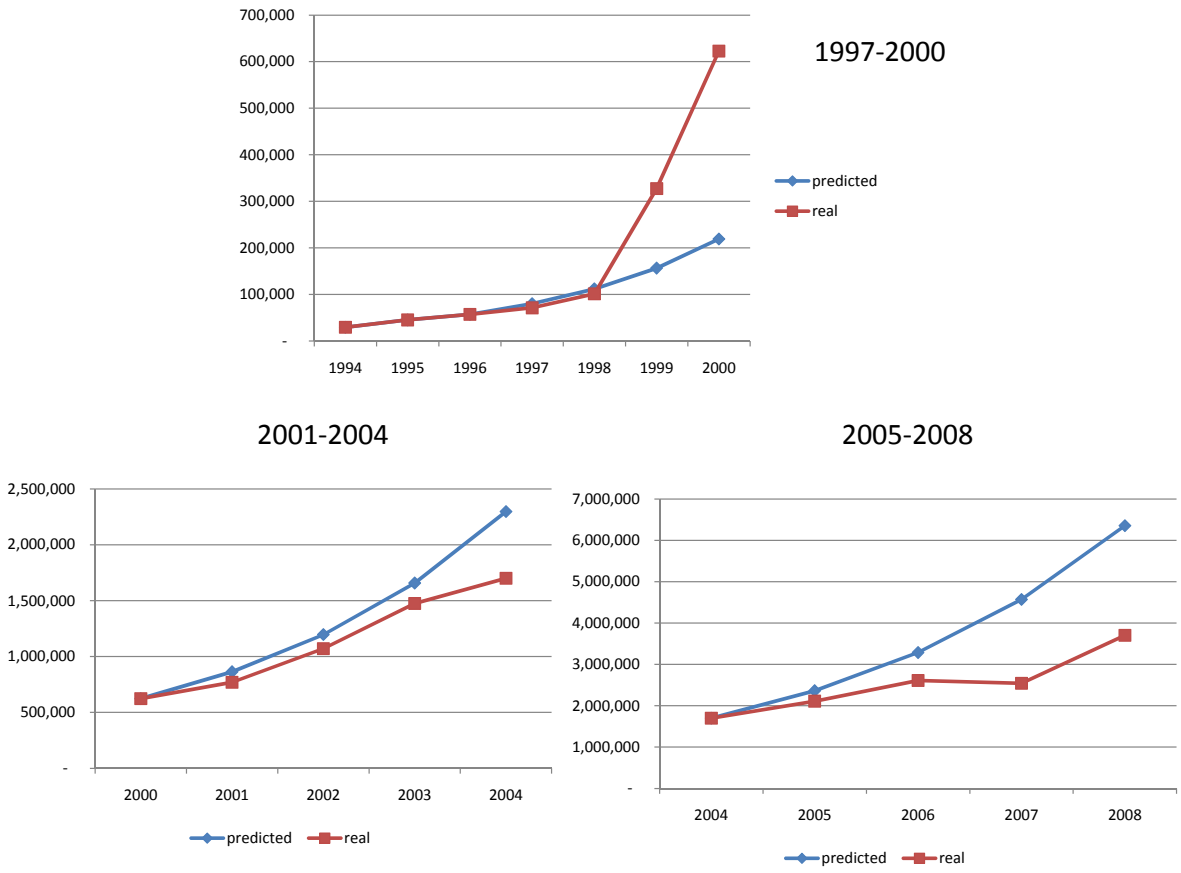
Notes:
This figure shows the median number of municipal employees per 1000 habitants on September 30th between 1997 and 2008 for two group of municipalities. Producing municipalities are municipalities on the coast of the nine oil producing states under analysis that have oil extracted from an oil field within their borders in the reference year. Non-producing municipalities are the other municipalities on the coast of these nine oil producing states (those which do not produce oil).

Figure 7: Number of Tenured and Non-tenured Employees 1997-2008



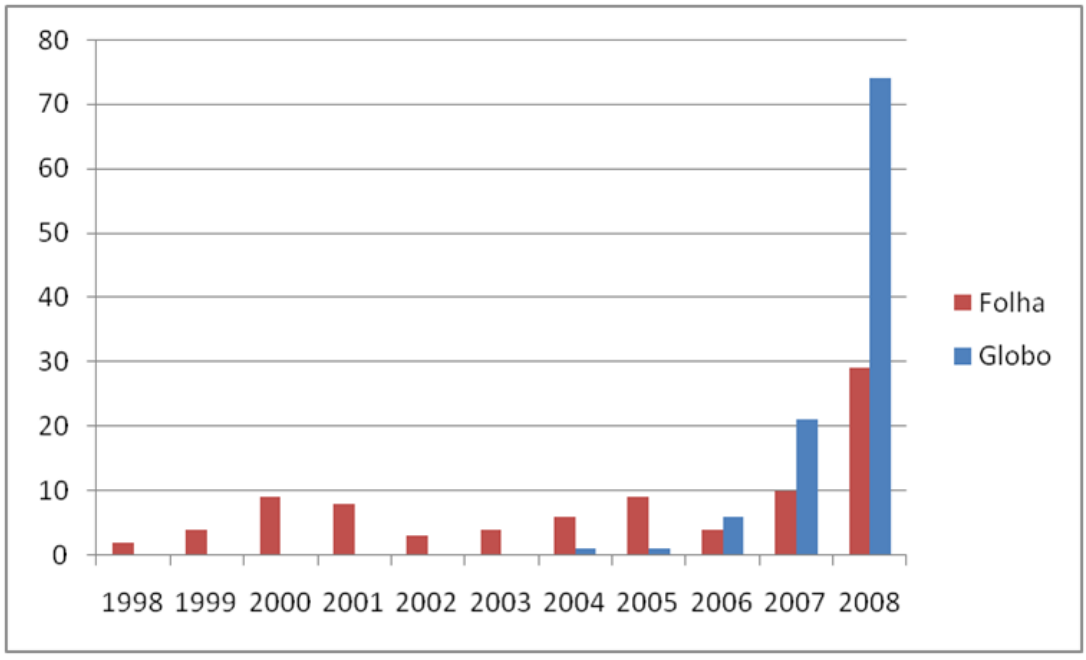
Notes:
This figure shows the median number of tenured and non-tenured municipal employees per 1000 habitants on September 30th between 1997 and 2008 for two group of municipalities. Producing municipalities are coastal municipalities that have oil extracted from an oil field within their borders in the reference year. Non-producing municipalities are coastal municipalities which do not produce oil.

Figure 8: Actual and Predicted Royalties



Notes: This figure shows the actual and predicted values of royalty payments for 1997-2000, 2001-2004 and 2005-2008 political mandates. To predict 1997-2000 royalty payments, we first use the royalty payments average annual growth rate from 1994 to 1996 to calculate $PredictedRoyalties_{1997} = Royalties_{1996} * (1 + AverageGrowth1994 - 1996)$. We then used the formula $PredictedRoyalties_{t+1} = PredictedRoyalties_{t} * (1 + AverageGrowth1994 - 1996)$ where $t = 1997, 1998, 1999$. We follow the same procedure to predict royalty payments for 2001-2004 using 1997-2000 average real growth rate; and to predict 2005-2008 payments based on 2001-2004 average real growth rate.

Figure 9: Newspaper Coverage



Notes: This figure shows the number of articles with the words 'petróleo" (oil), 'royalties" and 'municípios" (municipalities) published by year by Folha de São Paulo (since 1998) and O Globo (since 2003).