

# Oil Windfalls and the Political Resource Curse: Evidence from a Natural Experiment in Brazil\*

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## **Abstract**

Do natural resource windfalls affect democratic outcomes? We argue that the effect of such revenues on democratic outcomes is conditioned by the strength of political institutions. Where institutions are weak, natural resource revenues are diverted towards clientelistic practices, which increase incumbent reelection rates. Where institutions are strong, we expect no such effect. To test this theory, we exploit a natural experiment in Brazil by which municipalities are allocated offshore oil royalties as-if randomly. We confirm that oil resources boost incumbent reelection rates where institutions are weak. We trace the mechanisms through which reelection rates increase: in municipalities with poor institutions, incumbents use resources to increase public employment, spending on administration, election campaign expenditures, and turnout rates. Together, these clientelistic practices increase incumbent reelection rates. Our argument provides a possible principled way in which to reconcile the divergent findings of the political resource curse literature.

Is there a political resource curse? Do windfall revenues from natural resources affect democratic outcomes? For some time, political scientists have thought so.<sup>1</sup> Oil resources, in particular, are widely thought to strengthen autocrats and dampen support for democratization across countries (e.g., [Ahmadov 2014](#); [Karl 1997](#); [Ross 2001, 2012](#)). And among democratic regimes, resources are thought to decrease the quality of democracy by strengthening incumbents and stimulating corruption (e.g., [Goldberg, Wibbels and Mvukiyehe 2008](#); [Ramsay 2011](#)).

Yet, scholars have recently begun to question this conventional wisdom, largely on empirical grounds ([Haber and Menaldo 2011](#); [Wright and Czelusta 2004](#)). They note that identifying a causal effect of resources on democratic outcomes is complicated by two pitfalls: that politicians themselves choose how much oil to produce and that resource extraction and regime type may be jointly determined by other factors, like the prior strength of institutions. In other words, the cross-national analyses on which findings of a resource effect rest may well suffer from the well-known inferential problems associated with endogeneity.

This paper contributes to the scholarly debate over the political resource curse both theoretically and empirically. At the level of theory, we posit that one reason for the empirical impasse may be that the effect of resources on democratic outcomes depends on the strength of existing political institutions. Where those institutions are weak, windfalls from natural resources will have the deleterious effects that the conventional wisdom expects. But where political institutions are strong, we expect those institutions to prevent incumbents and rent-seeking politicians from using them to stifle democracy. In other words, we argue that institutions condition whether resource windfalls will affect democratic outcomes or not.

We also exploit a natural experiment that addresses the potential endogeneity in typical cross-national analyses. In Brazil, municipalities are allocated a share of oil royalties based on a predetermined formula that is a function of their geographic proximity to offshore oil wells, international oil prices and population. Once the oil sector was liberalized in 1997, new offshore fields were discovered, oil production more than doubled, and hundreds of municipalities received

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<sup>1</sup> For a recent review of this literature, see [Ross \(2015\)](#).

windfall revenues over which local politicians had no control. The as-if random assignment of oil royalties to municipalities allows us to identify their effect on democratic outcomes by ruling out the potential for endogeneity. The fact that our research design uses subnational data is also an advantage, since it not only allows us to rule out a number of possible confounds, but also because it allows us to dig deeper into the precise mechanisms behind our main finding.

In the context of Brazil, we find that oil resources do not boost overall incumbent reelection rates. However, they do so in municipalities with weak institutions. Our analysis of the mechanisms by which these effects obtain suggest that in municipalities with weak institutions, royalties cause politicians to expand public employment and administrative expenses. Incumbents in these municipalities also increase their campaign expenditures and boost turnout. Together, these results suggest that royalties facilitate clientelistic practices which boost incumbent reelection rates.

## **Natural Resources, Institutions, and Democracy**

For several decades, political scientists have maintained that “unearned income” – easily-produced revenues such as those from natural resources like oil or from foreign aid – are a curse that strengthens autocracies and erodes democratic institutions ([Ahmadov 2014](#); [Ahmed 2012](#); [Cuaresma, Oberhofer and Raschky 2011](#); [Jensen and Wantchekon 2004](#); [Karl 1997](#); [Ross 2001, 2012](#)).<sup>2</sup> Since natural resource rents are akin to “manna from heaven,” they lessen states’ incentives to tax their citizens. Some governments might, moreover, use revenue from natural resources to buy their citizens’ support, thereby making citizens accountable to politicians rather than the reverse. Untaxed citizens, in turn, have lower incentives to hold governments to account. Natural resources thus undermine both states’ incentives to provide citizens with goods and services, and citizens’ incentives to hold the state to account. That makes it easier for autocrats to strengthen their hold on power and stave off a transition to democracy ([Bueno de Mesquita and Smith 2010](#)).

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<sup>2</sup> An extensive body of work also finds that natural resources induce conflict ([Collier and Hoeffler 2004](#); [Fearon and Laitin 2003](#); [Humphreys 2005](#); [Koubi et al. 2014](#)) and generate negative economic effects ([Auty 2001](#); [Sachs and Warner 1999](#); [van der Ploeg 2011](#)).

Recent studies, however, raise questions about the causal relationship between natural resources and democratization (Dunning 2008a; Haber and Menaldo 2011; Liou and Musgrave 2013; Wright and Czelusta 2004). They argue that preexisting conditions may moderate – or completely drive – the apparent effect of resource wealth on autocratic survival (but see Andersen and Ross 2014). Indeed, several studies find that contextual factors from social cleavages to inequality to the stability of the ruling coalition condition whether natural resources bolster autocratic survival (Dunning 2008a; Morrison 2011; Smith 2007). And Ross (2012) finds that time moderates the relationship between resources and autocratic survival, which only obtains after 1980.

There is even less consensus about the political effects of resource windfalls in countries that are already democratic. Whereas some evidence suggests that resource wealth bolsters regime stability and democratic outcomes (Dunning 2008a; Morrison 2009; Smith 2004; Tsui 2011), other studies instead find that resources have no political effects in democracies (Al-Ubaydli 2012; Andersen and Aslaksen 2013; Ulfelder 2007; Wiens, Poast and Clark 2014). Still others find that windfalls do induce incumbents to engage in rent-seeking and bad types to run for potentially-lucrative elected offices (Brollo et al. 2013; Carreri and Dube 2015; Goldberg, Wibbels and Mvukiyehe 2008; Ramsay 2011).

We reconcile this mixed record by proposing that the political effect of resource wealth among democracies is conditioned by the preexisting strength of institutions. We argue that democracies with strong institutions that foster accountable government are either unchanged or benefited by natural resources. Their leaders will not engage in rent-seeking, but use resources to provide public goods and services. On the other hand, democracies with weak institutions prone to corruption, institutions that fail to hold incumbents to account, incumbents will use resources to undermine democratic competition.

Politicians always have some incentives to engage in corruption and rent-seeking. We argue that resource revenues increase those incentives for incumbent politicians. Windfall revenues increase the resources – and, therefore, power – of incumbents. They may also be siphoned off for personal enrichment. As a result, these revenues increase the returns to holding office, raising the

stakes of winning reelection. Incumbents therefore have strong incentives to skim off at least some resource revenues to help them stay in power.

How do incumbents use resource revenues to stay in office? In much of the developing world, incumbents can use the power of the purse to benefit their reelection efforts in three ways. First, they can use government jobs – particularly non-tenured positions that would be jeopardized by the incumbent losing reelection – to recruit political brokers who will then mobilize voters on their behalf (Oliveros 2013). Incumbents can also direct resource revenues toward their campaigns, artificially bolstering their campaign war chests. Finally, incumbents can devote windfall revenues toward vote-buying or turnout-buying, giving small payments or goods to voters in exchange for their electoral support (e.g., Stokes et al. 2013). Incumbents can use their control over government resources to direct windfall revenues toward their own reelection efforts rather than toward providing goods and services to the public.

But we argue that not all incumbent politicians will succumb to the temptation to engage in rent-seeking when their governments receive windfall revenues. As with many political decisions, the choice to use resource revenues for personal gain is also a function of the probability of getting caught. In some contexts, that probability may be quite low, and the expected benefit of rent-seeking may far outweigh the expected cost. In other contexts, the probability may be quite high, such that they far outweigh the incumbent's expected benefits from succumbing to rent-seeking.

Under what circumstances is the probability of being held to account high? We argue that this occurs when democracies have strong institutions. In contexts where the apparatus of government has the capacity to monitor itself and to provide what O'Donnell (1994) calls horizontal accountability, strong institutions make it likely that rent-seeking will be discovered. The non-executive arms of the state – such as the judiciary and audit bureaus – will be able to check the propensity of executives to engage in clientelistic practices. As a result, we expect incumbents in these contexts not to engage in rent-seeking, but instead to spend resource windfalls on public goods and services. In other words, we expect resource windfalls to have no effect on democratic outcomes where preexisting institutions are strong. Where institutions are weak, on the other hand,

such checks and balances might be ineffective or entirely lacking.

These propositions build upon similar arguments that institutions condition the effect of natural resources on economic outcomes (Mehlum, Moene and Torvik 2006; Robinson, Torvik and Verdier 2006; Tornell and Lane 1999) and conflict (Morrison 2012). Some studies of the political resource curse have also implied that institutions might condition the political effects of resources, pointing, in particular, to the benign or even positive effects of resources in contexts such as the United States and Norway. Along these lines, Ross (2012) limits his examination of the resource curse to countries with weak institutions, that is, to autocracies. Similarly, Jensen and Wantchekon (2004) find that resources undermine institutions of accountability, and use this to argue that policies that strengthen institutions could help guard against the resource curse. Our argument expands on these insights by positing that variation in the strength of preexisting democratic institutions may help to explain why resources are a curse in some democracies but not in others.

To properly test our hypothesis about the conditioning role of institutions, we need a comparable measure of institutional strength as well as measures of our proposed mechanisms: rent-seeking and clientelism. We also need to mitigate the potential endogeneity of the resource-democracy relationship in observational studies. We address these requirements by turning to subnational analysis and exploiting a natural experiment.

## **Exploiting a Natural Experiment in Brazil**

One reason that research on the political resource curse has been so inconclusive is the potential for endogeneity. If leaders can endogenously determine how much resource extraction to engage in (Dunning 2010; Menaldo 2014), then it may be political outcomes driving resource wealth, rather than the other way around. We would be inferring the wrong causal direction from the observed correlations between resources and politics. Moreover, some preexisting differences between countries – like the legacy of colonial institutions – may be driving both resource depen-

dence and political regime (Haber, Razo and Maurer 2003; Manzano and Monaldi 2008), making the correlation spurious (Haber and Menaldo 2011).

A number of studies seek to address these methodological challenges in one of two ways. Some leverage plausibly exogenous changes in natural resource dependence – like oil price shocks (Liou and Musgrave 2013; Ramsay 2011) or new discoveries (Tsui 2011) – to disentangle the causal effect of resources on political regime. Others shift the analysis from the cross-national to the subnational (Asher and Novosad 2014; Carreri and Dube 2015; Goldberg, Wibbels and Mvukiyehe 2008; Mahdavi 2015).<sup>3</sup> By comparing subnational units within the same national political, economic, and sociological context, this strategy helps to avoid the problem of spuriousness induced by preexisting differences between countries.

In this paper, we combine both methodological innovations and use them – for the first time – to study the conditional resource curse hypothesis. We exploit subnational variation among over one thousand Brazilian municipalities. By comparing political outcomes within a nationally democratic and transparent regime, we can help isolate the effect of resources – and the conditioning effect of institutions – on political outcomes.<sup>4</sup> Doing so also helps us to employ comparable measures of our key variables and delve more deeply into the mechanisms underlying our main findings.<sup>5</sup>

We also improve upon prior identification strategies by leveraging a natural experiment: oil windfalls to Brazilian municipalities over which they had no control and which could not have affected local politics except by increasing municipal revenues.<sup>6</sup> In 1997, Brazil’s federal gov-

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<sup>3</sup> Brollo et al. (2013) and Gervasoni (2010) similarly study subnational variation in local windfalls from federal transfers.

<sup>4</sup> This strategy is not costless: focusing on subnational variation means that we cannot say for sure that our results would obtain in other contexts. But we think the methodological benefits outweigh this cost, particularly given the overwhelming focus of prior research on cross-national variation.

<sup>5</sup> Indeed, one common critique of cross-national research on democracy is that it relies heavily on coarse and noisy measures of the outcome of interest – democratization or the quality of democracy (e.g., Bollen and Jackman 1989; Elkins 2000).

<sup>6</sup> Some working papers exploit the same natural experiment to study economic and social out-

ernment passed legislation that set out a precise formula by which different levels of government would benefit from royalties paid to the state by the parastatal oil company, Petrobras.<sup>7</sup> Royalties are allocated to municipalities using a formula, calculated each month, which is a function of geographic region, international oil prices, and populations, as estimated by the National Bureau of Statistics (IBGE). Royalties from offshore oil wells are allocated to municipalities based on geodesic orthogonal and parallel lines drawn from each municipality's coastline.<sup>8</sup> As a result, municipalities in Brazil receive oil revenue based on a predetermined formula over which government officials have no discretion.<sup>9</sup>

In the late 1990s and early 2000s, and after the formulae to share royalties across municipalities had been frozen, Brazil discovered enormous reserves of oil, particularly in offshore wells. Between 1996 and 2012, Brazil's oil output more than doubled from 795 to 2,061 barrels per day, according to the US Energy Information Administration. With soaring international oil prices, royalties in constant prices to the median municipality tripled.

Brazilian municipalities thus received substantial windfalls of oil revenue because of factors outside local political control – their geographic proximity to oil wells and spikes in the international price of oil. This as-if random assignment allows us to identify the effect of resource wealth on democracy without being concerned that oil wealth may be endogenous to democracy.<sup>10</sup> Since local politicians cannot affect how much oil revenue their municipalities receive, we can rule out reverse causation.

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comes (Caselli and Michaels 2009; Ferraz and Finan 2011). Other unpublished works have used it to study political outcomes (Brambor 2012; Monteiro and Ferraz 2012). However, to our knowledge we are the first to test a conditional political hypothesis using a natural experiment.

<sup>7</sup> The primary purpose of the law was to end the monopoly of Petrobras and allow international competition in the oil production sector.

<sup>8</sup> We provide more detailed information about these formulas in the online appendix.

<sup>9</sup> Indeed, we have corroborated that the actual monthly oil royalties Brazilian municipalities received between July 2007 and September 2013 appeared to follow this formula. Our calculated royalties are very highly correlated with actual royalties received by municipalities.

<sup>10</sup> On the logic of natural experiments and the inferential advantages of as-if random assignment, see Dunning (2012).

Our analysis focuses specifically on offshore oil royalties. We want to isolate the effect of oil revenues on municipal budgets to see if budget windfalls affect democratic outcomes. But onshore oil production can affect municipal budgets in other ways – for instance, by bringing to the municipality oil-sector workers who patronize local business. The same is not true of offshore oil; offshore wells are hundreds of miles from the coast and have no effect on the local economy except by paying royalties to the municipality. Our regression analyses therefore use our calculation of offshore oil royalties as an instrument for the total royalties each municipality received.<sup>11</sup>

Focusing on subnational variation across municipalities within Brazil offers significant inferential advantages that help to address common concerns about cross-national studies of resource effects. It also allows us to closely examine the mechanisms by which royalties might work. We gathered data on Brazil’s municipal elections in 2000, 2004, 2008, and 2012 from Brazil’s Supreme Electoral Commission (TSE) and the statistical database, IPEADATA, maintained by the office of the Presidency of the Federal Republic of Brazil. Summary statistics for key variables in the dataset are in Online Appendix Table 1. Our key dependent variable is a dummy for whether or not a mayor is reelected. To delve into the possible mechanisms behind these effects, we also examine the effects of royalties on the behavior of municipalities and politicians both between and during elections.

Like prior scholars, we examine whether resources directly affect political outcomes. But we are specifically interested in whether a municipality’s preexisting institutions condition the political effect of resources. Here, again, our focus on Brazilian municipalities offers empirical advantages. By most measures, the institutional quality of Brazilian municipalities varies tremendously. Scholars frequently employ taxes as a percent of GDP as a proxy measure for institutional capacity in cross-national studies. This measure helps us to capture the capacity of the munic-

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<sup>11</sup> Put more technically, the offshore oil royalties measure meets the exclusion restriction because it is completely exogenous from municipal political outcomes (uncorrelated with the error term in our second-stage models) by virtue of being formula-based and a function of international oil prices. It is also a strong instrument because there is no reason to think that variation in total oil royalties that is related to offshore oil royalties has a different effect than variation in total oil royalties that is unrelated to offshore royalties (see [Dunning 2008b](#)).

pality to collect taxes, a defining feature of institutional strength (see [Hendrix 2010](#)). In Brazil's municipalities, taxes range between 0 to more than 100% of GDP, thereby encompassing the range in cross-national data.<sup>12</sup>

Using data from Brazil's Treasury, our measure of municipal taxes as a percentage of GDP includes revenue from the three taxes Brazilian municipalities are allowed to levy: a property tax on urban real estate (*Imposto Sobre Propriedade Predial e Territorial Urbana*, IPTU), a tax on services (*Imposto Sobre Serviços*, ISS), and a tax on the transfer of real estate (*Imposto Sobre a Transmissão de Bens Imóveis*, ITBI).<sup>13</sup> Since we are interested in institutional strength prior to receiving oil windfalls, we measure taxes in 2000, prior to our data on oil revenue. This also avoids the problem that resource revenues may themselves undermine the strength of institutions (e.g., [Sala-i Martin and Subramanian 2003](#); [Wiens 2014](#)).

Our dataset pools observations for each municipality across four municipal elections between 2000 and 2012. We focus our analysis on those coastal municipalities that received oil royalties at some point during our sample period.<sup>14</sup> Since Brazilian mayors are elected for four-year terms, this means that we end up with a sample of four observations for each of roughly 1,000 municipalities.

Our key independent variable is total oil royalties, and we use offshore oil royalties as an instrument for this potentially endogenous variable. Both of these figures come from Brazil's National Agency of Petroleum, Natural Gas, and Biofuels (ANP). The online appendix offers a detailed discussion of how we calculated annual offshore oil royalties for each municipality. We take the average of each during the four-year period between each municipal election.<sup>15</sup> In order to

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<sup>12</sup> Our results are robust to using GDP per capita as an alternative measure of institutional strength (see below).

<sup>13</sup> For details on these taxes, see [Souza \(2004\)](#)

<sup>14</sup> Analyses using data for all municipalities in coastal states have no effect on our results (see below).

<sup>15</sup> For the 2000 election, we take the average for 1999 and 2000 since we were only able to collect royalties data as far back as 1999.

test whether institutional strength conditions the effects of these oil resources, we interact royalties with predetermined levels of taxation.

We must also account for the fact that mayors in Brazil can only be elected for two consecutive terms.<sup>16</sup> This means that in some of the elections in our data an incumbent will be eligible for reelection, while in others the incumbent is term-limited. This distinction doubtless affects political competition, so our models also account for whether or not each election has an open seat. In order to account for time-invariant differences between municipalities, we use municipal fixed effects. To account for municipality-invariant differences across time, we employ time fixed effects.<sup>17</sup> Our instrumental variable models, therefore, are specified as follows:

$$\begin{aligned} reelected_{i,t} &= \beta_1 \widehat{oil}_{i,t} + \beta_2 (\widehat{oil}_{i,t} * taxes_i) + \beta_3 openseat_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t} \\ \widehat{oil}_{i,t} &= \alpha_1 offshore_{i,t} + \alpha_2 openseat_{i,t} + \zeta_t + v_{i,t} \end{aligned}$$

where  $\widehat{oil}$  is our measure of oil royalties, which is instrumented by offshore royalties, denoted by *offshore*, *taxes* is our measure of institutional strength, *openseat* is a dummy for whether incumbents are term-limited and therefore the seat is open, and  $\gamma_i$  and  $\delta_t$  are municipal and time fixed effects, respectively.

Our empirical strategy allows us to identify the causal effect of natural resources on reelection rates. As we show below, it also allows us to use fine-grained measures to test the mechanisms by which resources have their effects. By exploiting a natural experiment and studying subnational units within Brazil, we can address major questions about the political effects of resource revenues in ways that cross-national analysis cannot.

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<sup>16</sup> Prior to 1998, mayors could only serve a single term. As a result, every incumbent mayor was eligible to run for reelection in 2000.

<sup>17</sup> Our main specifications do not include lagged dependent variables because of the well-known biases associated with doing so in the context of fixed-effects models with a small number of time periods. Nevertheless, our results are robust to including a lagged dependent variable (see below).

## Oil Royalties and Reelection in Brazil

Do natural resources affect democratic outcomes? In Table 1, we examine the effects of resources on the chances that the incumbent was reelected.<sup>18</sup> Model 1 reports the simple bivariate relationship between royalties and these variables. Model 2 controls for whether incumbents were term-limited, and for municipal and period fixed effects. The point estimate suggests that royalties boost the chances of incumbent reelection, with a standard deviation increase in log royalties increasing the chances of reelection by 2.2 percentage points or 7%. This result is only statistically significant at the 10% level.

[Table 1 here]

Of course, total oil royalties may not be exogenous to local politics. Model 3 therefore reports our two-stage least squares estimates of the effects of oil royalties – instrumented by offshore oil royalties – on reelection.<sup>19</sup> When compared with OLS, the 2SLS specification yields a slightly larger point estimate of the effects of royalties on reelection, although this result is also only statistically distinguishable from zero at the 10% level. There is therefore statistically weak evidence for the direct effects of resources on incumbent reelection rates in Brazil.<sup>20</sup>

In model 4 of Table 1, we examine the heterogeneous treatment effects of resources, inquiring whether the causal effect of resources is contingent – as our theory suggests – on municipalities’ preexisting institutional strength, as measured by taxes as a percentages of GDP. Strong

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<sup>18</sup> Although incumbent reelection is a binary variable, we use a linear probability model for ease of interpretation, since all but one of the predicted reelection rates are between 0 and 1, and since using fixed effects with a instrumental variables probit regression is not possible.

<sup>19</sup> As expected, offshore royalties perform well as an instrument: they are highly correlated with total royalties ( $\rho = 0.8$ ) and yield a first stage  $F$ -statistic of over 1,000, well-above the conventional threshold of 10 for a strong instrument.

<sup>20</sup> These results are consistent with [Monteiro and Ferraz \(2012\)](#), who find an average positive effect of oil royalties on reelection rates, but only in the 2000 elections. Finding no such effect in 2008 (their analysis does not include 2012), they infer some learning by voters. When we interact a simple time trend with oil royalties in our main model, we find a statistically significant decline in the resource reelection bump over time (see Model 1 of Online Appendix Table 2). That said, we do not find that the conditional effect of royalties on reelection diminishes over time (Model 2).

institutions might work to ensure that oil royalties are not specifically deployed to boost incumbent reelection rates. To investigate this possibility, we interact royalties with this measure of institutional strength. We employ our two-stage least squares framework for this analysis, instrumenting the interaction of royalties and taxes with the interaction of offshore royalties and taxes.<sup>21</sup>

Figure 1 plots the marginal effects of the interaction term, suggesting that resources boost the reelection rate of incumbents to a statistically significant degree in the approximately 60% of municipalities that collect less than 1.6% of GDP in taxes. In a municipality that collects one standard deviation below mean taxes, a standard deviation increase in royalties boost reelection rates by a statistically significant 7 percentage points or 24%. Conversely, in a municipality with one standard deviation above mean taxes, a standard deviation increase in royalties has a substantively and statistically insignificant effect on the reelection of an incumbent.

[Figure 1 here]

These results suggest that there is a conditional resource curse. In municipalities that had weak institutions prior to oil windfalls, incumbents are able to use oil resources to boost their chances of reelection. Where municipalities instead had strong institutions, oil windfalls seem to have no effect on incumbents' reelection rates.

To gain confidence in our results, we test their robustness to a number of changes in our empirical strategy. First, we check that our results are unchanged when we employ an alternative measure of oil royalties. In column 1 of Table 2 we replace log royalties (our key independent variable) and log offshore royalties (our instrument) with log royalties per capita and log offshore royalties per capita. Previous studies have used both measures to investigate the effects of resources (compare, for example, [Brollo et al. 2013](#) and [Haber and Menaldo 2011](#)). Whether we measure oil royalties in absolute or per capita terms has no bearing on our substantive results.

[Table 2 here]

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<sup>21</sup> The first stage *F*-statistic for the interaction term is greater than 500, again well-above the conventional threshold of 10 for strong instrumentation.

We next verify that our results are robust to using an alternative measure of institutional strength. One common, if crude, measure of institutional strength is GDP per capita (see, e.g., [Fearon and Laitin 2003](#)). When we replace our main measure of institutional strength – taxes as a percentage of GDP – with GDP per capita in 1999 (logged), our results (column 2) are substantively unchanged, although less precisely estimated. In column 3, we also verify that our results are unchanged if we use a larger sample of municipalities – all the municipalities in coastal states – than just the municipalities that received some oil royalties in the period we study.

We also check whether our results are robust to three specification changes. In column 4, we interact instrumented oil royalties with lagged institutional strength rather than the 2000 value of institutional strength. This model treats resource revenues in each new period as a new windfall whose effects are conditioned by the local institutions as they existed just prior. Although this modification does not affect our results, we prefer models that measure institutional strength prior to the entire windfall period. That is because research has shown that resource revenues can undermine institutions, and especially taxation (e.g., [Sala-i Martin and Subramanian 2003](#); [Wiens 2014](#)). A second modification in column 5 adds a lagged dependent variable to our models. Although doing this in a model with fixed effects can induce bias, our results remain substantively unchanged, although we lose precision. A final modification in column 6 specifies a reduced-form model in which reelection is simply regressed on exogenous offshore royalties. Again, our substantive results remain unchanged.

Lastly, in column 7, we present the results of a placebo test. If our empirical strategy is sound – and if offshore oil royalties are indeed exogenous to political outcomes – we should see no relationship between incumbents' reelection chances and future royalties received by their municipality. Our results bear this out. Using a unique natural experiment and no matter how we slice the data, there seems to be evidence of a conditional political resource curse in Brazil.

## Mechanisms

Among Brazilian municipalities, exogenous resource windfalls appear to boost incumbent reelection rates only where preexisting institutions are weak. But is this evidence of a resource curse? After all, mean reelection rates for Brazilian mayors are unusually low (Klašnja and Titiunik 2013; Schiumerini 2016), so increasing the incumbency advantage may be desirable in this context. The question is whether the boost in reelection chances for mayors receiving resource windfalls is the result of undemocratic practices.

We have argued that when existing institutions are weak, incumbents can use resource revenue to bolster their political campaigns by putting political brokers on the municipal payroll and using state resources to fund their campaigns. These kinds of clientelistic practices are, by definition, difficult to observe, particularly in cross-national studies. Our subnational research design again allows us to exploit a richer set of measures that point toward clientelism as the mechanism at work. In Table 3 and Figure 2, we use our standard 2SLS regression framework to estimate the causal effect of oil royalties on a number of additional dependent variables. Of course, even these measures can only be considered proxies, and our analysis cannot directly demonstrate that they indeed mediate the relationship between oil royalties and reelection rates. Still, taken together, they paint a strongly suggestive picture, certainly one that is more precise than cross-national studies have been able to uncover.

[Table 3 and Figure 2 here]

If our theory is correct, we should see evidence that in municipalities with weak institutions, oil windfalls are associated with mayors increasing municipal employment and spending on administrative expenses – staff salaries and running costs. Column 1 of Table 3, and the first interaction plot in Figure 2, confirm that this is the case in places with poor institutions. For municipalities with the lowest taxes, a 10% increase in royalties causes a 0.5% increase in administrative expenditures. Column 2 and the second interaction plot further suggests that part of this increase in administrative costs is due to an increase in the number of municipal employees per capita, again

in municipalities with weak institutions. In this instance, the magnitude of the effect is statistically significant but small: in municipalities with the poorest institutions, a 10% increase in royalties boost municipal employment per capita by 0.005%.

At the same time that weak institutions allow mayors who receive windfalls to hire political brokers into the municipality, they also allow them to use those resources for campaign purposes. Column 3 and its accompanying interaction plot suggests that the campaign expenditures of incumbents increase in municipalities with low taxes and in response to royalties. A 10% increase in royalties causes a 0.7% increase in the electoral expenditures of incumbent parties.

Our theory also suggests that we should observe more clientelism when municipalities with weak institutions receive resource windfalls. Of course, clientelism is difficult to observe (Stokes 2007). As a reasonable proxy for clientelism, we measure the concentration of the incumbent's vote, following Gingerich (2014b). The intuition behind this proxy is that clientelism in the Brazilian context relies on local brokers embedded in their communities (Gingerich 2014a). These brokers distribute goods and favors to their neighbors in exchange for votes, campaign locally for their candidate, and transport voters to the polling places on Election Day (Stokes et al. 2013). If they receive the resources they need to be effective, their candidate should attract votes disproportionately from the communities in which they operate. Thus, a candidate's vote should be more geographically concentrated the more she relies on clientelism. To measure vote concentration, we rely on the G-index introduced by Avelino, Biderman and da Silva (2011). Column 4 and its interaction plot confirm that vote concentration increases due to royalties in municipalities with weak institutions, although this result is not statistically significant.

Some of this patronage and clientelistic brokering could be buying votes, but some might also buy turnout (Nichter 2008). Even in a context with compulsory voting and high turnout, mayors in municipalities with weak institutions may use some resource windfalls to bolster turnout in their favor. Indeed, column 5 and its accompanying interaction plot suggest that in the lowest capacity municipalities, a standard deviation increase in royalties increases turnout by 1.5 percentage points or 1.7%.

Taken together, these findings are consistent with clientelism being the key mechanism by which royalties increase incumbent reelection rates. In municipalities with weak institutions, royalties incentivize incumbents to increase public employment and, therefore, administrative expenses. These effects are consistent with rentierism implied by theories of a political resource curse (Ross 2001). In addition, incumbents' electoral expenditures in municipalities with weak institutions increase, possibly as public resources are diverted to finance elections, or as royalties make office more attractive. These expenditures in turn boost turnout, either through mobilization efforts by patronage employees or as political brokers buy turnout. When resource windfalls boost reelection rates in Brazilian municipalities that have weak institutions, it seems to be because their mayors engage in more clientelism.

## **A Conditional Political Resource Curse**

Despite decades of scholarship on the political resource curse, the jury is still out. Particularly among democracies, the empirical record has been far from conclusive (Ross 2015). One reason is theoretical. As we have argued in this paper, the political resource curse in democracies depends crucially on the strength preexisting political institutions. Although resource revenues increase the incentives for incumbents to engage in rent-seeking and undermine democratic competition, they are less likely to do so when strong institutions of accountability make it likely that they will be caught. In contexts with weak institutions, incumbents are frequently able to commandeer resources to ensure their reelection. Where institutions are strong, resources have no such effect. The argument that the resource curse is conditional on institutional strength has been made explicitly with regards to the effects of resources on economic outcomes (Mehlum, Moene and Torvik 2006) and conflict (Morrison 2012), but has not been made explicitly with regards to the political resource curse. This account has the potential to help reconcile the divergent empirical findings on the political resource curse.

Another reason the empirical record has been mixed is empirical. Incumbents may endoge-

nously determine how many resources to extract, or preexisting factors may drive both resource extraction and political outcomes. Observational studies have trouble ruling out these potential sources of endogeneity. To overcome these challenges, we test our argument using a subnational research design in Brazil, both since the institutional strength of its municipalities varies hugely, and also since its municipalities are assigned oil royalties in a plausibly exogenous way. This strategy allows us to recover estimates of the causal effects of resources in contexts with varying institutional strength.

Consistent with our theory, we find that institutional strength conditions the effects of oil royalties on incumbent reelection. In municipalities with weak institutions, incumbents divert resources to boost municipal employment, administrative expenditures, campaign expenditures and turnout, all which ensure their reelection. In municipalities with strong institutions, reelection rates do not increase. We were able to further substantiate our argument by documenting how clientelistic practices – increased hiring of municipal staff, increased administrative and campaign expenditures and turnout buying – increase in areas with weak institutions.

Our argument that institutions condition the political resource curse offers a theory that could reconcile the divergent empirical record to date. Whether it does, in fact, reconcile the cross-national findings is a matter for future work. Our argument also adds nuance to the robust finding that resources have a positive effect in Latin America ([Dunning 2008a](#); [Ross 2012](#)) by showing that the effects of resources can be negative – in regions with weak institutions – even within this context. Moreover, our argument that resources spur clientelism in municipalities with weak institutions points to the specific practices – like hiring more municipal staff and turnout-buying – that ought be studied further in these contexts.

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Table 1: Effects of oil royalties on incumbent reelection

	1 OLS	2 OLS	3 2SLS		4 2SLS
			1st stage	2nd stage	2nd stage
Ln royalties	0.00251* (0.00132)	0.00508* (0.00308)		0.00676* (0.00347)	0.0216*** (0.00691)
Ln royalties $\times$ Ln Taxes/GDP, 2000					-0.00988** (0.00392)
Term-limited incumbent		-0.611*** (0.0130)	0.0260 (0.0678)	-0.611*** (0.0130)	-0.614*** (0.0131)
Ln offshore royalties			0.825*** (0.0238)		
Municipal fixed effects?	N	Y	Y	Y	Y
Year fixed effects?	N	Y	Y	Y	Y
Observations	3945	3945	3945	3945	3885
Adjusted $R$ -squared	0.00	0.19	0.89	0.19	0.20
Wald $F$ -test for royalties			1206		677
Wald $F$ -test for interaction term					510

Notes: Standard errors, clustered by municipality, in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2: Robustness tests for the effects of oil royalties on incumbent reelection

	1	2	3	4	5	6	7
	2SLS	2SLS	2SLS	2SLS	2SLS	OLS	2SLS
Ln royalties per capita	0.0636** (0.0263)						
Ln Taxes/GDP, 2000 × Ln royalties per capita	-0.0243 (0.0152)						
Ln royalties		0.0415 (0.0329)	0.0173** (0.00673)	0.0123** (0.00581)	0.0135 (0.00847)		
Ln royalties × Ln GDP per capita, 1999		-0.00437 (0.00408)					
Ln royalties × Ln Taxes/GDP, 2000			-0.00934** (0.00392)		-0.00523 (0.00491)		
Lagged Ln Taxes/GDP × Ln royalties				-0.00395 (0.00320)			
Lagged Ln Taxes/GDP				0.0490 (0.0370)			
Lagged dependent variable					-0.310 (0.348)		
Ln offshore royalties						0.0167*** (0.00583)	
Ln Taxes/GDP, 2000 × Ln offshore royalties						-0.00714** (0.00317)	
Ln royalties in $t + 1$							0.00598 (0.0106)
Ln Taxes/GDP, 2000 × Ln royalties in $t + 1$							-0.00268 (0.00679)
Term-limited incumbent	-0.615*** (0.0131)	-0.613*** (0.0131)	-0.630*** (0.00659)	-0.614*** (0.0132)	-0.271 (0.348)	-0.614*** (0.0131)	-0.700*** (0.0119)
Municipal fixed effects?	Y	Y	Y	Y	Y	Y	Y
Year fixed effects?	Y	Y	Y	Y	Y	Y	Y
Observations	3884	3885	15290	3899	2844	3887	2844
Adjusted $R$ -squared	0.20	0.20	0.08	0.19	0.26	0.20	0.20
Wald $F$ -test for royalties	1	1	1	1	1	.	1
Wald $F$ -test for interaction term	1	1	1	1	1	.	1

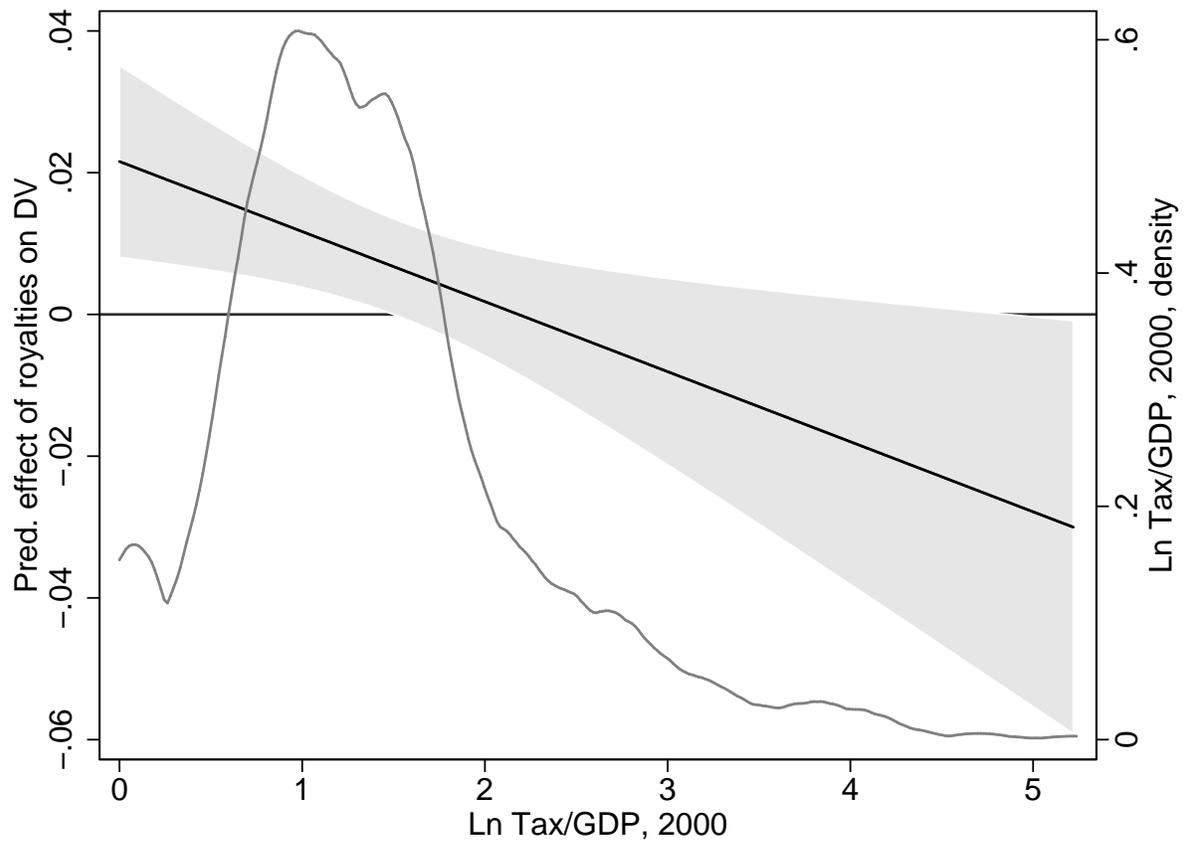
Notes: Standard errors, clustered by municipality, in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 3: Mechanisms to explain the conditional effects of oil royalties on incumbent reelection

	1	2	3	4	5
Dependent variable:	Ln admin. exp./cap.	Ln gov. employment/cap.	Ln incum. party electoral exp.	Incum. party g-index	Turnout, %
Ln royalties	0.0527** (0.0207)	0.000584** (0.000241)	0.0719* (0.0412)	0.584** (0.236)	0.350*** (0.0775)
Ln royalties × Ln Taxes/GDP, 2000	-0.0234** (0.0106)	-0.000154 (0.000148)	-0.0188 (0.0158)	-0.292 (0.200)	-0.210*** (0.0393)
Term-limited incumbent	-0.0170 (0.0284)	-0.000660* (0.000392)	-0.0638 (0.110)	-2.976*** (0.805)	-0.0340 (0.148)
Municipal fixed effects?	Y	Y	Y	Y	Y
Year fixed effects?	Y	Y	Y	Y	Y
Observations	3884	2895	1731	1615	3836
Adjusted <i>R</i> -squared	0.45	0.81	0.25	0.53	0.60
Wald <i>F</i> -test for royalties	676	284	76	53	673
Wald <i>F</i> -test for interaction term	510	233	60	40	508

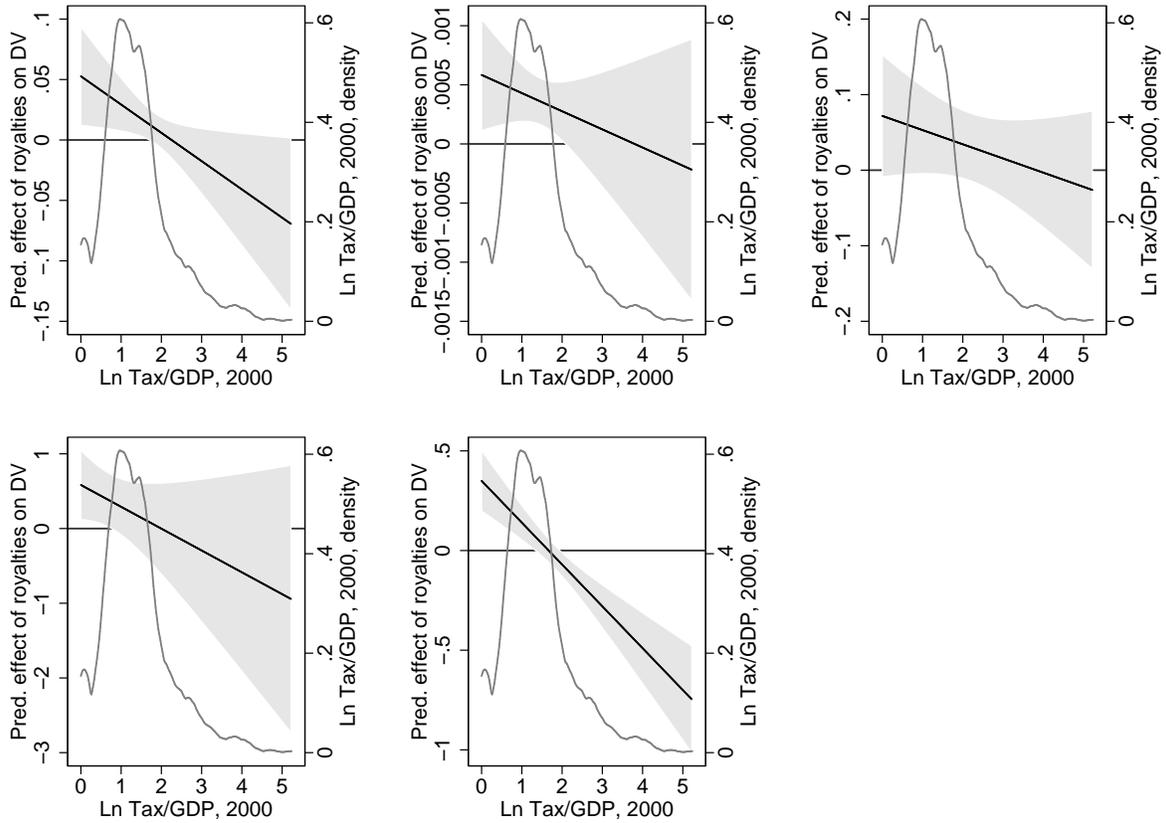
Notes: Standard errors, clustered by municipality, in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Figure 1: Conditional effect of oil royalties on incumbent reelection



Notes: The coefficients for the plot are from regression 4 of Table 1. The shaded region represents the 95% confidence interval.

Figure 2: Mechanisms to explain the conditional effects of oil royalties on incumbent reelection



*Notes:* The coefficients for the plots are from Table 3. The dependent variables for the plots are (from left to right and then top to bottom) log administrative expenditures per capita, log municipal employees per capita, log incumbent party electoral campaign expenditure, incumbent party vote concentration or g-index, and % turnout. The shaded regions represent 95% confidence intervals.

# Online Appendix for “Oil Windfalls and the Political Resource Curse: Evidence from a Natural Experiment in Brazil”

## Total Yearly Royalties

The total royalties (from both offshore and onshore fields) received by each municipality by year from 1999 to 2012 was gathered from the website of the Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (National Agency on Oil, Natural Gas, and Biofuels; ANP) at <http://www.anp.gov.br/?pg=9080&m=&t1=&t2=&t3=&t4=&ar=&ps=&cachebust=1258622130031>. Each of the files for monthly royalties includes data on royalties accumulated for the year up until that month. Therefore, we used the accumulated royalties data on the December files, which include all royalties accumulated for the year up to the third week in December (the third week of each month is when royalty transfers to municipalities are made, so this data captures the yearly amount).

## Offshore Royalties – First 5 Percent

We first calculated the total 5 percent royalties accrued for each offshore oil field using the oil and gas prices and oil and gas outputs by month. Oil and gas prices were obtained from the ANP website at <http://www.anp.gov.br/?id=534>. Because royalty transfers experience a two-month lag time, royalties data for a given month is calculated using the prices set two months prior (i.e. royalties for January 2008 uses price data from November 2007; royalties for October 2011 uses price data from August 2011, etc.). Data on monthly offshore oil field output (both oil and natural gas) can be found on the ANP website at <http://www.anp.gov.br/?id=532>. The first 5 percent royalties for each oil field were calculated using the following formula:

$$\text{Total 5 percent royalties} = \text{Oil Reference Price (R\$/m}^3\text{)} \times \text{Oil Output (m}^3\text{)} + (\text{Gas Reference Price (R\$/m}^3\text{)} \times \text{Gas Output (m}^3\text{)}) \times 0.05$$

For a tiny number of data points, the calculated royalties did not match up with the actual data obtained from the ANP website at <http://www.anp.gov.br/?pg=67687&m=&t1=&t2=&t3=>

<http://www.anp.gov.br/?pg=67687&m=&t1=&t2=&t3=&t4=&ar=&ps=&cachebust=1378507194836>. The actual published data is only available from July 2007 to December 2012.

Next, we calculated the total offshore royalties to each municipality by month. This was done by first calculating the total royalties by mesoregion (which essentially means state in this case). The formula to calculate the first 5 percent royalties to each municipality is given by:

Royalties to municipality (first 5 percent) = Mesoregion total  $\times$  Population ratio  $\times$  0.3

The population ratio for each municipality is found on the ANP website at <http://www.anp.gov.br/?pg=67687&m=&t1=&t2=&t3=&t4=&ar=&ps=&cachebust=1378507194836>. The population ratios were occasionally adjusted slightly during the period for which data was available, so these figures were changed accordingly. It is multiplied by 0.3 because, per the ANP, 30 percent of the 5 percent royalties are to go to municipalities in relevant geoeconomic zones.

Population ratios vary according to the geoeconomic zone designation of each municipality. There are three types of zones:

- Main zones: municipalities deemed “producing zones” based on their proximity to the offshore field. Municipalities in this zone share 60 percent (of the 30 percent of the 5 percent) royalties for their respective mesoregion.
- Secondary zones: municipalities traversed by pipelines for transporting offshore oil. These municipalities share in 10 percent (of the 30 percent of the 5 percent) royalties for their respective mesoregion.
- Bordering zones: municipalities bordering main zones or which serve as the location of three or more oil processing or transportation sites. These municipalities share in 30 percent (of the 30 percent of the 5 percent) royalties for their respective mesoregion. If the mesoregion does not have any secondary zones, which is the case for some, they share in 40 percent (of the 30 percent of the 5 percent) royalties for their respective mesoregion.

The description of these zones can be found at <http://www.anp.gov.br/?dw=6558>. Each municipality can only belong to one zone. A very small number of municipalities experienced a change in their geoeconomic zone designation over the period covered by the data.

## **Offshore Royalties – Variable Quotas**

To determine the variable quota (amount over 5 percent) royalties to each municipality, we first calculated how monthly royalties from each offshore field were allocated. This was done by using the variable quota figures found on the ANP website at <http://www.anp.gov.br/?pg=67687&m=&t1=&t2=&t3=&t4=&ar=&ps=&cachebust=1378507194836>. Variable quota royalties are only allocated to municipalities found in the “main geoeconomic zone,” a designation discussed above. The distribution of variable quota royalties for each offshore field is determined by a municipality’s “facing percentage,” which is calculated by the ANP using the geographical relationship between the wells being exploited and the municipality. Using the facing percentage document in the zip files at the above page, we determined which municipalities received variable quota royalties from a given field and the percentage they received. The formula is given by:

Variable quota royalties by municipality for a given field = Total variable quota royalties for offshore field × Facing Percentage × 0.225

The factor of 0.225 in the above formula is given by the ANP, which allocates 22.5 percent of the variable quota royalties to municipalities facing offshore fields (again, see <http://www.anp.gov.br/?pg=67687&m=&t1=&t2=&t3=&t4=&ar=&ps=&cachebust=1378507194836>). On occasion, the facing percentages for offshore oil fields are adjusted based on the location of exploitation, and very rarely, new municipalities received variable quota royalties because of changes in their geoeconomic zone designation. Our calculations account for these changes.

## **Discrepancies**

To be added

Online Appendix Table 1: Summary statistics

	Mean	Std. Dev.	Min.	Max.
Incumbent reelected	0.30	0.46	0.00	1.00
Ln royalties	8.86	4.37	0.00	19.52
Ln offshore royalties	8.21	4.30	0.00	19.22
Term-limited incumbent	0.23	0.42	0.00	1.00
Ln Taxes/GDP, 2000	1.38	0.83	0.00	5.24
Ln GDP per capita, 1999	7.84	0.79	6.54	11.88
Ln administrative expenditures per capita	7.23	1.07	0.00	9.78
Ln municipal employees per capita	0.04	0.02	0.00	0.23
Ln incumbent party electoral campaign expenditure	12.29	2.01	0.00	18.40
Incumbent party vote concentration index (g-index)	13.43	19.07	0.00	298.21
% Turnout	86.04	6.04	58.16	98.69

Online Appendix Table 2: Do the conditional effects of oil royalties on incumbent reelection deteriorate over time?

	1	2
	2SLS	2SLS
Ln royalties	0.0185*** (0.00554)	0.0334*** (0.0105)
Ln royalties $\times$ Period	-0.00509** (0.00203)	-0.00525 (0.00410)
Ln royalties $\times$ Ln Taxes/GDP, 2000		-0.0105* (0.00614)
Ln royalties $\times$ Ln Taxes/GDP, 2000 $\times$ Period		0.000337 (0.00239)
Ln Taxes/GDP, 2000 $\times$ Period		-0.00296 (0.0263)
Term-limited incumbent	-0.611*** (0.0129)	-0.614*** (0.0130)
Municipal fixed effects?	Y	Y
Year fixed effects?	Y	Y
Observations	3945	3885
Adjusted <i>R</i> -squared	0.20	0.20
Wald <i>F</i> -test for royalties	1209	688
Wald <i>F</i> -test for first interaction term	223	122
Wald <i>F</i> -test for second interaction term		525
Wald <i>F</i> -test for third interaction term		108

*Notes:* Standard errors, clustered by municipality, in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .