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Abstract

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JEL Classification: D72, H11, H7

Keywords: Federalism, distributive politics, Partisan Alignment, presidential elections, Aridity, Brazil

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Drought-reliefs and Partisanship[a]

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Abstract

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1 Introduction

Politicians often act based on political considerations that have little to do with welfare (Ferraz and Finan, 2011; Curto-Grau and Zudenkova, 2018; Finan and Mazzocco, 2021; Lauletta et al., 2022; Bonilla-Mejía and Morales, In Press). Particularly, in federal countries, the upper level of government disproportionally allocates funds to co-partisan local officers (Khemani, 2007; Arulampalam et al., 2009; Brollo and Nannicini, 2012; Bracco et al., 2015; Curto-Grau et al., 2018).

Our analysis provides a fresh perspective on the role of alignment in shaping distributive politics, by recognising that the optimal targeting strategy depends on which level of government is up for re-election next (local versus national). We thus identify a novel pattern of distributive politics, determined by the sequence of elections in countries with multiple tiers. Additionally, our data allow us to benchmark the actual allocation to its non-distorted counterpart.

We use data on drought-relief discretionary transfers to municipalities in Brazil between 2000 and 2016. Presidential and local elections alternate every two years, which allows us to study the impact of the election sequence on the allocative patterns. We adopt a Regression Discontinuity Design (RDD), based on close municipal elections, and measure the severity of droughts using data on both precipitations and evapotranspiration (Vicente-Serrano et al., 2010).

Before mayoral elections, we find that aligned districts enjoy a 6.3 p.p. higher probability of receiving a transfer. This result is in line with the literature.[1] However, the novel finding is that the effect is fully driven by municipalities suffering a moderate drought. In this case, aligned municipalities have 18 p.p. higher chances of receiving aid-reliefs. Instead, there is no alignment bias when aridity is either low or severe. We also show that the alignment bias completely disappears before federal elections.

Our theory model rationalises these patterns. Before local elections, despite being purely office-motivated, the president attaches a weight to voters' needs, as well as to the development of long-run relations with mayors. We show that, as a result, the president displays partisan bias only in marginal cases, when aridity is moderate. Instead, in municipalities with low or severe aridity, we do not observe any significant difference based on alignment. Such behaviour is already observed in the raw data. Before mayoral elections, the probability of receiving aid-relief increases respectively by 6.7 p.p. and 1.6 p.p. when transitioning from low to moderate aridity or from moderate to severe. A qualitatively identical pattern is observed

[1]There, the partisan bias is attributed to altruistic preference by the central politician (Bracco et al., 2015) or to an intrinsic interest in maximising the party local achievements (Brollo and Nannicini, 2012; Curto-Grau et al., 2018).

before presidential elections, when the average probability increase is respectively by 13.4 p.p. (from low to moderate) and by 6.8 p.p. (from moderate to severe).

In the remaining of our analysis, the theoretical model is in Section 2. The empirical analysis is in Section 3. Section 4 contains our final remarks. Proofs are relegated to the Appendix.

2 The model

We consider a two-tier country, with a central government and $i = 1, ..., N$ municipalities (or districts). Henceforth, *president* and *mayor* will refer, respectively, to the head of the central and local (municipal) government.

Two parties compete both at the central and local level: a municipality is *aligned* if mayor and president belong to the same party and *non-aligned* otherwise. We consider a two-period game. In each period $t = \{1, 2\}$, municipality i may suffer a drought of intensity $D_t^i \in \left[\underline{D}, \overline{D}\right]$, and the president grants a discretionary transfer $\overline{T}$ to an arbitrary subset of municipalities, so that $T_t^i = \{0, \overline{T}\}$ is the transfer received by municipality i at period t. All municipal elections take place at the end of period one, while presidential ones are at the end of period two.

In each district i, the representative voter derives utility from consumption (of private and public goods) that depends on $T_t^i - D_t^i$. Utility is increasing and concave in transfers, and decreasing and convex in damage from droughts. For simplicity, we assume $u_t^i = c(T_t^i - D_t^i)$, with $c' > 0$, $c'' < 0$ and $u(c(-\underline{D})) \geq 0$.

Politicians are concerned by their own reelection only.[2] Voters in each jurisdiction only care about their current level of utility. They support the re-appointment of the incumbent if their current-period utility is above a threshold that depends at most on three factors listed below. Factors 1 and 2 always count, while factor 3 only matters for presidential elections.

1. A popularity shock $\epsilon_i \sim U\left[-\frac{1}{2\phi}, \frac{1}{2\phi}\right]$. For expositional convenience, ϵ_i represents a negative shock for the incumbent, i.e. the incumbent politician gains votes when $\epsilon_i < 0$, while the challenger gains votes when $\epsilon_i > 0$.

2. A lower-bound utility $\underline{u}$. This could represent the utility voters expect to enjoy if the challenger is elected. We assume $\underline{u} < u(c(-\underline{D})) + \frac{1}{2\phi}$, hence, the incumbent politician always has a chance (albeit minimal) of being voted. Indeed, it requires that the incumbent is re-elected in a municipality that suffered the most severe drought and received no transfers, if the popularity shock is maximal ($\epsilon_i = -\frac{1}{2\phi}$).

[2] Either they enjoy some ego-rent, or they extract rents from sources unrelated to the assignment of transfers.

3. The mayor's gratitude (g_i) towards the president. Transfers assigned by the president before local elections increase the mayor re-election probability. We assume that mayors who received the transfer will express their gratitude, when the time comes, and support the presidential campaign. Only the president assigns the transfer, hence, gratitude (g_i) flows from the mayor to the president but not vice versa.

We solve the model backward, starting with the presidential elections and then moving to the president's optimal behaviour before mayoral elections.

Presidential elections The incumbent president is re-appointed if they receive more votes than the challenger, irrespective of the distribution of votes across municipalities.

In each municipality, the president is supported if $u(c_i) > \epsilon_i + \underline{u} - g_i$. Gratitude g_i is defined as:

$$g_i = \begin{cases} \gamma B_i^T & \text{if a transfer was granted in t=1 \& mayor was re-appointed} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

where B_i^T, formally defined in Eq. (3), is the electoral *benefit* that the incumbent mayor in i enjoyed at $t = 1$ (while running for reelection) thanks to transfer T. It seems natural to expect the exogenous parameter $\gamma \geq 0$. Furthermore, we allow it to vary conditional on partisanship, taking value γ_a for municipalities that are aligned and γ_m for non-aligned ones. We expect and assume $\gamma_a > \gamma_m$ because aligned mayors can openly endorse the incumbent president, while non-aligned mayors are bound to support their party's candidate (i.e. the challenger) and can, at best, be more lenient toward the incumbent president. Such mild endorsement may move some votes but it likely has a smaller impact than the open endorsement by aligned mayors.

The ex-ante probability of being voted in municipality i is:[3]

$$Pr(\epsilon_i < u(c_i) - \underline{u} + g_i) = \frac{1}{2} + \phi(u(c_i) - \underline{u} + g_i). \quad (2)$$

When district i is granted a transfer, the electoral benefit enjoyed by the incumbent is

$$B_i^T \equiv \phi\left(u(c(\overline{T} - D_i)) - u(c(-D_i))\right). \quad (3)$$

At $t = 2$ the president must decide which municipalities to grant the transfer to. We exclude the trivial case in which the president can grant a transfer to all municipalities. At the time of the decision, g_i is exogenously fixed (it depends on decisions that are taken at $t = 1$) and is heterogeneous across districts. The popularity shock ϵ is also heterogeneous, while lower-bound utility $\underline{u}$ is the same across municipalities.

[3]The probability can be interpreted either as the chance that the district representative agent votes for the incumbent president, or it can equivalently be interpreted as the district intensive margin of political support.

Proposition 1. *Before central elections, the president's ballot-maximising rule is to assign grants to municipalities that suffered the most severe drought.*

Corollary 1. *The president allocation of transfers is maximising voters' welfare.*

Proof. See Appendix A. □

The president is not specifically interested in winning one single constituency, but rather, in line with the single-district Brazilian electoral system, they want to maximise the total expected support at the federal level. It is optimal for the president to grant transfers where returns, in terms of votes, are larger. The concavity of the utility function ensures that the marginal utility of transfers is larger in places that suffered more heavily from aridity. Proposition 1 concludes that the president allocates transfers to municipalities that need it the most, implying that interests are aligned between career-concerned politicians and a welfare-maximising planner.

The scheme to allocate transfers before presidential elections depends entirely on the marginal impact that transfers have on the chances of election, as defined by Eq. (3). The election probability obviously depends, in level, on gratitude g_i. However, gratitude depends only on transfers in $t = 1$, hence, the president can manipulate the re-election chances in $t = 2$ via gratitude only through the allocation of funds before mayoral elections.

Mayoral elections If the president grants a transfer in period 1 to municipality i, they expect the period 2 electoral gain $E(g_i)$ to be equal to gratitude gains g_i weighted by the probability that the incumbent mayor is re-appointed,[4] hence:

$$E(g_i) = Pr(\epsilon_i < u(c_i) - \underline{u})g_i. \tag{4}$$

The allocation of transfers in $t = 1$ is intended to maximise the sum of the expected electoral gains in $t = 2$. The amount of municipalities obtaining a transfer is exogenous (and the constraint is binding), i.e. the president cannot assign transfers to all municipalities. Hence, the president selects the subset of municipalities that yields the largest gains.

Municipalities differ in two respects: i) they are aligned or non-aligned, ii) they suffer droughts of heterogeneous severity. Lemma 1 and Proposition 2 study how transfers are allocated, depending on alignment and aridity.

Lemma 1. *Given alignment, the president's benefit of allocating a transfer to a municipality in period 1 is increasing in the level of aridity if and only if* $\frac{u'(c(-D_i))}{u'\left(c\left(\overline{T}-D_i\right)\right)} > \Psi \in (1, 2)$, *with* $\Psi \equiv 1 + \frac{\phi(u(c(\overline{T}-D_i))-u(c(-D_i))}{1/2+\phi\left(u\left(c(\overline{T}-D_i)\right)-\underline{u}\right)}$.

[4] By construction, as explained above, g_i doesn't appear in the probability of the mayor of being re-elected, for g_i accounts for the electoral support provided by the mayor to the president's campaign, in sign of gratitude (*do ut des*) for the transfer received.

Proof. See Appendix A. □

Lemma 1 introduces a condition on the slope of the utility function with and without the transfer. It is verified when the allocation of a transfer drops the marginal utility of consumption enough. This depends on the combination between the curvature of the utility function, the size of the transfer and the variance of the popularity shock. More specifically, the condition is more likely to be satisfied if the utility function is very concave and the transfer as well as the variance of the popularity shock are large.

Proposition 2. *Provided that the impact of transfers on voters utility is large (that is* $u'(c(-D_i))/u'(c(\overline{T}-D_i)) > \Psi$*), two lower-bounds* D_a *and* D_m *exist for the level of aridity such that – before mayoral elections – the president allocates transfers to all aligned districts for which* $D_i \geq D_a$ *and to all non-aligned districts for which* $D_i \geq D_m$*. The threshold is lower for aligned municipalities (*$D_a < D_m$*) under our maintained assumption that* $\gamma_a > \gamma_m$*.*

Corollary 2. *The president's preferred allocation of transfers is not welfare maximising.*

Proof. See Appendix A. □

Proposition 2 conveys a simple and yet powerful message. Before mayoral elections, the allocation of discretionary drought-relief transfers depends not only on the level of aridity but also on party alignment. This is not desirable from a welfare perspective.

This result is based on two crucial assumptions. First, transfers matter enough for citizens ($u'(c(-D_i))/u'(c(\overline{T}-D_i)) > \Psi$). Second, the president benefits, in electoral terms, from the allocation of transfers ($g_i > 0$). The latter is not just instrumental to the pro-alignment distortion. Absent this condition, the president would have no incentives to allocate transfers before local elections. In the model, agents are all rational and selfish and there is full information.

The preferential treatment that aligned municipalities enjoy depends also on that gratitude from aligned mayors has a larger marginal impact ($\gamma_a > \gamma_m$). Importantly, this should not be confused with an alignment effect.[5] According to our model, if a mayor receives a transfer in $t = 1$, they will make an extra effort to support the incumbent-president campaign in $t = 2$. Our condition states that the *marginal* effect on gratitude of a transfer is larger for aligned mayors.

Interestingly, comparing Propositions 1 and 2 we notice an asymmetry. Alignment does not matter before presidential elections, while it does before mayoral elections. The empirical analysis shows that, indeed, before mayoral elections transfers are allocated based on aridity

[5] Feierherd (2020) estimates the alignment effect in Brazil and finds that it may be negative if voters are unsatisfied with the incumbent mayor. Our condition is fully compatible with that result.

and partisanship, so that the minimum level of aridity to observe a transfer is lower for aligned municipalities. Instead, such distortion is not present in the period preceding presidential elections.

3 Empirical Analysis

We test our model predictions using Brazilian data. We combine three sets of data: on elections, on municipalities that received a drought-emergency-transfer and on aridity.[6]

Political and administrative aspects. Brazil is a presidential democracy with a three-tiered federal system consisting of 26 states, a federal district and 5,570 municipalities. Voters elect chief executives (president, governors and mayors) at each tier. The president is elected in a single-district, majoritarian elections with run-off and so are mayors of large municipalities (above 200,000 inhabitants). Mayors in the remaining municipalities are elected by relative majority (i.e. plurality rule). Elections take place every four years, with mayoral and presidential elections alternating every two years.

The Brazilian political landscape is fragmented. The four presidents appearing in our sample belong to: the Workers' Party 'PT' (Lula and Rousseff), the Brazilian Democratic Movement Party 'MDB' (Temer) and the social democrat party 'PSDB' (Henrique Cardoso).

Our sample includes mayoral elections held in 2004, 2008, 2012 and 2016, and presidential elections held in 2002, 2006, 2010 and 2014.[7] Data come from *Tribunal Superior Eleitoral*.

State of emergency and transfers. For their funding, *federal and state governments* mostly rely on taxes and fees that they set and collect. Instead, *local governments* rely mainly on intergovernmental transfers: local taxes typically represent about 5.5% of the total budget (Brollo and Nannicini, 2012).

A large share of transfers is discretionary (*Transferências voluntárias da União*), including those for infrastructure and those assigned following a declaration of local state-of-emergency. Droughts being the most frequent natural disaster in Brazil, they account for approximately half of such declarations.

The government has been extensively using drought emergency-aids since the 1960s. The allocating procedure requires a preliminary Presidential declaration of the state of emergency for the targeted municipalities. Then, SEDEC, within the federal Ministry of National Integration, decides the composition for each targeted municipality of the aid-relief-package,

[6] Interested readers will find additional information in the online Appendix.

[7] Roussef's (PT party) 2016 impeachment, and her replacement with Temer, former vice-president and affiliated to a different party (MDB) for the remainder of the term, would complicate the definition of aligned municipalities. Hence, we limit our analysis to pre-2016.

which may include funds, goods, human resources or special authorisation to relax red-tape constraints.

Such procedure matches the setting of our model in that transfers are assigned in a discretionary way, with the president having a strong influence on which municipalities are targeted. Protocols are looser for droughts than for other natural disasters. Indeed, droughts in Brazil are known to be a source of clientelism and to lead to strategic behaviours for political gains (Bobonis et al., 2017).

The list of municipalities that were granted the drought-state-of-emergency status between 2000 and 2016 comes from *Sistema Integrado de Informações sobre Desastres Naturais* - S2ID.[8]

Drought We reliably measure aridity, which allows us to identify transfers that are not entirely justified by a drought emergency. We innovate on most of the economic literature that uses droughts, which usually measures it through precipitations alone (Rocha and Soares, 2015; Shah and Steinberg, 2017). Albert et al. (2021) and this paper are possibly the first in economics using the Standardised Precipitation Evapotranspiration Index (*SPEI*), which measures the moisture deficit relative to the historical average. It combines information on the amount of precipitations and of moisture retained in the soil (evapotranspiration). Accounting for evapotranspiration makes *SPEI* superior to indexes that predict aridity only through rainfalls, because aridity results from combining scarce-supply and excessive-demand of water (Vicente-Serrano et al., 2010).

Average precipitation and potential evapotranspiration since 1901 are obtained from the Climate Research Unit at the University of East Anglia, widely used in the climatology literature. Their database provides monthly data at 0.5 grid-level, representing approximately 55x55 km. We overlay the grid's data over a shapefile that delimits Brazilian municipality areas.

3.1 Our variables

Subscript b refers to the biennium between two consecutive elections. We use the electoral data to compute *party alignment* between the president and mayors. $Alg_{i,b}$ is an indicator variable taking value 1 if, during biennium b, the mayor of municipality i belongs to the president's party and 0 otherwise.

If t is the time of an election and $x = \begin{cases} 4 \text{ if municipal elections at } t \\ 2 \text{ if presidential elections at } t \end{cases}$, then $t - x$ is the time of the previous mayoral election.[9]

[8] Most of the populated areas of the country received them at least once.

[9] Remember that 2 years pass between a mayoral election and the subsequent presidential election, while

For municipality i, define $VS^{A}_{i,t-x}$ and $VS^{BR}_{i,t-x}$ as the vote shares at $t-x$ elections for i) the candidate from the party of time-t president and ii) the best-ranked among all the other candidates. The Margin of Victory ($MV_{i,t-x}$) is computed at t, based on the electoral results at $t-x$ (last mayoral election), as the (normalised) difference in vote shares:

$$MV_{i,t-x} = \frac{VS^{A}_{i,t-x} - VS^{BR}_{i,t-x}}{VS^{A}_{i,t-x} + VS^{BR}_{i,t-x}} \tag{5}$$

We can compute $MV_{i,t-x}$ only for municipalities where the party of the incumbent president in t nominated a candidate for the $t-x$ elections. If $MV_{i,t-x} > 0$, at t the mayor and the president are aligned, while a negative margin implies non-alignment.[10]

To measure aridity, we compute the negative of the Standardised Precipitation Evapotranspitration Index (*SPEI*) (Vicente-Serrano et al., 2010). For each municipality, it produces a normalised index of the net loss of water (i.e. potential evapotranspiration net of precipitations) during a given biennium:

$$SPEI_{i,b} = \frac{(PET_{i,b} - P_{i,b}) - mean(PET_i - P_i)}{sd(PET_i - P_i)}, \tag{6}$$

where PET_i and P_i define, respectively, the yearly Potential Evapotranspiration and Precipitation in municipality i, while $PET_{i,b} = \sum_{t-2}^{t} PET_i$ and $P_{i,b} = \sum_{t-2}^{t} P_i$ are, respectively, the cumulative PET_i and P_i for biennium b. The mean and s.d. are computed over the period 1901-1980. $SPEI_{i,b} > 0$ implies a below-average water balance, hence relative aridity.

We define three indicator-variables using *SPEI*:[11] $LowAridity_{i,b}$ takes value 1 if $SPEI_{i,b} < 0$, $ModerateAridity_{i,b}$ takes value 1 if $SPEI_{i,b} \in [0,1]$, $SevereAridity_{i,b}$ takes value 1 if $SPEI_{i,b} > 1$.

Table 1 provides descriptive statistics on our variables of interest. Our initial sample consists of 8,343 observations in our analysis of municipal elections and 5,312 observations for presidential elections. An observation is a pair (municipality-election) for which $MV_{i,t-x}$ can be computed.

an interval of 4 years separates two mayoral elections.

[10]By construction, we use the same municipal election to compute the margin of victory both for a presidential election and the subsequent mayoral election. However, the president's party may change after the presidential election, modifying the definition of 'alignment'. Therefore, the set of candidates used to compute the margin of victory may vary, even between subsequent elections for which the margin of victory is computed based on a same municipal election. For instance, Henrique Cardoso (PSDB) was the incumbent at the 2002 presidential elections: $MV_{i,t-2}$ compares the vote share of the PSDB candidate and the best-ranked opponent at the 2000 mayoral elections. Lula (PT) won the 2002 election. Hence, MV_{t-4} for the 2004 mayoral elections uses again the 2000 mayoral elections. However, it focuses on races involving the PT candidate against the best-ranked opponent.

[11]In choosing the cutoffs for the indicator-variables, we are aligned with previous studies that usually define the incidence of droughts when the standardised indices assume values greater than one standard deviation from the mean (Mueller and Osgood, 2009; Rocha and Soares, 2015; Brito et al., 2018).

Focusing on mayoral elections, 2,446 observations correspond to municipality-election pairs in which the incumbent mayor and president are aligned; in the remaining 5,897 observations they are non-aligned. The *% of aid* columns show, for each type of municipality, the fraction of observations that received government drought-aid-reliefs. For instance, 19.5% of aligned municipality-election pairs obtained aid relief before municipal elections, as opposed to 13.2% of non-aligned.

Data are also decomposed by level of aridity. We observe low aridity in 3,552 cases, moderate in 2,647 cases, severe in 2,144 cases. A noticeable pattern emerges that is aligned with our main message. When municipalities are in the low-aridity condition there isn't much room for manoeuvre in allocating aid-relief to politically aligned municipalities. Indeed, the means (0.100 and 0.112) are very close to each other, consistent with the idea that co-partisanship won't be of much help for a municipality in search of aid-relief. But if we only focus on the cases of moderate aridity, a different picture emerges. Non-aligned municipalities receive aid-relief 15% of the time, as opposed to above 25% for aligned municipalities. A similar picture can also be observed for observations in the severe-aridity category.

Table 1: Descriptive Statistics

		Before mayoral elections					Before presidential elections				
		obs	% of aid granted	mean (sd)	min	max	obs	% of aid granted	mean (sd)	min	max
Main variables											
SPEI (aridity)[1]		8343	—	0.258 (1.373)	-5.325	6.063	5312	—	-0.359 (1.419)	-6.791	8.938
Margin of victory		8343	—	0.004 (0.238)	-0.988	1.000	5312	—	-0.020 (0.249)	-0.988	1.000
Decomposition of municipalities by political alignment											
aligned		2446	0.195	—	0	1	2466	0.172	—	0	1
non-aligned		5897	0.132	—	0	1	2846	0.189	—	0	1
Decomposition of municipalities by level of aridity											
Low-Aridity		3552	0.108	—	0	1	2835	0.109	—	0	1
Moderate-Aridity		2647	0.175	—	0	1	1706	0.243	—	0	1
Severe-Aridity		2144	0.191	—	0	1	771	0.311	—	0	1
Decomposition of municipalities by level of aridity and alignment											
Low-Aridity	& aligned	1210	0.100	—	0	1	1330	0.096	—	0	1
	& non-aligned	2342	0.112	—	0	1	1505	0.120	—	0	1
Moderate-Aridity	& aligned	624	0.258	—	0	1	795	0.238	—	0	1
	& non-aligned	2023	0.150	—	0	1	911	0.248	—	0	1
Severe-Aridity	& aligned	612	0.319	—	0	1	341	0.317	—	0	1
	& non-aligned	1532	0.140	—	0	1	430	0.307	—	0	1

[1] SPEI indicates the Standardised Precipitation Evapotranspiration Index

3.2 Estimation strategy and results

We want to estimate the advantage that aligned municipalities allegedly enjoy in the allocation of transfers, conditional on the aridity level. A preliminary inspection of the data (Table 1) already showed that aligned-municipalities in the moderate-aridity range are more likely to have the drought-state-of-emergency declared by the federal government before municipal elections.

Consistent with the findings in Table 1, Fig. 1 descriptively shows the relative probability of receiving drought-aid-relief, conditional on a given level of the *SPEI* index. Municipalities with similar *SPEI* are grouped together. Positive values on the vertical axis represent a greater probability of drought-aid-relief in favour of aligned municipalities. It is only in the intermediate range of *SPEI* levels before mayoral elections that aligned municipalities are systematically more likely to receive those funds compared to non-aligned municipalities.

Political alignment, however, could be correlated with factors that are unobservable to the econometrician and possibly correlated with the dependent variable. For instance, an omitted variable bias might occur if characteristics of the incumbent mayor, such as competence and political preference on environmental issues, may be correlated both with political affiliation and with the ability to obtain drought-aid-relief from the central government.

To address this concern, we use a Regression Discontinuity Design (RDD) to simulate partisan alignment between governments in a quasi-experiment way. The maintained assumption is that municipalities with a nearly-zero margin of victory ($MV_{i,t-x}$) have statistically-similar unobservable characteristics, except for their alignment status. The McCrary density test confirms no discontinuity in $MV_{i,t-x}$ (our forcing variable) both for municipal and federal elections.

Eq. (7) represents the baseline RDD specification to study the impact of alignment on municipality i's probability of receiving discretionary transfers:

$$Aid_{i,b} = \beta_0 + \beta_1 Alg_{i,b} + \gamma_p MV_{i,t-x} + \theta_p Alg_{i,b} * MV_{i,t-x} + \epsilon_{i,b}, \tag{7}$$

where $Aid_{i,b}$ indicates whether municipality i received transfers during the pre-election biennium.[12] In our linear estimations we focus on tight elections in which $MV_{i,t-x}$ can take positive or negative values. We selected the optimal bandwidth according to Calonico et al. (2014).

Fig. 2 plots the coefficients and 95% confidence interval of β_1 for municipalities within each 0.2 interval of *SPEI* values.[13] The vertical axis displays the relative size of the coefficient of aligned versus non-aligned municipalities. In other words, conditional on a given value of *SPEI*, the greater the estimated value for aligned municipalities, the higher the dot in this

[12]For instance, if considering the 2016 mayoral election, $Aid_{i,b}$ considers transfers granted over biennium $b = 2015 - 16$. Similarly, if considering the 2014 presidential election, $Aid_{i,b}$ considers transfers granted over biennium $b = 2013 - 14$.

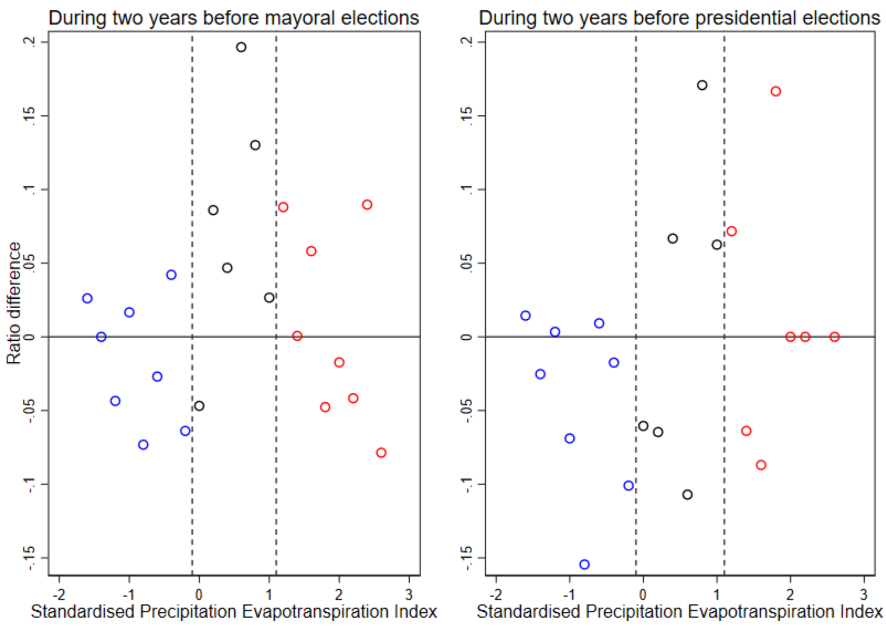
[13]*SPEI* is truncated at -1.2 and 1.2 because the number of observations drops and Calonico et al. (2014) optimal bandwidth cannot be computed. At each end, we grouped the remaining municipalities together.

graph. In the top graph, corresponding to the period before mayoral elections, the coefficients are statistically indistinguishable from zero for $SPEI < 0$. That is, when aridity is low, being politically aligned with the president does not lead to a greater probability of receiving aid-relief.

A different picture emerges for positive values of *SPEI*. The coefficients display an inverted U-shape with a peak at a value of *SPEI* close to 0.8, which is also statistically significant. The results in this top graph are again consistent with the main message of the paper: it is at moderate levels of aridity when politicians in the presidential party have more degrees of freedom to allocate aid funds to aligned municipalities.

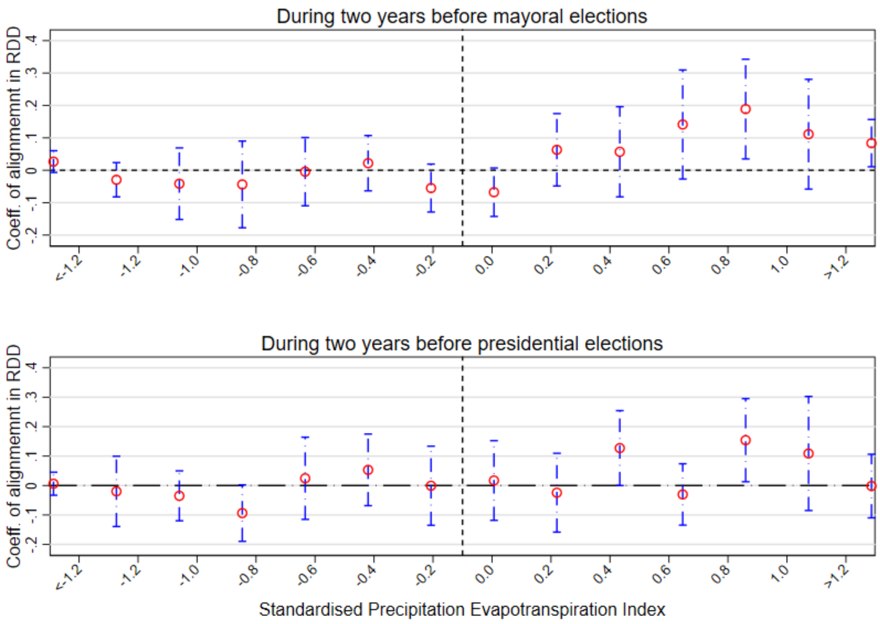
The bottom graph repeats the exercise for the period before presidential elections. For $SPEI < 0$, a similar picture emerges as all coefficients are close to zero and not statistically significant. For positive values of *SPEI*, both positive and negative coefficients can be found and, furthermore, no consistent pattern emerges. In contrast to the top graph, one cannot conclusively claim that being aligned to the presidential party will lead to a higher probability of aid relief.

Figure 1: Share of municipalities that obtained aid-relief: difference between aligned and non-aligned municipalities.



Notes: The vertical axis represents the difference between the 'share of aligned municipalities that received aid' and the same share for the non-aligned municipalities: positive values correspond to when the share of aligned municipalities that received aid is larger than the one for non-aligned municipalities. Each dot corresponds to a different degree of aridity, measured by the Standardised Precipitation Evapotranspiration Index (*SPEI*). The two dashed vertical lines delimit the area defined as moderate aridity.

Figure 2: Alignment impact on obtaining aid relief for SPEI ranges.



Notes: Estimated coefficients of alignment in RDD for each SPEI range, optimal bandwidth of the forcing variable is selected following Calonico et al. (2014), and local polynomial 1. The vertical line at each dot represents a 95% confidence interval.

Turning to the main empirical specification, we extend the baseline specification in Eq. (8) to account for the heterogeneity in the level of aridity:

$$
\begin{aligned}
Aid_{i,b} = \beta_1 LowAridity_{i,b} + \beta_2 LowAridity * Alg_{i,b} + \\
\beta_3 ModerateAridity_{i,b} + \beta_4 ModerateAridity * Alg_{i,b} + \\
\beta_5 SevereAridity_{i,b} + \beta_6 SevereAridity * Alg_{i,b} + \\
\gamma_p MV_{i,t-x} + \theta_p MV_{i,t-x} * Alg_{i,b} + \epsilon_{i,b}.
\end{aligned}
\tag{8}
$$

For each of the three aridity levels, we test whether the coefficients for aligned and non-aligned municipalities are statistically different. Rejecting the null hypothesis implies that the federal government shows systematic partisanship bias. To ease the interpretation of the coefficients, we omit the constant term (β_0) as we don't explicitly account for any baseline category. That is, the coefficients β_1 to β_6 tell us the chance that each type of municipality has of receiving government aid.

Table 2: Impact of alignment on the assignment of aid relief

Dep. variable: Aid-relief (drought-state-of-emergencies)		Before mayoral elections (1)	(2)	(3)	(4)	Before presidential elections (5)	(6)	(7)	(8)
Low-Aridity	& aligned	0.149***	0.007	0.017	0.045	0.167***	-0.009	0.128**	0.068
		(0.028)	(0.034)	(0.041)	(0.043)	(0.030)	(0.037)	(0.054)	(0.056)
	& non-aligned	0.111***				0.127***			
		(0.018)				(0.023)			
Moderate-Aridity	& aligned	0.407***	0.233***	0.230***	0.212***	0.317***	0.174***	0.189***	0.151**
		(0.046)	(0.046)	(0.062)	(0.058)	(0.036)	(0.041)	(0.064)	(0.063)
	& non-aligned	0.226***	0.106***	0.107***	0.088**	0.322***	0.209***	0.166***	0.164***
		(0.027)	(0.029)	(0.040)	(0.037)	(0.035)	(0.035)	(0.062)	(0.057)
Severe-Aridity	& aligned	0.406***	0.235***	0.263***	0.270***	0.423***	0.256***	0.362***	0.312***
		(0.048)	(0.049)	(0.068)	(0.069)	(0.054)	(0.056)	(0.074)	(0.074)
	& non-aligned	0.340***	0.205***	0.176***	0.192***	0.425***	0.314***	0.277***	0.296***
		(0.041)	(0.041)	(0.058)	(0.057)	(0.055)	(0.051)	(0.076)	(0.070)
Observations		1,507	1,507	1,507	1,507	1,395	1,395	1,395	1,395
R-squared		0.279	0.320	0.775	0.795	0.305	0.352	0.681	0.711
Bandwidth		0.117	0.117	0.117	0.117	0.142	0.142	0.142	0.142
Year FE		No	Yes	No	Yes	No	Yes	No	Yes
Municipality FE		No	No	Yes	Yes	No	No	Yes	Yes
F-statistics tests: (aligned = non-aligned)									
(1) in Low-Aridity municipalities:		1.380	0.043	0.176	1.095	1.210	0.059	5.669	1.458
p-value		0.241	0.836	0.675	0.296	0.272	0.808	0.018	0.228
(2) in Moderate-Aridity municipalities:		12.09	6.398	3.819	3.877	0.012	0.524	0.092	0.034
p-value		0.001	0.012	0.051	0.049	0.914	0.469	0.762	0.854
(3) in Severe-Aridity municipalities:		1.332	0.300	1.742	1.370	0.001	0.662	0.767	0.029
p-value		0.249	0.584	0.187	0.242	0.980	0.416	0.381	0.865

Note: The forcing variable is the margin of victory in the previous mayoral election of the candidate from the party of the incumbent president. Optimal bandwidth selected according to Calonico et al. (2014). Polynomial order: 1.
Robust standard errors in parentheses. *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.10.

Table 2 presents results combining a regression-discontinuity design (RDD) with a set of fixed effects. The dependent variable is a dummy taking value one in case of receiving drought-aid-relief and zero otherwise. That is, we decompose the sample into six bins depending on their alignment status and aridity level. Columns 1-4 present the set of observations before mayoral elections, while columns 5-8 redo the exercise before presidential elections. The samples obey two restrictions. Firstly, values of the forcing variable ($MV_{i,t-x}$) are within the optimal bandwidth selected according to Calonico et al. (2014); secondly, we limit our sample to municipalities that appear at least twice, as we account for municipality fixed effects.

Column 1 includes no fixed effects and already displays the main message of this paper. Aligned with theoretical predictions, being politically aligned with the presidential party has no impact on the probability of receiving aid-relief in the absence of clear drought signals. The F-statistic comparing the estimated coefficients takes a value of 1.38 and is therefore non-significant.

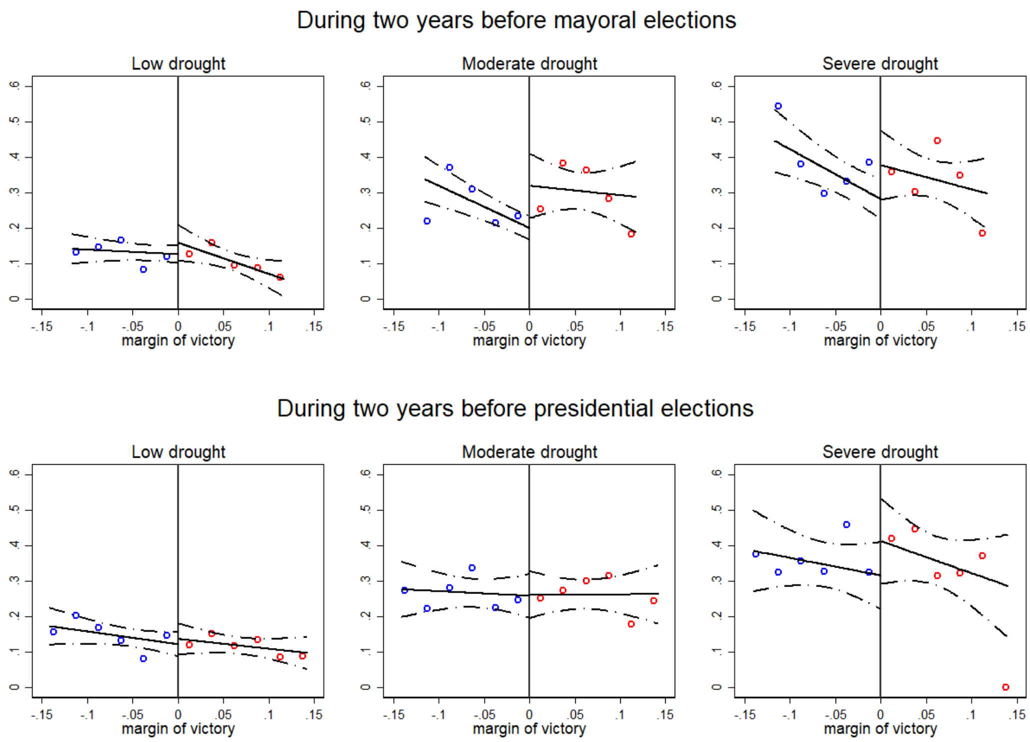
Once we move to the moderate-aridity case, municipalities aligned with the presidential party are clearly more likely to receive aid relief. In particular, while the probability of aid relief is approximately 22% for non-aligned municipalities, it jumps to 40% for aligned ones; the difference is statistically significant (F-statistic = 12.09). Finally, this difference of 18 percentage points diminishes to only 6 percentage points for the observations allocated in the severe-aridity category. In summary, it is only when aridity conditions are moderate that the presidential party biases its support towards aligned municipalities. A similar picture emerges in column 2 when including year fixed effects, in column 3 when including municipality fixed effects, and in column 4 when including both sets of fixed effects. Remarkably, the last column states that the political bias towards aligned mayors also emerges when only using variation *within* a municipality over time.[14]

Columns 5-8 present the results before presidential elections. Consistent with our theory, we do not find signs of favouring politically aligned municipalities. The F-statistics are not statistically significant.

Fig. 3 shows the differences in predicted values around the RDD threshold between aligned and non-aligned municipalities. We split the sample of municipalities based on aridity (low, moderate, severe) and implement the regressions separately. The top three graphs correspond to the two years before mayoral elections and the bottom ones to the two years before presidential elections. Consistent with previous results, the only statistically significant discontinuity occurs in municipalities with moderate aridity preceding municipal elections.

[14]Following the inclusion of fixed effects, variable 'low-aridity & non-aligned' is omitted due to collinearity and will be considered as the baseline.

Figure 3: Regression Discontinuity Design.



Notes: Graphs represent predicted values of RDD. The dependent variable is aid relief, the forcing variable is the margin of victory of the candidate from the party of the incumbent president at the previous mayoral election. The top three graphs show the predicted values separately for the municipalities at each aridity level in the years preceding a municipal election. The bottom three graphs represent predicted values for the years leading up to a presidential election. Circles represent the local mean and dashed lines represent 95% confidence intervals.

4 Final remarks

Our analysis establishes a novel pattern of distributive politics in federal countries, based on the sequence of upcoming central and local elections. We show evidence that the alignment advantage emphasised in the previous literature (Brollo and Nannicini, 2012; Bracco et al., 2015; Curto-Grau et al., 2018) materialises only in the period before municipal elections (when being aligned implies an increase in the chances of receiving a transfer by 6.3 p.p.), while it disappears in the period before presidential elections. Furthermore, we show that even before mayoral elections the alignment bias is large and significant (18 p.p.) for districts with intermediate levels of aridity, while it is statistically indistinguishable from zero otherwise.

Finally, the probability that a municipality receives the drought-relief increases when transitioning from low to moderate and from moderate to severe aridity. We rationalise these findings in a model with selfish and office-motivated politicians and perfectly informed voters.

Our results hint at the importance of the sequence of upcoming elections in federal countries in determining the welfare effects of discretionary funds. A reduction of the distortions requires to time the discretionary allocations as far as possible from local elections and as close as possible to central elections. A related research question would involve understanding the partisan bias in countries in which central and local elections overlap.

An alternative measure to limit the distortions is to design geographically-different districts for voting and for transfer purposes, making it hard for the central government to target any specific voting district.

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Appendix A Proofs

Proof of Proposition 1. The electoral benefit for the incumbent is increasing in droughts:

$$\frac{\partial B_i^T}{\partial D} = \phi\left(\frac{\partial u(c(\overline{T}-D_i))}{\partial D} - \frac{\partial u(c(-D_i))}{\partial D}\right) > 0,$$

where the sign is guaranteed by the concavity of c. Therefore, the best strategy for the president is to grant transfers in order of severity of the drought, starting from the most severe.

Because the utility function is increasing and concave, the marginal utility of transfers is larger for agents in municipalities that suffered a more severe drought, which means that the president optimal strategy is also the strategy that maximises social welfare (as defined by the utilitarian social welfare function). □

Proof of Lemma 1. Substituting in $E(g_i) = Pr(\epsilon_i < u(c_i) - \underline{u})g_i$ we obtain

$$E(g_i) = \left(\frac{1}{2} + \phi(u(c(\overline{T}-D_i)) - \underline{u})\right)\gamma\phi\left(u(c(\overline{T}-D_i)) - u(c(-D_i))\right) \tag{9}$$

The condition for $E(g_i)$ to be increasing in droughts is $\frac{\partial E(g_i)}{\partial D_i} > 0$, that is

$$\frac{\phi^2 u'(c(\overline{T}-D_i))\left(u(c(\overline{T}-D_i)) - u(c(-D_i))\right)}{\left(\frac{1}{2} + \phi(u(c(\overline{T}-D_i)) - \underline{u})\right)\phi} + u'(c(\overline{T}-D_i)) < u'(c(-D_i)) \tag{10}$$

The equation simplifies into

$$\frac{u'(c(-D_i))}{u'(c(\overline{T}-D_i))} > \frac{\phi\left(u(c(\overline{T}-D_i)) - u(c(-D_i))\right)}{\left(\frac{1}{2} + \phi(u(c(\overline{T}-D_i)) - \underline{u})\right)} + 1 \equiv \Psi_i \tag{11}$$

from which it is immediate to notice that $\frac{\phi\left(u(c(\overline{T}-D_i)) - u(c(-D_i))\right)}{\left(\frac{1}{2}+\phi(u(c(\overline{T}-D_i)) - \underline{u})\right)} \in (0,1)$ and $\Psi \in (1,2)$, given the maintained assumption that $\underline{u} < u(c(-\underline{D})) + \frac{1}{2\phi}$. □

Proof of Proposition 2. The president assigns transfers to the municipalities that generate more electoral gains. From Lemma 1 we know that, given alignment, transfers will go to municipalities that suffered more sever droughts.

What we still don't know is whether the severity of drought is the only criterion for the allocation of transfers or whether alignment matters too. To check that, we start by defining D_a to be the least severe level of drought among all the aligned municipality that received a transfer. Similarly, D_m denotes the least severe levels of drought among all the mis-alligned municipalities that received a transfer.

Lemma 1 can be rephrased in the following way: if and only if $\frac{u'(c(-D_i))}{u'\left(c\left(\overline{T}-D_i\right)\right)} > \Psi$, the president grants a transfer to all aligned municipalities with $D_i \geq D_a$ and to all mis-aligned municipalities with $D_i \geq D_m$.

The only missing step to prove the proposition is to verify if $D_a < D_m$. The expected electoral gain for the president is defined by Eq. (12) for the aligned municipality that suffered drought D_a and by Eq. (13) for the mis-aligned one district that suffered drought D_m.

$$E(g_i) = \left(\frac{1}{2} + \phi(u\left(c\left(\overline{T} - D_a\right)\right) - \underline{u})\right)\gamma_a\phi\left(u\left(c\left(\overline{T} - D_a\right)\right) - u(c(-D_a))\right) \tag{12}$$

$$E(g_i) = \left(\frac{1}{2} + \phi(u\left(c\left(\overline{T} - D_m\right)\right) - \underline{u})\right)\gamma_m\phi\left(u\left(c\left(\overline{T} - D_m\right)\right) - u(c(-D_m))\right) \tag{13}$$

Comparing Eqs. (12) and (13), it is immediate to notice that, if $D_a = D_m$, the expected benefit is the same for aligned and misaligned municipalities only if $\gamma_a = \gamma_m$.

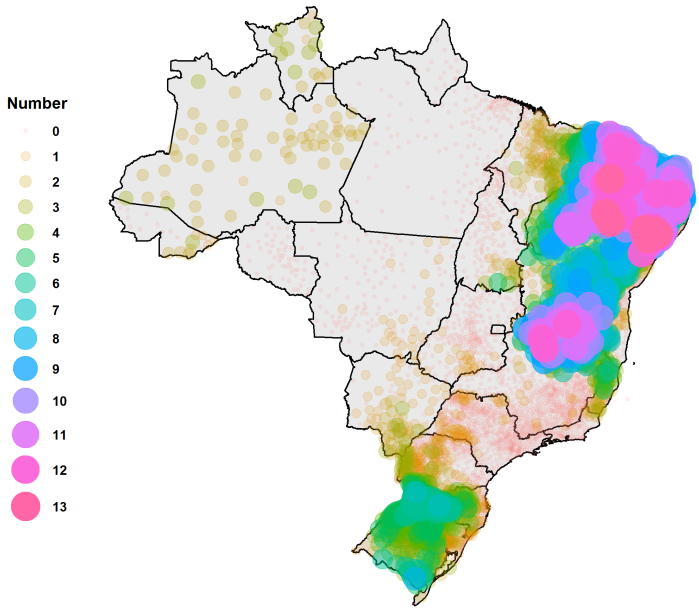
Suppose that $\frac{u'(c(-D_i))}{u'\left(c\left(\overline{T}-D_i\right)\right)} > \Psi$. Since $\gamma_a > \gamma_m$ by assumption, it follows immediately that the expected benefits are equal if and only if $D_a < D_m$. Clearly, the result would be inverted $(D_a > D_m)$ if $\gamma_a < \gamma_m$.

The welfare maximising allocation of transfers would require them to be assigned based on the severity of droughts only, irrespective of alignment. Any deviation from that is welfare-inferior. Hence, every time that $\gamma_a \neq \gamma_m$, the president's allocation is not optimal in terms of voters' welfare. □

Online Appendix

The full list of municipalities included in any draught-motivated declaration of the state of emergency for the period 2002 - 2016 comes from *Sistema Integrado de Informações sobre Desastres Naturais* (S2ID). Figure 1 shows the total number of declarations by each municipality over such period.

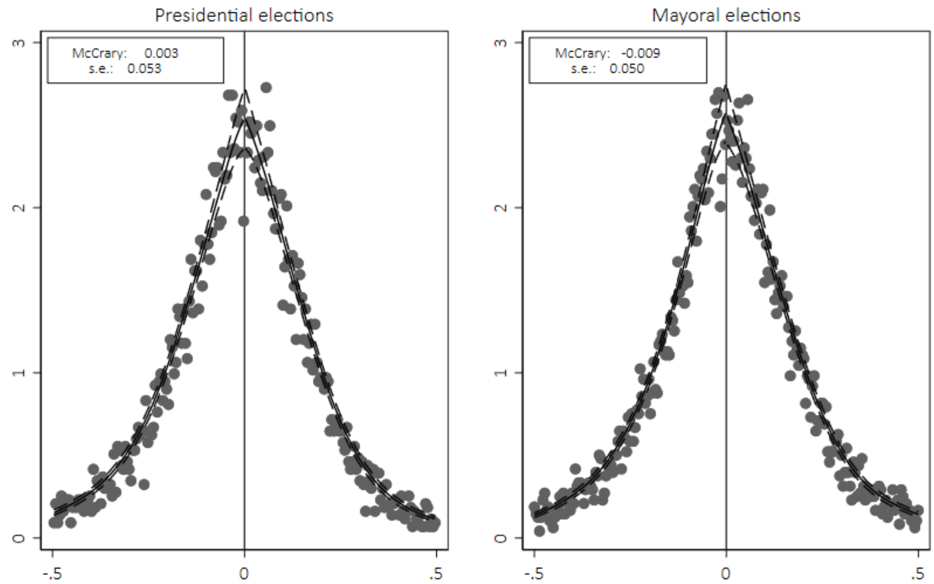
Figure 1: Total number of state of emergency declaration because of drought.



Notes: Period between 2002-2016. Map of Brazil divided by states.

The McCrary density test confirms that there is no discontinuity in the forcing variable, both for municipal and federal elections.

Figure 2: McCrary Density Test.



Notes: Margin of victory (at previous elections) for the candidate mayor running for the same party as the (current) president.