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Working Paper

Politics under the Weather: Droughts, Parties and Electoral Outcomes

IDB Working Paper Series, No. IDB-WP-455

Provided in Cooperation with:

Inter-American Development Bank (IDB), Washington, DC

Suggested Citation: Bastos, Paulo; Miller, Sebastian (2013) : Politics under the Weather: Droughts, Parties and Electoral Outcomes, IDB Working Paper Series, No. IDB-WP-455, Inter-American Development Bank (IDB), Washington, DC

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Politics under the Weather:

Droughts, Parties and Electoral Outcomes

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October 2013

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2013

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Bastos, Paulo.

Politics under the weather : droughts, parties and electoral outcomes/ Paulo Bastos, Sebastián Miller.
p. cm. (IDB working paper series ; 455)

Includes bibliographical references.

1. Politics, Practical—Brazil. 2. Elections—Brazil. 3. Droughts—Brazil. I. Miller, Sebastián. II. Inter-American Development Bank. Research Dept. III. Title. IV. Series.
IDB-WP-455

<http://www.iadb.org>

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Abstract*

The increased occurrence of extreme weather conditions leading to drought is a key development challenge. This paper studies how these extreme events interact with the political process at the local level using rich administrative data for drought declarations and mayoral elections in Brazil. While accounting for current and historical rainfall patterns, the paper finds that that: i) municipalities led by a mayor affiliated with the President's party are more likely to receive formal drought declarations prior to the municipal election; and ii) receiving a drought declaration reinforces the electoral advantage of incumbent mayors running for reelection. These results are robust to the inclusion of a rich set of controls for municipal attributes.

JEL classifications: Q54, D72

Keywords: Climate change, Drought, Political economy, Brazil

* We are grateful to participants at the Second World Congress of the Public Choice Societies in Miami for helpful comments and suggestions. We also thank Jose Fernandez Donoso and Jaime A. Urrego for excellent research assistance. The views expressed herein are those of the authors and not of the institutions they are affiliated with.

1. Introduction

The climate is changing. Average temperature is projected to increase considerably across the globe, rainfall levels are predicted to fall in many regions, and weather conditions are expected to become more volatile, leading to a more frequent occurrence of extreme events such as droughts, storms and floods (IPCC, 2007a, b, c). For many low and middle income nations with a strong dependence on agriculture, the prospect of widespread drought is a key development challenge of our time (Verner, 2010, 2011). But while there has been a generalized call for developing appropriate responses to these events, we still know relatively little about the political economy considerations involved in such a process.¹

The occurrence of extreme weather conditions leading to drought is typically beyond the control of individual governments. Yet the policy response to these events tends to be managed by bureaucrats and local politicians. In particular, the provision of emergency relief is generally triggered by a formal emergency declaration, whose existence and timing may be subject to political influence. In this paper, we use rich Brazilian data on formal drought declarations and municipal elections to examine whether and how: i) party affiliation matters for the likelihood of receiving formal drought declarations prior to the municipal election; and ii) the issuance of drought declarations before the election affects the electoral performance of incumbent mayors.

Brazil offers an unusually rich setting for such a study. It is a large emerging economy, with a vast agricultural sector, where drought declarations represent about two-thirds of total emergencies in each year.² It has a highly decentralized system of government, with over 5,500 municipal governments elected every four years. Formal drought declarations result from the interaction between elected mayors and central government bureaucrats: the former have the main responsibility of submitting the request, the latter that of verifying if the situation justifies an emergency declaration. Finally, Brazil has rich administrative data on recent local elections and emergency declarations, which we complement with information on historical and contemporaneous rainfall patterns.

We first examine if the likelihood of issuing formal drought declarations prior to the 2004 and 2008 local elections was systematically higher in municipalities where the incumbent mayor was affiliated with the President's party. To mitigate concerns about potential heterogeneity of

¹ As emphasized by Acemoglu (2010), political economy considerations often play a chief role in determining policy actions and outcomes in developing countries.

² This proportion is based on administrative data on emergency declarations over 2003-2008, described below.

municipalities, we: i) account for both state fixed effects and a rich set of observable municipal attributes; ii) introduce flexible controls for the margin of victory of the elected mayor in the previous race; and iii) account for both contemporaneous and historical patterns of local rainfall. The results suggest that partisan considerations play a role in driving emergency declarations associated with drought: in municipalities where the mayor is affiliated with the President's party, the probability of issuing at least one drought declaration in the two years prior the local election increases by about 4 percent, on average.

We then investigate if (and how) the occurrence of drought declarations prior to the electoral race influences voting outcomes. We begin by estimating the incumbent effect for municipalities where the mayor is eligible for reelection, in the spirit of Ferreira and Gyourko (2009, 2010). We find, not surprisingly, that mayoral candidates elected by a narrow margin are considerably more likely to win the next election. Our main interest, however, lies in the extent to which the magnitude of this incumbent effect is influenced by the issuance of drought declarations. And we find that receiving a drought declaration prior to the electoral race appears to reinforce the electoral advantage of incumbent mayors running for reelection. Our results further suggest that the level of contemporaneous rainfall is positively linked with the magnitude of the incumbent effect, suggesting that voters respond both to actual weather conditions and to the policy response to extreme weather events.

This paper builds on and contributes to the small but growing literature on the political economy of extreme weather events. In an analysis of county-level vote returns for gubernatorial and presidential elections in the United States over 1970-2006, Gasper and Reeves (2011) find that voters punish presidents and state governors for severe weather damage. They also find, however, that the electorate is attentive and responsive to the actions of their officials, punishing the president and rewarding the governor when the former rejects a request by the latter for federal assistance. Also for the United States, Reeves (2011) finds that a state's electoral competitiveness affects the likelihood of receiving a disaster declaration from the president; the author also provides evidence that voters reward presidents for issuing disaster declarations.³ In a paper that is perhaps closer to our own, Cole, Healy and Werker (2012) examine how state governments in India respond to rainfall shocks and how voters react to governmental action. They find that voters

³ In related work, Cohen and Werker (2008) offer a theoretical analysis of the political economy of natural disasters.

punish the incumbent party for rainfall shocks, but less so when the government responds vigorously to the crisis in the year prior to the election.

Our paper complements and extends this literature in several ways. First, we provide evidence on the role of party affiliation in determining drought declarations prior to the election at the municipal level. Second, we study whether the existence of drought declarations before the election influences the electoral advantage of individual incumbent mayors running for reelection, and examine the role of partisan considerations in shaping this effect.⁴ Third, in doing so we account for a wide array of municipal attributes, thereby mitigating concerns about underlying heterogeneity of municipalities.

The remainder of the paper is organized as follows. Section 2 provides background on the system of drought declarations and local elections, and describes the sets of data used in the empirical analysis. Section 3 examines whether and how political parties matter for drought declarations before the elections, while section 4 examines the extent to which these declarations influence subsequent electoral outcomes. Section 5 concludes.

2. Background and Data

With a population of about 192 million over 8.5 million km², Brazil is the largest nation of the Southern Hemisphere and the world's fifth largest country. Its climate comprises a wide range of weather conditions across a diverse topography, with five major subtypes: equatorial, tropical, semiarid, highland tropical, temperate, and subtropical. From an administrative perspective, the Brazilian Federal Union comprises 26 states, one federal district and over 5,500 municipalities.

2.1 Municipal Governments and Elections

Municipal governments in Brazil have autonomous administrations, collect their own taxes, and receive a share of taxes collected by the federal union and the state government. They are run by an elected mayor and an elected city council. Mayors are directly elected by voters (with plurality rule) for a four-year term. Elections are typically held in October, and mayors take office in January of the subsequent year. Since the 2000 election, mayoral term limits have been extended from one to two terms.

⁴ Using country-level data for sub-Saharan Africa, Bruckner and Ciccone (2011) show that negative rainfall shocks are followed by significant improvement to political institutions.

2.2 Drought Declarations

The procedures for declaring an emergency in Brazil can be summarized as follows. The mayor (*Prefeito*) or state governor makes a formal request to the Ministry of National Integration (*Ministério da Integração Nacional*) in the 10 days after the disaster has struck. The request describes the nature of the disaster and its main effects, including estimates of damages, casualties, injuries, and services being affected, among other possibilities. The ministry then declares an emergency or state of public calamity for a period of up to 180 days, which may then be renewed. The ministry may also reject the request if it is considered not to comply with a set of pre-established conditions. The federal government may unilaterally (and preemptively) declare a state of emergency to accelerate the process of distributing disaster relief, while it receives the formal request by local authorities. Although disaster relief is coordinated by Civil Defence (*Defesa Civil*), each of the corresponding Ministries (e.g., Agriculture, Health or Finance) is responsible for its own relief activities.

Accounts from several national sources cast doubt on the integrity of drought declarations and associated relief actions. For example, many references point to the existence of a “drought industry” (*indústria da seca*) in the Northeast region. This phenomenon is defined in Wikipedia as follows:⁵

The “drought industry” is the process by which political and economic groups use the natural phenomenon of drought in the Northeast of Brazil to their own benefit, such as receiving donations from the government and using them for their own purposes. It is a political process whereby large landowners and their political allies in various government levels use the drought to extract public money at the excuse of addressing it. These resources are then used to make improvements in their own properties, e.g., using labor inputs funded by the government to build dams in their own land. It is not seldom that these resources are deviated to uses other than agricultural activities and drought relief. This way, public resources aimed at addressing drought do not reach the population that suffers the most with it, benefiting instead the local elites. (...) In parallel, there is “vote-buying” (*voto de cabresto*), whereby the goods supplied to address the drought are deviated and used to buy votes of large landowners, who then ask their workers to vote in the politician that brought them the goods.

⁵ Original in Portuguese available at: http://pt.wikipedia.org/wiki/Ind%C3%BAstria_da_seca

2.3 Data

The empirical analysis in this paper draws on the following sets of data:

1. *Drought declarations.* We use administrative data on emergency declarations from the National Secretariat of Civil Defense (*Secretaria Nacional de Defesa Civil*) for 2003-2008. This data set contains the following information by municipality: type of event (flood, drought, rain, storms, wind, etc.), type of emergency declared (state of emergency or state of public calamity), starting date and duration of the declaration. Using these data we construct two different variables: the number of droughts declared in each year by the municipality, and a dummy variable that takes the value of one if at least one drought was declared in that municipality-year (and zero otherwise).
2. *Mayoral candidates and votes.* We draw on data from the Brazilian Electoral Court (*Tribunal Superior Eleitoral*) on the biographical and electoral records of the mayors and their opponents in the 2000, 2004 and 2008 municipal elections, including the party with which the candidate is affiliated and its vote share in the election. We further exploit data from the 1996 municipal election to verify if incumbent mayors are eligible in the 2004 election.
3. *Rainfall.* We use data on monthly rainfall at the municipality level covering the period 1960-2009. Data for 1960-2002 come from the University of East Anglia's Climate Research Unit (dataset CRU TS 3.0). We complement this information with data from the National Environmental Data System (*Sistema Nacional de Dados Ambientais*) for the period 2002-2009. Using a kriging procedure we compute rainfall for each municipality on a monthly basis for the whole sample period.
4. *Local public spending, income and population.* Annual data on municipal public spending for 2000-2008 come from the National Treasury (*Tesouro Nacional*) through the FINBRA data set. Yearly data on municipal GDP and its composition, and on local population come from the National Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*).

3. Does Party Affiliation Matter for Drought Declarations?

The political budget cycle theory suggests that politicians may tinker policies such that economic conditions improve in order to increase the chances of reelecting a sitting government. Intuitively, electors will vote for (against) a politician if economic conditions are good (bad). Brender and Drazen (2005) find that political budget cycles are a feature of new democracies, and that in general they tend to last only a few periods. In the present paper, we seek to determine if municipalities where the mayor is affiliated with the party of the Brazilian President—in the period of analysis, Lula da Silva from *Partido dos Trabalhadores* (PT)—are more likely to issue a drought declaration running up to an election. A drought declaration entails additional resources for the municipality. Hence, the incumbent mayor running for reelection might use its privileged political connections to receive a drought declaration, and thereby increase his chances of reelection. Moreover, the concept of drought is somewhat imprecise, implying that opportunistic bureaucrats and local politicians have some leeway into issuing or not a formal drought declaration.

A related theoretical explanation for partisan influence in the issuance of drought declarations is the pork barrel spending theory, which implies that politicians will direct spending towards their own districts rather than providing resources intended for the population at large (Lizzeri and Persico, 2001; Drazen and Eslava, 2006). Moreover, there is compelling evidence that congressional representatives in the United States benefit from “getting the pork” (e.g., Mayhew, 1974; Ferejohn, 1974). Mayors may therefore want to exploit their political connections to show their constituents that they are able to obtain drought declarations and thereby “get the pork” back home.

3.1 Empirical Strategy

Our aim in this section is to empirically assess if (and how) the issuance of drought declarations prior to the election is influenced by the party affiliation of the local mayor, particularly affiliation with the party of the Brazilian President. To mitigate potential biases associated with heterogeneity of municipal characteristics, we restrict our attention to municipalities that had at least two mayoral candidates in the previous election. Using information on the two most voted opponents in each election, we then follow the standard approach of absorbing the variation coming from non-close elections using flexible controls for the vote share (Lee, Moretti and Butler,

2004; Ferreira and Gyourko, 2009, 2010). Specifically, we adopt a parametric setting adding a three-order polynomial on the relative margin of victory to the regression function, and estimate the following equation:

$$Drought_{ct} = \alpha + \beta PT_{ct} + \sum_{j=1}^3 \gamma_j MV_{ct}^j + \delta' X_{ct} + \varepsilon_{ct} \quad (1)$$

where: $Drought_{ct}$ is a dummy variable indicating whether there has been a drought declaration in municipality c in the two years prior to the election; PT_{ct} a dummy variable that takes the value of 1 if a mayor from President's party won the previous election; MV_{it} is the margin of victory relative to the second most voted candidate; and ε_{ct} an error term capturing all other observed and unobserved determinants of the policy. We also include a vector of controls X_{ct} for municipal characteristics.⁶ These include a wide array of socioeconomic attributes of the municipality, as well as historical and contemporaneous rainfall patterns. The socioeconomic attributes are the electoral term averages for log population, log real GDP per capita, share of agricultural GDP, share of services GDP, and log municipal expenditure per capita. Contemporaneous rainfall is defined as the average monthly rainfall observed in the two years prior the election, while historical rainfall refers to the average monthly rainfall observed in the period 1960-2009.

The effect of electing a mayor from the PT party on the likelihood of having a drought declaration is captured by the coefficient β . We focus on the two years prior the 2004 and 2008 municipal elections (2003-2004 and 2007-2008), and we estimate (1) in a pooled regression, with a binary control for the electoral period and dummy variables for the 26 federal states.

3.2 Results

Table 1 reports summary statistics for the set of municipalities that had at least two candidates in the previous mayoral election. In about 20 percent of municipalities, at least one drought was issued in the two years prior the municipal elections of 2004 and 2008. On average, each municipality had 0.35 drought declarations in this period. But there is substantial heterogeneity in the number of drought declarations across municipalities and regions, with a number of municipalities in the Northeast and Southern regions recording several drought declarations

⁶ The addition of covariates other than the margin of victory contributes to eliminate biases resulting from the inclusion of observations not very close to the threshold and to improve precision (Imbens and Lemieux, 2008).

(Figure 1). In the electoral periods 2001-2004 and 2005-2008, about 5 percent of municipalities were led by a mayor affiliated with the party of the Brazilian President, *Partido dos Trabalhadores* (PT). This proportion increased considerably in the second of these electoral terms.

Table 2 reports the estimates yielded by several variants of (1). The regression reported in column (1) accounts only for federal-state dummies, while that in column (2) adds controls for observable municipal attributes. In columns (3) to (5), we progressively add controls for the margin of victory of the incumbent the previous election. The regression results are very similar across all these specifications, and suggest that municipalities led by PT mayors are more likely to receive at least one drought declaration in the two years prior to the election. In columns (6) and (7) we further include controls for historical and contemporaneous rainfall patterns. Results from these regressions suggest that municipalities experiencing less rainfall are more prone to receiving drought declarations, as would be expected. But most importantly the coefficient capturing partisan influences remains significant and little changed when accounting for rainfall patterns; results from our preferred specification, presented in column (7), indicate that municipalities led by PT mayors are about 4 percent more likely to receive at least one drought declaration in the two years before the election.

For robustness, we then examine if the results prevail when specifying instead the dependent variable as the number of droughts declared in the two years before the election. The estimates, shown in Table 3, suggest once again that the number of drought declarations is systematically higher in municipalities where the mayor is affiliated with the President's party. This result is robust across the several specifications considered.

As we noted above, one possible explanation for this result is that mayors affiliated with the President's party are more able to extract additional resources for the municipality from the federal government. This may reflect pure partisan alignment of federal government bureaucrats, who would therefore be more lenient towards emergency requests from municipalities led by mayors affiliated with the President's party. Alternatively, it may signal that PT mayors possess stronger information networks within the federal administration and are therefore more able to fulfill the requirements of the drought declaration system.

4. Do Drought Declarations Affect Electoral Outcomes?

We now turn our attention to whether the occurrence of drought declarations influences electoral outcomes. In particular, we examine the extent to which the issuance of at least one drought declaration in the two years prior to the election affects the magnitude of the incumbent effect—a measure of reelection success. Hence we examine the response of voters to the occurrence of drought declarations. We adopt an approach very similar to that presented above, but at the candidate level.

4.1 Empirical Strategy

To examine the incumbent effect we estimate the following equation:

$$W_{ict} = \alpha + \beta W_{ict-1} + \sum_{j=1}^3 \gamma_j MV_{ict-1}^j + \delta' X_{ct-1} + v_{ict} \quad (2)$$

where W_{ict} is a dummy for candidate i winning the election at municipality c in period t , while the other variables have the same meaning defined above. We use a balanced panel on the two most voted candidates in $t-1$, and exclude information for municipalities in which, due to binding term limits, the incumbent mayor is not eligible for reelection.⁷ Thus, β consistently captures the average incumbent effect.

To identify the role of drought declarations prior to the election in shaping this incumbent effect, we estimate the following equation:

$$W_{ict} = \alpha + \beta_1 W_{ict-1} \times Drought_{ct} + \beta_2 W_{ict-1} \times (1 - Drought_{ct}) \quad (3)$$

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defined. + $\sum_{j=1}^3 \gamma_j MV_{ict-1}^j + \delta' X_{ct-1} + v_{ict}$

where β_1 captures the incumbent effect for incumbent mayors in municipalities in which at least one drought has been declared in the two years prior to the corresponding electoral race, while β_2 captures the incumbent effect for mayors running for reelection in municipalities without drought declarations over the same period. We will conduct formal tests on the equality of these two coefficients.

⁷ As we noted above, since the year 2000 mayors in Brazil can be reelected, but for only one subsequent term.

Finally, we examine potential heterogeneity in this effect across PT and non-PT municipalities. To this end we estimate the following equation:

$$\begin{aligned}
 W_{ict} = & \alpha + \beta_1 W_{ict-1} \times Drought_{ct} \times PT + \beta_2 W_{ict-1} \times (1 - Drought_{ct}) \times PT \\
 & + \beta_3 W_{ict-1} \times Drought_{ct} \times (1 - PT) + \beta_4 W_{ict-1} \times (1 - Drought_{ct}) \times (1 - PT) \\
 & + \sum_{j=1}^3 \gamma_j MV_{ict-1}^j + \delta' X_{ct-1} + v_{ict}
 \end{aligned} \tag{4}$$

where all variables have the meaning defined above.

4.2 Results

Table 4 presents the results yielded by (2). These estimates point to an incumbent effect of about 26 percent, on average. This effect is estimated with a great degree of precision, and it is remarkably stable across the various specifications considered. Interestingly, the estimated incumbent effect for Brazilian mayors is somewhat lower than previous estimates for the United States reported by Ferreira and Gyourko (2009, 2010). The estimates presented in column (7) provide some evidence that higher levels of contemporaneous rainfall increase the incumbent effect. Given that higher levels of rainfall are likely to be associated with greater proceeds from agricultural production, this result suggests that voters tend to reward the incumbent mayor when economic conditions are more favorable.

In Table 5, we examine the extent to which the incumbent effect differs systematically with the party affiliation of the incumbent mayor. To do this, we estimate a variant of (2), where the W_{ict-1} term is interacted with a dummy variable that takes the value of 1 if the candidate is affiliated with the PT party. The results suggest that the incumbent effect is indeed systematically higher for candidates affiliated with the President's party: the estimated coefficients point to a difference of about 13 percentage points, and F-tests reject the hypothesis of equality of coefficients at the 1 percent level. Once again, this result prevails across the various specifications considered. One possible explanation for this finding is that PT mayors may be favored by the central government (e.g., via larger federal transfers), putting them at greater advantage when running for reelection. Alternatively, this result may simply reflect the fact that, in the period of

analysis, President Lula da Silva was highly popular among voters, who might therefore be expected to express their support for his party in local elections.

In Table 6, we examine whether and how the issuance of at least one drought declaration before the election affects the incumbent effect in a systematic way. As can be observed, we find that incumbent mayors from municipalities in which at least one drought has been declared enjoy an additional incumbency advantage of about 3 percentage points, on average. F-tests confirm that the two coefficients of interest are statistically significantly different from each other at the 5 percent level. This result is consistent with the “pork barrel” story outlined above, in which constituents reward incumbents for bringing the “pork.”

Our last set of regressions looks at whether the electoral effects of drought declarations vary systematically PT and non-PT candidates; see equation (4). In Table 7 we see that the issuance of drought declarations before the election appears to magnify the electoral advantage of the incumbent, regardless of whether the incumbent has the same party affiliation of the President; the absolute difference between estimated coefficients within each group is very similar (about 3 percentage points). With respect to inference, F-tests suggest that such a difference is only statistically significant for candidates who are not affiliated with the President’s party, but this may reflect lack of statistical power due to a smaller number of observations for PT candidates.

5. Concluding Remarks

The increased occurrence of extreme weather conditions leading to drought poses major challenges for many developing nations. But while politicians and policy makers have been called for developing adequate policy responses to such extreme events, we still know relatively little about the political economy considerations involved in such a process.

Exploiting unusually rich data on Brazilian municipalities, we have studied whether and how drought declarations interact with the political process. Focusing on mayoral elections, we have found that the probability of having a drought declaration in the two years prior to the election is about 4 percent higher in municipalities led by a mayor affiliated with the President’s party, and that receiving a drought declaration prior to the race reinforces the electoral advantage of the incumbent mayor. These findings suggest that policy responses to extreme weather conditions are subject to political influence, and have important effects on the working of chief democratic

institutions. They therefore underscore the importance of accounting for political economy considerations in the design and management of relief-related activities.

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Tables

Table 1. Summary Statistics

	2004	2008	Pooled
Dummy=1 if municipality had at least one drought declaration in the two years prior to the municipal election	0.229 (0.42)	0.178 (0.383)	0.204 (0.404)
Number of droughts declared in the 2 years before the election (range: 0-5)	0.337 (0.729)	0.354 (0.846)	0.345 (0.787)
Dummy=1 if municipalities led by mayor from the President's party (PT)	0.033 (0.18)	0.081 (0.272)	0.056 (0.23)
Log historical rainfall (average montly rainfall observed in 1960-2009)	1.325 (0.259)	1.322 (0.251)	1.324 (0.255)
Log contemporaneous rainfall (average monthly rainfall observed in the two years prior the election)	1.496 (0.161)	1.419 (0.215)	1.459 (0.193)
Log population	9.36 (1.093)	9.408 (1.113)	9.385 (1.103)
Log real GDP per capita	8.707 (0.713)	8.917 (0.687)	8.808 (0.708)
Agricultural value added/GDP	0.269 (0.167)	0.238 (0.157)	0.254 (0.163)
Services value added/GDP	0.572 (0.147)	0.592 (0.145)	0.581 (0.147)
Log government spending per capita	6.467 (0.431)	7.012 (0.405)	6.729 (0.4998)
Margin of victory of the mayor in the previous election (percentage points difference relative to the second most voted candidate)	16.349 (15.281)	14.329 (13.749)	15.378 (14.599)
Observations	4734	4381	9115
Number of municipalities	4734	4381	5237

Notes: Demographic and economic variables are electoral period averages. Nominal variables expressed in local currency (real values of 2008).

Table 2. Party Affiliation and Existence of Drought Declarations prior to the Election

	Dep. variable: At least one drought declaration in the two years before the election						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PT	0.036** [0.016]	0.042*** [0.016]	0.042*** [0.016]	0.042*** [0.016]	0.042*** [0.016]	0.037** [0.015]	0.036** [0.015]
Log historical rainfall						-0.697*** [0.025]	-0.619*** [0.028]
Log contemporaneous rainfall							-0.229*** [0.029]
Observations	9115	9115	9115	9115	9115	9038	9038
R-squared	0.254	0.272	0.272	0.272	0.273	0.332	0.343
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear margin of victory	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic margin of victory	No	No	No	Yes	Yes	Yes	Yes
Cubic margin of victory	No	No	No	No	Yes	Yes	Yes

Notes: All regressions include fixed effects by electoral period and federal state. Standard errors are clustered by municipality. Economic controls are electoral period averages of: log population, log real GDP per capita, agricultural value added/GDP, services value added/GDP; log municipal public expenditure per capita. *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Party Affiliation and Number of Drought Declarations

	Dep. variable: Number of drought declarations in the two years before the election						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PT	0.078** [0.032]	0.081** [0.032]	0.083*** [0.032]	0.083*** [0.032]	0.083*** [0.032]	0.070** [0.029]	0.069** [0.029]
Log historical rainfall						-1.627*** [0.063]	-1.477*** [0.068]
Log contemporaneous rainfall							-0.444*** [0.073]
Observations	9115	9115	9115	9115	9115	9038	9038
R-squared	0.240	0.256	0.257	0.257	0.257	0.347	0.355
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear margin of victory	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic margin of victory	No	No	No	Yes	Yes	Yes	Yes
Cubic margin of victory	No	No	No	No	Yes	Yes	Yes

Notes: All regressions include fixed effects by electoral period and federal state. Standard errors are clustered by municipality. Economic controls are electoral period averages of: log population, log real GDP per capita, agricultural value added/GDP, services value added/GDP; log municipal public expenditure per capita. *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Pure Incumbency Effect

	Dependent variable: Won current election						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Won previous election	0.259*** [0.008]	0.259*** [0.008]	0.259*** [0.008]	0.259*** [0.008]	0.259*** [0.008]	0.258*** [0.008]	0.258*** [0.008]
Log historical rainfall						0.007 [0.019]	-0.006 [0.020]
Log contemporaneous rainfall							0.039* [0.023]
Observations	13162	13162	13162	13162	13162	13050	13050
R-squared	0.087	0.087	0.089	0.089	0.089	0.088	0.089
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear margin of victory	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic margin of victory	No	No	No	Yes	Yes	Yes	Yes
Cubic margin of victory	No	No	No	No	Yes	Yes	Yes

Notes: All regressions include fixed effects by electoral period and federal state. Standard errors are clustered by municipality. Economic controls are electoral period averages of: log population, log real GDP per capita, agricultural value added/GDP, services value added/GDP; log municipal public expenditure per capita. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Party Affiliation and the Incumbency Effect

	Dependent variable: Won current election						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Won previous election * PT	0.376** *	0.378** *	0.377** *	0.377** *	0.377** *	0.374** *	0.374** *
	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]
Won previous election * Other party	0.250** *	0.250** *	0.250** *	0.250** *	0.250** *	0.249** *	0.249** *
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
Log historical rainfall						0.009 [0.019]	-0.004 [0.020]
Log contemporaneous rainfall							0.039* [0.023]
Observations	13162	13162	13162	13162	13162	13050	13050
R-squared	0.089	0.090	0.091	0.091	0.091	0.091	0.091
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear margin of victory	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic margin of victory	No	No	No	Yes	Yes	Yes	Yes
Cubic margin of victory	No	No	No	No	Yes	Yes	Yes

Notes: All regressions include fixed effects by electoral period and federal state. Standard errors are clustered by municipality. Economic controls are electoral period averages of: log population, log real GDP per capita, agricultural value added/GDP, services value added/GDP; log municipal public expenditure per capita. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Existence of Drought Declarations prior to the Election and the Incumbency Effect

	Dependent variable: Won current election						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Won previous election * Drought	0.296*** [0.015]	0.297*** [0.016]	0.297*** [0.016]	0.297*** [0.016]	0.297*** [0.016]	0.301*** [0.016]	0.302*** [0.016]
Won previous election * No drought	0.249*** [0.009]	0.249*** [0.009]	0.249*** [0.009]	0.249*** [0.009]	0.249*** [0.009]	0.247*** [0.009]	0.247*** [0.009]
Log historical rainfall						0.027 [0.019]	0.012 [0.021]
Log contemporaneous rainfall							0.044* [0.023]
Observations	13162	13162	13162	13162	13162	13050	13050
R-squared	0.088	0.088	0.090	0.090	0.090	0.089	0.090
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear margin of victory	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic margin of victory	No	No	No	Yes	Yes	Yes	Yes
Cubic margin of victory	No	No	No	No	Yes	Yes	Yes

Notes: All regressions include fixed effects by electoral period and federal state. Standard errors are clustered by municipality. Economic controls are electoral period averages of: log population, log real GDP per capita, agricultural value added/GDP, services value added/GDP; log municipal public expenditure per capita. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Existence of Drought Declarations prior to the Election, Party Affiliation and Incumbency Effects

	Dependent variable: Won current election						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Won previous election * Drought * PT	0.404*** [0.060]	0.407*** [0.060]	0.408*** [0.061]	0.408*** [0.061]	0.407*** [0.061]	0.404*** [0.061]	0.404*** [0.061]
Won previous election * No Drought * PT	0.369*** [0.027]	0.370*** [0.027]	0.369*** [0.027]	0.369*** [0.027]	0.370*** [0.027]	0.366*** [0.027]	0.366*** [0.027]
Won previous election * Drought * Other party	0.288*** [0.016]	0.289*** [0.016]	0.289*** [0.016]	0.289*** [0.016]	0.289*** [0.016]	0.294*** [0.016]	0.295*** [0.016]
Won previous election * No Drought * Other party	0.241*** [0.009]	0.240*** [0.009]	0.240*** [0.009]	0.240*** [0.009]	0.240*** [0.009]	0.238*** [0.009]	0.238*** [0.009]
Historical rainfall						0.029 [0.019]	0.014 [0.021]
Contemporaneous rainfall							0.045* [0.023]
Observations	13162	13162	13162	13162	13162	13050	13050
R-squared	0.090	0.091	0.092	0.092	0.092	0.092	0.092
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear margin of victory	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic margin of victory	No	No	No	Yes	Yes	Yes	Yes
Cubic margin of victory	No	No	No	No	Yes	Yes	Yes

Notes: All regressions include fixed effects by electoral period and federal state. Standard errors are clustered by municipality. Economic controls are electoral period averages of: log population, log real GDP per capita, agricultural value added/GDP, services value added/GDP; log municipal public expenditure per capita. *** p<0.01, ** p<0.05, * p<0.1.

Figures

Figure 1. Drought Declarations before the 2004 and 2008 Mayoral Elections

