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The Incumbency Curse: Weak Parties, Term Limits, and Unfulfilled Accountability

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We study how representation works in a context where accountability to voters is restricted because of term limits and accountability to parties is limited because of party weakness. Analyzing all Brazilian mayoral elections between 1996 and 2012 using a regression discontinuity design, we show that becoming the incumbent party results in large subsequent electoral losses. We theorize that the presence of term limits, combined with political parties to which politicians are only weakly attached, affects the incentives and behavior of individual politicians in such a way that their parties' suffer systematic losses. A descriptive analysis of an original dataset on the career paths of Brazilian mayors suggests that our assumptions are an accurate description of Brazil's political context, and we find support for three central empirical implications of our theoretical explanation. Moreover, based on an analysis of additional data from Mexico, Peru, Chile, Costa Rica, and Colombia, we show that the negative effects found in Brazil also exist in other democracies.

INTRODUCTION

The central characteristic of democratic representative government is the delegation of authority from citizens to elected officials. This act of delegation implies that citizens lose control over the behavior of their representatives—at least temporarily. The main mechanism to ensure that representatives act in the best interest of the public is the existence of periodic elections, the key instrument that voters have to both retrospectively sanction elected officials and prospectively select "good" candidates who are honest and share their policy goals (e.g., Manin, Przeworski, and Stokes 1999).

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In most cases, the delegation from voters to representatives is mediated by the political parties to which candidates are affiliated. Voters, candidates and parties form two related chains of principal-agent relationships (Moreno, Crisp, and Shugart 2003). Voters (as the principal) delegate authority to parties and their candidates—the voters' agents. In turn, the party (as the principal) delegates authority to the party's elected candidates—the party's agents. Thus, candidates are agents of both their parties and voters, and in both cases there is a tension between delegation and accountability—between letting the agent implement policy on the principal's behalf and minimizing the agent's opportunistic behavior. In a recent contribution, Samuels and Shugart (2010) argue that this tension is resolved differently in presidential than in parliamentary systems because both adverse selection and moral hazard problems are more severe in the former than in the latter, resulting in weaker parties in presidential democracies.

We build on these ideas, focusing on how the interaction between the conflicting demands of accountability to both parties and constituents may result in suboptimal outcomes. While Samuels and Shugart (2010) highlight the ways in which constitutional separation of powers may weaken parties, we highlight the vacuum of accountability that may occur when electoral rules that limit voters' ability to sanction individual elected officials are adopted in a context where most parties are *already* weak. In particular, we study executive offices elected via plurality rules in a context where (i) accountability to voters is restricted because of term limits, and (ii) accountability to parties is limited because most parties have low ability to discipline their members and prevent candidates' frequent party switches. What, if any, are the distinctive characteristics of representation in such situations?

We investigate this question systematically through a study of how access to office affects political parties' future electoral outcomes in Brazil's municipalities, a context where these two conditions hold. Brazilian

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mayors can serve no more than two consecutive terms, and the Brazilian party system is widely considered to be weakly institutionalized and underdeveloped (e.g., Mainwaring 1999; Samuels 2003). For the argument we develop, however, it is important to make a distinction between the strength of the party system as a whole, and the strength of each individual party that composes it. In their influential contribution, Mainwaring and Scully (1995) define a weakly institutionalized party system as one where the patterns of competition between parties are unstable, ties between parties and society are tenuous, parties and elections enjoy limited legitimacy, and party organizations are weak. Although most of these characteristics are true of the Brazilian party system, our framework highlights the role of one of these four components in particular, the weakness of individual party organizations—understood here as the inability of parties to constrain their members' actions. From this conceptual distinction between *weak party* and *weak party system*, it follows that some of the individual political parties that compose a weak party system may nonetheless be strong parties—a phenomenon that occurred in Brazil in the period we study and, as we discuss below, plays a role in the test of some of the empirical implications of our argument.

We analyze all Brazilian mayoral elections between 1996 and 2012 using a regression discontinuity (RD) design. By comparing municipalities where a party barely wins an election to municipalities where a party barely loses, this design allows us to isolate the causal effects of winning office from the spurious correlation between current and future electoral success—a correlation that may arise, for example, if parties with good reputation or strong candidates are more likely to succeed in the first place. The RD effects we report are local by construction, since they represent the effects of gaining access to office in extremely close elections. As we discuss in the last section, a large proportion of Brazil's mayoral elections are highly competitive, enhancing the relevance of our RD-based results within Brazilian municipalities.

We divide our investigation into three parts. First, we ask whether winning a mayoral election per se makes a party more likely to win again in the following election. Winning public office gives parties access to direct and indirect benefits (public funds, name recognition, the ability to deter challengers, etc.) that can be leveraged to boost future electoral support. It also gives parties an opportunity to implement policies that are preferred by a plurality of voters, and cultivate its brand. On average, in a political system where representation works as expected, parties should either benefit from winning office or at least not be harmed by it.

What we find, however, is the opposite: when a party (barely) wins a mayoral election in Brazil, its chances of winning the following election are severely diminished relative to its chances in similar municipalities where the party does not hold the mayor's office. For example, on average, an incumbent party that is barely reelected is 15 percentage points less likely to win the following election than a similar incumbent party that is barely defeated. This overall disadvantage is not limited to a few political parties or electoral years but is a rather widespread phenomenon in the period we study—a period that covers most municipal elections held since Brazil's transition to democracy in the late 1980s.[1]

Second, we use a conceptual framework built on the distinction between accountability to voters and parties to develop an explanation for why this disadvantage may occur. Absent electoral incentives and unconcerned about a future career within the party, some term-limited candidates may have an incentive to exert less effort or engage in opportunistic behavior—a kind of behavior that has been documented among Brazilian mayors (e.g., Ferraz and Finan 2011; Zamboni and Litschig 2014). Voters may still choose not to vote for a party when the party's departing incumbent has behaved in undesirable ways. A weak party, however, cannot act on the anticipation of this electoral punishment and prevent the incumbent's behavior, given its lack of ability to control its incumbent candidate. The result is what we call "unfulfilled accountability"—a situation in which the incumbent candidate engages in undesirable behavior in their last term, voters sanction the incumbent candidate's party retrospectively, but weak parties are unable to prevent the candidates' undesirable behavior. We formalize our explanation in a simple three-period principal-agent model with three types of actors (voters, parties and politicians) and show that, under certain assumptions, our explanation can indeed be sustained as an equilibrium.

In the final part of our study, we conduct an extensive analysis that shows that several implications and assumptions of our explanation are supported by our data. We first present an original study of the career path of Brazilian mayors, for which we name-matched over 20,000 elected mayors to all political candidates who contested any election in Brazil between 1992 and 2012. Consistent with our assumption of low accountability to parties and the previous literature on party weakness in Brazil, we find that after the end of their mayorship, a large proportion of mayors run for office for a different party. In addition, guided by our model and conceptual framework, we decompose the overall effect and find that, as predicted, the disadvantage to incumbent parties is concentrated in municipalities where a lame-duck mayor is forced to retire rather than in municipalities where a reelection-eligible mayor finished his first term in office. We also show that municipalities where a lame-duck mayor is in office seem to exhibit lower public good provision.

Finally, exploiting the conceptual distinction between the strength of a party system and the individual parties that compose it, we conduct a separate analysis of the Workers Party (Partido dos Trabalhadores, PT), a relatively programmatic, cohesive, and high-discipline party during the period we study that had been long considered one of the few stronger parties within the weakly institutionalized Brazilian party system (Hunter 2010; Mainwaring 1999). According to our explanation, unfulfilled accountability occurs

[1] At the time this article was accepted for publication, Brazil's 2016 municipal election had not yet taken place.

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when parties are weak; thus the mechanism we identify should not generally hold for the PT in the period we study. Indeed, the disadvantage in municipalities where the PT lame-duck mayor just retired cannot be distinguished from the disadvantage in municipalities where the PT mayor is eligible for reelection. Moreover, PT's mayors are considerably less likely to switch to other parties upon leaving office.

Our theoretical explanation suggests that the interaction between individual party weakness and electoral rules that restrict reelection may affect individual politicians' incentives and careers in a way that compromises accountability, increases volatility and prevents the consolidation of the party system necessary to break the cycle. In other words, our framework suggests that one of the components of party system weakness—the strength of individual party organizations—can interact with individual politician's reelection incentives in a way that can reinforce the other components of party system institutionalization and thus perpetuate the weakness of the party system as a whole.

As we elaborate in the final section, we believe that our argument is generalizable beyond the context of Brazil. Based on a preliminary analysis of five additional Latin American countries—Chile, Colombia, Costa Rica, Mexico, and Peru—we find clear evidence that the existence of large electoral losses incurred by incumbent parties is not limited to Brazil. Moreover, consistent with our explanation, we find tentative evidence that the incumbent losses are concentrated in countries with term limits, and primarily among these countries' weaker political parties. We are exploring these patterns further in ongoing research.

ACCOUNTABILITY IN A CONTEXT OF WEAK PARTIES AND TERM LIMITS

The literature on representation has long recognized the difficulties arising from voters having a single instrument, elections, to both select policy platforms prospectively and sanction representatives' performance retrospectively (see Manin, Przeworski, and Stokes 1999, and references therein). Since the alignment of representatives' and constituents' preferences is never complete, it is essential that voters have the ability to monitor representatives (Mansbridge 2009). It follows that electoral rules—such as term limits—that restrict the accountability of individual candidates may deprive voters of one of elections' fundamental roles. At the same time, the delegation from citizens to politicians is often mediated by political parties. We explore how the existence and strength of parties can alleviate or worsen the representation challenges induced by electoral rules that constrain the ties between individual candidates and the electorate.

As mentioned above, this process can be understood as two related principal-agent relationships between voters, elected officials, and political parties. Voters delegate authority to parties and their candidates, while parties delegate authority to their candidates. Elected officials are thus agents of two principals—their party and the voters. The quality of representative government will depend on the degree of alignment between the incentives of voters, individual politicians, and their parties, and on the existing mechanisms to select agents and minimize opportunistic behavior when misalignment does exist.[2]

Samuels and Shugart (2010) argue that the separate origin and survival of the executive and legislative branches makes the tension between delegation and accountability much higher in presidential than in parliamentary systems. Adverse selection is more likely in presidential systems, they argue, because parties need to recruit candidates that are appealing to a national constituency, and the qualities that make a candidate competitive at the national level are often in conflict with those that make him a faithful party agent. Furthermore, moral hazard is also more likely in presidential systems because the party has no power to remove the president from office, and is thus unable to prevent the president from abandoning the party line. The result is that constitutional separation of powers puts strong pressures on political parties to prioritize vote-seeking over policy, and adopt broad coalitions and diffuse ideological commitments.

While Samuels and Shugart's (2010) framework focuses on how national party systems vary across constitutions, we build on these ideas to develop expectations regarding the nature of representation and accountability within a single political system. Our contribution highlights that the tensions in the principal-agent relationship between party and candidates can be multiplied within a single political system when subnational executive positions are elected with plurality rules, as is often the case. Subnational executives are imperfect agents of their parties in much the same way presidents are, since (i) in order to be elected they also must be competitive in a locality-wide election that in some cases might be large and, most importantly, (ii) like presidents, they cannot be removed from office if they abandon the party line. We argue that the extent to which these misaligned incentives result in unfulfilled accountability will depend on two related features: the electoral horizon of elected officials, and the strength of individual political parties.

Samuels and Shugart (2010) emphasize the misalignment in incentives in the principal-agent relationship between parties and candidates (presidents). Their framework assumes that elections induce accountability in the second principal-agent relationship from voters to politicians. But a feature that is often overlooked is that executive offices tend to have term limits at both the national and subnational level. The very definition of accountability implies that "the principal has the right to withdraw the conditionally delegated authority altogether. This usually means dismissing (firing) the agent" (Moreno, Crisp, and Shugart 2003, 83). Thus,

[2] This is a simplified description, and other factors could be incorporated into the theory. For example, in a study of U.S. senators, Lindstädt and Vander Wielen (2011) find support for the hypothesis that legislators' accountability to constituents varies strategically over time.

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when elected officials are not eligible for reelection, the very essence of accountability may be threatened.[3]

Two factors are likely to reinforce accountability to voters in presidential systems when reelection is not allowed. One is presidents' desire to protect their legacy, which can discourage unsustainable policies. The other is political parties. If presidents are associated with "national policy proposals that are associated with partisan appeals" (Samuels and Shugart 2003, 37), voters can hold presidents accountable retrospectively by giving or withholding support to the president's party in the following election. A municipality's executive office—the subnational executive unit we study in this article—lacks the visibility and importance of the presidency, making legacy considerations much less important. Thus, in subnational contexts, the main mechanism to guard against the removal of electoral accountability via term limits is the presence of strong and programmatic political parties—organizations with a longer electoral horizon that seek to enforce the ideological cohesiveness and discipline of its members in order to build a credible reputation (Kitschelt et al. 2010).

When parties are weak, term limits may result in undesirable outcomes by restricting individual accountability in a context where accountability to parties cannot be relied upon to ensure representation. Voters may still choose to punish a party when its term-limited incumbent has behaved in undesirable ways. But if a weak party cannot act on the anticipation of this punishment to prevent the incumbent's behavior, and if there are no other incentives to prevent the incumbent candidate's behavior, such as a future career within the party or the possibility of reelection, this retrospective sanctioning results in unfulfilled accountability—a cycle of undesirable but unavoidable incumbent behavior from which neither parties nor voters can escape.

The result is a paradoxical effect of term limit policies. Term limits are typically adopted with the goal of restricting politicians' grip on power and increasing voters' ability to populate elected offices with politicians closely aligned with them. But this presupposes that there are other, nonelectoral mechanisms of accountability in place, such as the existence of strong parties. In developing democracies, however, individual parties are often weak, and the adoption of rules that constrain electoral accountability may feed into higher volatility, which can in turn weaken parties' roots in society and decrease their legitimacy. This dynamic can create a vicious cycle where the weakness of individual parties, in combination with limited electoral accountability, reinforces the weakness of the party system as whole.

Unfulfilled Accountability as an Equilibrium

In applying our conceptual framework, one important question is whether the cycle of unfulfilled accountability we describe can be sustained as an electoral equilibrium. We now present a formal model to show that it can. Unlike standard principal-agent models which feature one principal (the voter) and one agent (the politician), our model has three actors: the voter, the party, and the incumbent politician.[4] In line with our conceptual framework, the voter is the principal to both the politician and the party, and the party serves as the principal to the politician. An incumbent politician faces a two-term limit, being prevented from running after successfully completing two successive terms in office. The party is not subject to the two-term limit, allowing us to evaluate what, if any, electoral consequences exist for the party from the existence of a term limit on individual candidates. We therefore consider a three-period game, with two elections after the first and the second period.

The politician chooses public good provision; for simplicity, the action space is binary $g_t \in \{0, 1\}$, where $g_t = 0$ denotes "shirking" (i.e., low effort). Public good provision is one of the fundamental tasks of executives for which voters can hold them accountable, and it is therefore commonly used in retrospective voting models as a way to capture the accountability relationship between voters and their representatives (e.g., Besley 2007). As we explain below, mayors in Brazil have substantial prerogatives in local public good provision.[5]

As is common in agency models of politics (e.g., Besley 2007; Persson and Tabellini 1999), the politician is assumed to get a rent from being in office—"ego" rents and monetary benefits—in period t, $r_{I,t}$, where I stands for being an incumbent. We assume $r_{I,t} > g_t$ so that, in principle, returns from holding office give incentives to politicians to run. The politician incurs a cost of public good provision of θg_t, with $\theta \in \{B, G\}$. For simplicity, we let $G = 1$ and B be such that $B > r_{I,t}$. In other words, the politician facing $\theta = B$ will always choose $g_t = 0$, i.e., he cannot be incentivized (by the voter or the party) to provide the public good. We interpret this as the presence of some politicians who are simply insufficiently competent or too reckless, or both. Research on developing democracies indicates that such bad candidates are not infrequent (Caselli and Morelli 2004; Klašnja, Little, and Tucker Forthcoming; Svolik 2013), especially in the presence of weak parties, as we hypothesize in our theory. Hereafter, we call politicians facing $\theta = G$ "good" and those facing $\theta = B$ "bad." θ is observed by the politician—but not by the voter or the party—and is randomly chosen by nature with draws

[3] Term limits have been shown to alter the behavior of politicians in systematic ways. See, for example, Alt, de Mesquita, and Rose (2011) and Besley and Case (1995).

[4] As is standard in principal-agent models, the challenger and his party are drawn randomly from the same distributions of types characterizing the incumbent politician and the party, allowing us to simplify our exposition by omitting the challenger and his party from the discussion.

[5] We note that an interesting extension to our theoretical argument would be to focus on the role of policy preferences instead of public good provision. For example, it could be the case that, in municipalities where social policies are particularly important, left parties would be punished more when their lame-duck mayors failed to provide social assistance. We believe that the Brazilian context is not a well-suited case for such an argument because, as we and others have argued, parties' ideological platforms and voters' policy preferences are quite fluid. But this may be a fruitful avenue for future research.

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that are identically and independently distributed over periods (if a new candidate is in office). The politician may be punished by the party for shirking, $p_t \in \{0, 1\}$, where $p_t = 1$ is the punishment. Therefore, the politician's utility is $r_{I,t} - \theta g_t - p_t$.

The party chooses whether to punish the politician for shirking, at a cost $c(p_t)$, such that $c(0) = 0$ and $c(1) = \kappa$, and $\kappa \in \{L, H\}$. κ is observed by the party and the politician, but not directly by the voter.[6] As argued above, κ may represent the strength of the party in disciplining its members, its ability to provide career advancement, and/or its ideological cohesion (i.e., its ability to screen incongruent members). κ is randomly drawn by nature at the start of the game. The party gets a benefit from having an incumbent in office, $r_{P,t}$. For simplicity, let $r_{I,t} = r_{P,t}$, so that rewards from office to a candidate and the party are the same. Henceforth, we refer to these office benefits simply as r_t. The party's utility is thus $r_t - c(p_t)$. Suppose that cost L is such that $r_t - L \geq 0$, that is, the party with the low cost is strong enough to punish the shirking politician. We are interested in the effect of party strength when $\kappa = H$, and how it varies relative to r_t.

The voter gets utility from the candidate's effort in public good provision, g_t, and chooses whether to vote for the party given the effort of the politician and the sanctioning decision by the party. That is, the voter votes for the party when its candidate provides the public good, but votes against the party when the candidate shirks and the party fails to punish the candidate. While weak party systems and voters' weak partisan attachments may obscure parties' responsibility for outcomes and weaken this retrospective voting, there is ample evidence in Latin American and other developing democracies that voters condition their vote on their perceptions of party competence and performance (e.g., Benton 2005; Calvo and Murillo 2014; Domínguez and McCann 1995; Tucker 2006; Weyland 2003).

Finally, the timing of the game is as follows: (a) Nature chooses the type of incumbent politician and the cost for the party; (b) the politician chooses g_1 and the party chooses p_1; (c) the voter observes g_1, p_1 but not the type of the politician or the cost to the party, and votes (end of period one); (d) if the politician is replaced, nature chooses the new politician and his type, the politician chooses g_2, and the party chooses p_2 (if the politician is kept); (e) the voter observes g_2, p_2 and votes (end of period two); (f) if the politician is replaced, nature chooses the new politician and his type, the politician chooses g_3, and the party chooses p_3 (if politician is kept); (g) all payoffs are realized and the game ends.

The main prediction arising from this model is the following:

Proposition 1 *When the party is weak (i.e., when $\kappa = H > r$), the good politician provides the public good in the first period, is reelected, but shirks in the second period; the party does not punish the politician, and the voter in turn votes against the party in the second election. When the party is strong (i.e., when the cost of punishing is low), in equilibrium, the good politician exerts effort in both terms in office, and the voter does not vote against the party in the second election.*

Proof. The proof is in Section S3 of the Online Appendix. □

The logic of the proposition is straightforward. Since the voter does not directly observe the strength of the party nor the type of the politician, she must try to infer them from the choices made—the public good provision and punishment. Given that the bad politician cannot be incentivized to provide the public good, and that the strong party is capable of punishing shirking good politicians, observing shirking by the lame-duck politician and lack of punishment from the party signals to the voter that the party is weak. Given the voter's strategy, the weak party is punished in the election following the last term of its reelected incumbent.

The model stresses the importance of the variation in individual party strength for equilibrium electoral outcomes in the presence of term limits, and reinforces the distinction between the weakness of individual parties and the weakness of the party system as a whole introduced in previous sections. If all parties were weak, then candidates would shirk in their first as well as in their second term in office, and the voter would seek to punish the party in both terms. In other words, we would see an incumbency disadvantage in all elections, irrespective of whether the term limit is binding. However, in the presence of some strong parties, this would not constitute equilibrium behavior, because a strong party has an incentive to discipline their retiring candidate in order to avoid voter punishment and separate itself from weak parties.

BRAZILIAN MUNICIPALITIES AND PARTIES

We apply our theoretical framework to the study of Brazil's municipal elections. Brazil is a highly decentralized federal system with strong states (Abrucio 1998; Samuels 2003). The political power of municipalities increased gradually during the 1970s and 1980s, and they are now considered among the most decentralized and autonomous subnational units below the state level in Latin America (Nickson 1995), enjoying substantial policy responsibilities that include the parceling of land and the organization and provision of local public services, such as public transportation, education, and health services (IBGE 2002).

At the time of our writing, Brazil had 5,564 municipalities (*municípios*). The mayor (*prefeito*) is in charge of the municipal executive, and a municipal legislature (*câmara de vereadores*) is in charge of local legislative matters. Since 1996, both the mayor and the municipal legislature are elected in general elections every four years. The legislature is elected by a proportional representation system, while the mayor is elected

[6] The information structure we have chosen has important consequences for the solutions to our model. In Section S3 of the Online Appendix, we discuss these implications in more detail, as well as an alternative assumption that would lead to the same result.

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TABLE 1. Descriptive Statistics of Brazilian Municipalities, 1996–2012

	Overall Sample			Sample of Close Races		
Variable	Obs	Mean	Std Dev.	Obs	Mean	Std Dev.
GDP	21,947	292,073.1	1,976,741.0	2,140	175,970.5	463,926.6
Population	27,372	24,703.5	84,584.7	2,693	19,541.8	29,896.5
Vote % winner	27,455	55.70	12.55	2,701	46.18	6.37
Vote % runner-up	26,707	38.78	8.92	2,701	45.18	6.36
PSDB runs	27,455	0.34	0.47	2,701	0.34	0.47
PMDB runs	27,455	0.47	0.50	2,701	0.50	0.50
DEM runs	27,455	0.30	0.46	2,701	0.31	0.46
PT runs	27,455	0.28	0.45	2,701	0.30	0.46
PP runs	27,455	0.23	0.42	2,701	0.27	0.44
No. effective parties	27,455	2.16	0.53	2,701	2.36	0.56

Note: Sample of close races only includes elections where the winner party's margin of victory is no larger than two percentage points. Election variables refer to mayoral elections. Municipalities with a runoff election are excluded.

by simple plurality.[7] We merged a municipality-level dataset of demographic and socioeconomic variables obtained from the Instituto Brasileiro de Geografia e Estatística (IBGE), with election returns and characteristics of individual candidates, parties and coalitions for mayoral and municipal legislature elections for 1996, 2000, 2004, 2008 and 2012, obtained from Brazil's Tribunal Superior Eleitoral. As shown in the descriptive statistics presented in Table 1, our final dataset has 27,455 municipality-year observations.

The number of parties that contest Brazilian mayoral elections is large; in the 1996–2012 period we analyze, eight different parties won 5% or more of all mayoral elections. Our main analysis below pools all parties and focuses on the future effects of winning office for an incumbent party (i.e., the party previously elected and currently in office), regardless of the identity of this party. But we also present individual results for the four parties that win the largest share of mayoral elections in the 1996–2012 period: the Partido do Movimento Democrático Brasileiro (PMDB), the Democratas (DEM, formerly Partido da Frente Liberal), the Partido da Social Democracia Brasileira (PSDB), and the Partido Progressista (PP). In addition, as mentioned in the Introduction, we present results for the PT (The Outlier PT section).

Brazil's national and state-level political system are characterized by a weakly institutionalized party system, including high electoral volatility, low levels of party identification in the electorate, high fractionalization, low capacity of parties to exercise discipline over their members, and a lack of strong ideological platforms (e.g., Ames 2001a; 2001b; Mainwaring 1993; 1999; Samuels 2003).[8] Moreover, party switching in Brazil's Chamber of Deputies is a common phenomenon (e.g., Desposato 2006).

We corroborate that this weak institutionalization of the party system also extends to the context of Brazilian municipal elections. We demonstrate this through several summary measures, focusing on the five parties mentioned above (PSDB, PMDB, DEM, PP, and PT). First, the Pedersen's index of electoral volatility is around 31, implying that 31% of the votes received by the parties in one election are allocated differently in the following election (a value of zero means that all parties receive the same vote percentage in both elections). This value is higher than in most other (national-level) party systems in Latin America (see for example Table 1.1 in Mainwaring and Scully 1995). Second, conditional on having run in one election, the five major parties on average run again in the same municipality in the next election only 53% of the time. Moreover, the party labels are quite fluid. Ticket-splitting is frequent, as evidenced by the average absolute difference between the party vote share for its mayoral candidate and for the concurrent municipal council of around 12 percentage points. Related, parties often run in coalitions which shift tremendously between elections: the absolute size of coalition from one election to the next changes on average by 62% across the five major parties.

The weakness of Brazil's party system, however, does not mean that all Brazilian parties are created equal. Parties on the left, in particular the PT, stood out in the first decades of the New Republic as more disciplined, cohesive, and programmatic than their counterparts on the center and the right. We come back to this variation across parties in the later sections to both explain some of the results we observe and derive testable implications of our argument.

RESEARCH DESIGN

To study how holding the mayor's office affects the electoral performance of parties in future elections, we use a regression discontinuity design. In this design, all

[7] In municipalities with more than 200,000 eligible voters, mayoral elections where no party reaches 50% of the vote must go to a runoff election. Municipalities with a runoff elections are excluded from our analysis.

[8] However, scholars have recently noticed some signs of progress towards party system consolidation (e.g., Hagopian, Gervasoni, and Moraes 2009).

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units have a score, and those units whose score exceeds a known cutoff receive the treatment while those below the cutoff do not. Under appropriate assumptions, a comparison of units with and without the treatment close to the cutoff can be used to study the causal effect of the treatment on some outcome of interest.[9] In our application, the unit of observation is the municipality, and the party's winning a given election (the treatment) depends on the margin of victory obtained in that election (the score), defined as the party's vote share minus the vote share of its strongest opponent. The cutoff that determines electoral victory is thus normalized to zero: the party wins the election when its vote margin is positive and loses otherwise.

If municipalities where a party barely wins the election at t (the "treatment group") are not abruptly different from municipalities where the party barely loses the election at t (the "control group"), the RD design allows us to study the (local) average effect at the cutoff of a party winning office at t on its subsequent electoral success at $t+1$. This effect is based on a comparison of the party's $t+1$ average electoral outcomes in municipalities where the party barely won at t to the party's $t+1$ average outcomes in municipalities where it barely at lost t. For a more formal definition of the estimand and assumptions, see Section S4 of the Online Appendix.[10]

For estimation, we use local polynomial methods to fit two separate regression functions above and below the cutoff, with the estimated RD effect calculated as the difference between the two estimated intercepts. In particular, we estimate a local linear regression of the party's electoral victory at $t+1$ on the margin of victory at t, with weights computed by applying a kernel function to the distance between each observation's score and the cutoff. These kernel-based estimators require a bandwidth for implementation, with observations outside the bandwidth typically receiving zero weight. We follow common practice and select an optimal bandwidth that minimizes the mean squared error (MSE). Since MSE minimization leads to bandwidth choices that are too large for conventional confidence intervals to be valid, we use the robust confidence intervals developed by Calonico, Cattaneo and Titiunik (2014b), which estimate the asymptotic bias ignored by conventional inference and correct the standard errors appropriately to produce valid inferences even for large bandwidths. For implementation, we use the `rdrobust` software.[11]

THE ELECTORAL DISADVANTAGE OF BRAZILIAN INCUMBENT PARTIES IN MUNICIPAL ELECTIONS

As discussed above, the number of political parties that contest and win Brazilian mayoral elections is large. For this reason, we first present the results for the incumbent party, whichever party this may be. This incumbent party analysis identifies the party that wins the election at $t-1$ and studies the effects of this party's barely winning or losing at t on outcomes at election $t+1$. Since it requires three rounds of elections, our incumbent party analysis includes elections in 2000, 2004, 2008, and 2012.[12]

To provide more disaggregated information, we complement our main incumbent party analysis with the analysis of the four largest parties at the municipal level mentioned above: PMDB, PSDB, DEM, and PP. A detailed description of the composition of the treated and control groups in our RD analysis for both the incumbent party and the individual party analysis is provided in Section S2 of the Online Appendix (Tables S1 and S2, respectively).

Our main outcome of interest is an indicator of whether the party of interest (incumbent party or individual party) wins the mayoral office at $t+1$. (In Section S7 of the Online Appendix, we also present results for the party's vote margin at $t+1$.) Brazilian parties do not contest mayoral elections in all municipalities each year—during the 2000–2012 period, the incumbent party runs for reelection in approximately 60% of municipalities. Studying the downstream effects of becoming the incumbent party is thus complicated by having a relatively large number of municipalities where the party does not contest the future election.

One possible approach is to focus only on those municipalities where the party contests the election at $t+1$. However, this would introduce bias if the party's decision to run at $t+1$ were influenced by the anticipation of its electoral performance at $t+1$, and if this tendency affected the treatment and control groups differently. Instead, we focus on an outcome that is free of such complications: whether the party wins the $t+1$ election regardless of whether the party had a candidate at $t+1$ or not. We call this outcome "unconditional victory" or "victory unconditional on running," since it does not condition on the party's contesting the $t+1$ election.[13]

The first row of Table 2 reports the results for unconditional victory at $t+1$ from the incumbent party

[9] See the edited volume by Cattaneo and Escanciano (Forthcoming), for a recent overview of the RD literature.

[10] Throughout this article, we adopt a continuity-based approach to analyze and interpret the RD design—but see Cattaneo, Frandsen, and Titiunik (2015) for a randomization-based alternative. See also Cattaneo, Titiunik and Vazquez-Bare (Forthcoming).

[11] Software available at https://sites.google.com/site/rdpackages/rdrobust. See Calonico, Cattaneo, and Titiunik (2014a) for details on the STATA implementation, and Calonico, Cattaneo, and Titiunik (2015b) for details on the `R` implementation. All the results reported in our tables were obtained with the penultimate version of `rdrobust` (version 2014). The latest 2016 version of the software was released after the article was accepted for publication. In the second Online Appendix, we present all the main results using the latest version of `rdrobust`. The results are substantively very similar.

[12] Since our sample starts in 1996, the incumbent party is undefined in our sample in the 1996 election.

[13] In the Online Appendix, we also present (i) the effect of barely winning at t on whether the party fields a candidate at $t+1$ (Section S7), (ii) the effect of barely winning at t on whether the party wins the $t+1$ election given that the party has a candidate in this election (Section S7), and (iii) an analysis that treats all municipalities where the party does not contest the $t+1$ election as missing data and calculates bounds for the victory effect (Section S8). All our substantive results remain unchanged.

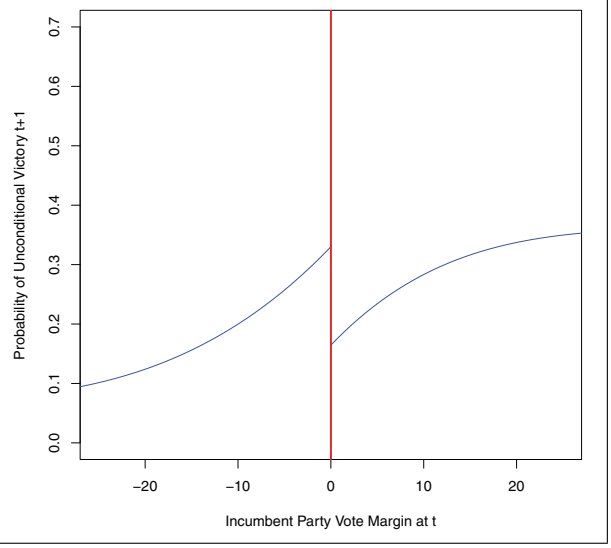
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TABLE 2. RD Effect of Winning at t on Victory at $t+1$ (Unconditional on Running) for Various Parties—Brazil Mayoral Elections, 1996–2012

	Outcome: Unconditional Victory $t+1$					
Party	Estimate	95% CI	p-val	h	n_{tr}	n_{co}
INCUMBENT	−0.15	[−0.213, −0.101]	0.000	13.55	2,755	2,547
PMDB	−0.11	[−0.180, −0.066]	0.000	14.63	2,878	3,102
PSDB	−0.03	[−0.102, 0.018]	0.173	18.77	2,357	2,397
DEM	−0.09	[−0.171, −0.033]	0.004	12.16	1,700	1,843
PP	−0.16	[−0.259, −0.091]	0.000	12.43	1,333	1,315

Note: Running variable is party's margin of victory at t, outcome is dummy =1 if party wins the following election at $t+1$, =0 otherwise. Estimate is average treatment effect at cutoff estimated with local linear regression with triangular kernel and MSE-optimal bandwidth. Columns 3–7 report, respectively, 95% robust confidence intervals, robust p-value, main optimal bandwidth, treated observations within bandwidth, and control observations within bandwidth.

FIGURE 1. RD Effect of Winning at t on Victory at $t+1$ (Unconditional on Running) for Incumbent Party—Brazil Mayoral Elections, 2000–2012



analysis for the 2000–2012 period; the other rows report the individual party results. The results for the incumbent party indicate that when an incumbent party (regardless of what party this is) barely wins the t election, it is on average 15 percentage points less likely to win the following $t+1$ mayoral election than when it barely loses—an effect significantly different from zero, with robust 95% confidence interval ranging from −21 to −10 percentage points. The effect is illustrated in Figure 1 with an RD plot where the dots are optimally-chosen binned means and the solid line is a fourth-order polynomial fit (Calonico, Cattaneo, and Titiunik 2015a).

Similar negative effects are observed in all the individual party analyses, with the exception of the PSDB, the only party in the group that has been a consistent contender in presidential elections since the 1990s (having won two presidential elections since). Although this party has not developed a coherent platform, it can be seen as the second-most coherent party after the PT in terms of, for example, party identification in the electorate (Samuels and Zucco 2014). In the context of our framework, this "intermediate" placement of the PSDB in the weak-strong continuum (see also Mainwaring 1995) might explain the different pattern of results observed for this party.

In all, our analysis shows that Brazilian parties that win the mayoral election at t by a small margin are significantly less likely to win office again at $t+1$. The results are strong, but we must ensure that there are no threats to their validity. The RD design estimates would be invalid if, for example, parties could precisely manipulate close elections to their advantage, in which case observations on either side of the cutoff might not be comparable. Two types of tests are now commonly used to examine the validity of the design: covariate tests that seek to show null RD effects on important predetermined variables—i.e., variables that are prior to or unaffected by the election outcome at t; and density tests that show that the approximate number of observations just above the cutoff is not significantly different from the number of observations just below it (Cattaneo, Jansson, and Ma 2015; McCrary 2008). In Section S5 of the Online Appendix, we show evidence that supports the validity of our design in both ways. Our placebo tests consider several covariates, including population, GDP, number of effective parties, revenue and expenditures, geographic location, and previous victory. We also show that the RD effects reported in Table 2 are robust to the inclusion of these covariates in the analysis (see Table S5; for details on the implementation of covariated-adjusted RD analyses, see Calonico et al. 2016).

EXPLAINING WHY BRAZILIAN PARTIES ARE HURT BY WINNING MAYORAL ELECTIONS

The results just reported show that in closely fought municipalities Brazilian parties hurt their future electoral success by winning mayoral elections. The effect is not only large but it is also remarkably persistent

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in the period we study. Section S6 of the Online Appendix shows that the negative effects (conditional and unconditional) observed in the pooled 2000–2012 period for the incumbent party are also found when every election in this period is analyzed separately.

What explains this finding? How is it possible that political parties, organizations whose important goal is to win and maintain office, are systematically hurt by winning elections? And how can this be sustained over time? Brazilian mayors can only serve two consecutive terms, forcing parties to run with a nonincumbent candidate at least as frequently as every other election. When we juxtapose this phenomenon with the weakness of most Brazilian parties, we can apply our conceptual framework directly. Our explanation centers on the interaction between mayoral term limits and the relative weakness of Brazilian political parties.

An incumbent politician's accountability to voters is eliminated in the mayor's second term, and his or her accountability to their party is severely restricted by party weakness. The result is that in the absence of reelection incentives, Brazilian mayors may have little incentive to act in the best interest of the public. Consistent with our framework, Ferraz and Finan (2011) have shown that Brazilian mayors engage in higher corruption in their last term (see also Zamboni and Litschig 2014).

Our next step is to verify the key assumptions and test the empirical implications of our explanation. We provide several pieces of evidence. First, we explore the career path of Brazilian mayors and show that, as assumed in our theoretical framework, they exhibit weak attachments to their parties as measured by frequent party switches. Second, we examine three empirical implications of our model's proposition. The first is that having a lame-duck incumbent will hurt the party more in the subsequent election than having a first-term incumbent who may be disciplined by reelection incentives. The second is that public good provision should be lower under incumbents serving their second than their first term. The third implication builds on the exceptional status of the PT as a strong party within Brazil's weak party system in the period we study. According to our model, voter defection following the last term of a term-limited incumbent politician should mainly be borne by weak parties, suggesting that an important component of the process that leads to future electoral losses should be muted for the PT—a party that has had tighter control over its candidates than the other parties in the system during the period we study. We consider each implication in turn.

The Careers of Brazilian Mayors

The central part of our argument is that lame-duck mayors have little incentive to provide public goods and that parties are unable to control the mayors' behavior absent reelection incentives. Term limits for Brazilian mayors, however, only apply to consecutive elections, and a candidate can run for reelection again after a one-term hiatus. Thus, if a large proportion of lame-duck mayors ran again in the future and they ran with same party with which they were previously elected, the mayors' electoral horizon would in practice be longer than two terms. We would then expect the party to exploit this long-term relationship to incentivize behavior that is beneficial to the party's future success.

To establish whether our model's premises are appropriate in this context, we analyzed the political career path of all mayors elected between 1996 and 2008 (the 2012 cohort is too recent to analyze). We matched mayors' names to a database we compiled of all the politicians running for an office at the municipality level or higher between 1996 and 2012.[14] Table 3 shows the results for the 2000 cohort—the results for the other cohorts are qualitatively very similar and are reported in Section S10.1 of the Online Appendix. The first column shows the career path for the full sample of mayors elected in 2000, reporting in every cell the number of mayors who run in every subsequent election year between 2002 and 2012. We further disaggregate the full sample results, reporting counts in the second column for the subset of mayors who in 2000 were reelected to their second and last term, and in the third column for the subset who were elected for their first term. Years 2004, 2008, and 2012 are election years for municipal offices, while 2002, 2006, and 2010 are election years for state and federal offices.

Our unique data uncover several noticeable patterns that had not been documented before. First, a small percentage of Brazilian politicians seek higher office after being elected mayor. For example, of the total 5,553 (64 + 5,489 in first two columns of first row) mayors in our sample elected in 2000, only 444 and 421 run for higher office, respectively, in 2006 and 2010. (Section S10.1 of the Online Appendix shows that this pattern holds for the other cohorts as well.) Except for a small minority, the political career of Brazilian mayors seems to be confined to the municipal level. Second, a large proportion of eligible mayors run for a consecutive second term in 2004. Of the total 3,461 mayors in this subsample (24 + 3437 in first row), 70% (2,417) run for reelection in 2004.

Third, about half of the mayors who served two consecutive terms run for election again after waiting one election. Of the 2,092 mayors elected for a second consecutive term in 2000 (40 + 2,052 in first row), all of whom are lame ducks and are therefore ineligible to run for mayor in 2004, 53% (1,109) contest the 2008 municipal election (either for city council or mayor). This figure might suggest that, contrary to the assumptions of our model, the electoral horizons of mayors are longer than the consecutive term limits might suggest. However, more than half of these mayors who seek to be elected for a third term in 2004 (581 or 52%) run with a different party, suggesting that there is little continuity in mayors' political careers within a single party, and confirming our modeling assumption (and

[14] Our dataset includes candidates for the office of governor, federal deputy, federal senator, state deputy, state senator, mayor, and city council elections.

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TABLE 3. Career Path of Brazilian Mayors Elected in 2000 (Full Sample)

	Full Sample			Elected to 2nd term			Elected to 1st term		
2002	**Yes**		**No**	**Yes**		**No**	**Yes**		**No**
Runs	64		5489	40		2052	24		3437
	Yes	**No**		**Yes**	**No**		**Yes**	**No**	
Wins	18	46	–	14	26	–	4	20	–
Runs with same party	26	38	–	18	22	–	8	16	–
Runs and wins with same party	12	–	–	9	–	–	3	–	–
2004	**Yes**		**No**	**Yes**		**No**	**Yes**		**No**
Runs	2455		3098	38		2054	2417		1044
	Yes	**No**		**Yes**	**No**		**Yes**	**No**	
Wins	1359	1096	–	14	24	–	1345	1072	–
Runs with same party	1688	767	–	22	16	–	1666	751	–
Runs and wins with same party	946	–	–	7	–	–	939	–	–
2006	**Yes**		**No**	**Yes**		**No**	**Yes**		**No**
Runs	444		5109	281		1811	163		3298
	Yes	**No**		**Yes**	**No**		**Yes**	**No**	
Wins	133	311	–	100	181	–	33	130	–
Runs with same party	216	228	–	137	144	–	79	84	–
Runs and wins with same party	81	–	–	57	–	–	24	–	–
2008	**Yes**		**No**	**Yes**		**No**	**Yes**		**No**
Runs	1968		3585	1109		983	859		2602
	Yes	**No**		**Yes**	**No**		**Yes**	**No**	
Wins	485	1483	–	302	807	–	183	676	–
Runs with same party	975	993	–	528	581	–	447	412	–
Runs and wins with same party	251	–	–	146	–	–	105	–	–
2010	**Yes**		**No**	**Yes**		**No**	**Yes**		**No**
Runs	421		5132	152		1940	269		3192
	Yes	**No**		**Yes**	**No**		**Yes**	**No**	
Wins	135	286	–	69	83	–	64	205	–
Runs with same party	180	241	–	67	85	–	113	156	–
Runs and wins with same party	67	–	–	33	–	–	34	–	–
2012	**Yes**		**No**	**Yes**		**No**	**Yes**		**No**
Runs	1665		3888	664		1428	1001		2460
	Yes	**No**		**Yes**	**No**		**Yes**	**No**	
Wins	681	984	–	301	363	–	380	621	–
Runs with same party	728	937	–	270	394	–	458	543	–
Runs and wins with same party	316	–	–	131	–	–	185	–	–

Note: All cells report counts, i.e., the number of mayors in every category. First two columns (labeled *Full Sample*) report results for all mayors who were elected in 2000, while the sets of columns labeled *Elected to 2nd term* and *Elected to 1st term* subset these results by reelection status. Columns labeled *Elected to 2nd term* report results for the subset of mayors elected in 2000 who in 2000 were reelected to their second consecutive term, while columns labeled *Elected to 1st term* report results for the subset of mayors who was elected in 2000 for their first consecutive term.

the conventional scholarly view) that Brazilian politicians have weak attachments to their parties.

In sum, although our career analysis shows that a considerable proportion of mayors run for municipal office again after having served two consecutive mayoral terms and waiting for at least one election, the degree of party switching is pervasive, which is consistent with our assumption that weak parties exert scant control over politicians. Our analysis of the 2000 cohort shows that of the 2,092 mayors who are reelected to their second consecutive term in 2000, only 25% run again in 2008 under their previous party (i.e., the party under which they held office for two terms). A similar pattern occurs in 2012, when only 12% (270) of mayors run again with their previous party. Having offered evidence consistent with our key assumption, we now turn to testing the empirical implications of our framework.

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TABLE 4. Description of Treatment and Control Groups in Incumbent Sample

Treatment Group
- A party wins at $t-1$, so it is the incumbent party at t;
- The incumbent party's candidate who won at $t-1$ runs for reelection at t and (barely) wins;
- We analyze outcomes for the party at $t+1$, when it is still an incumbent party (because it barely won election t) but the candidate who won at $t-1$ and t cannot run anymore due to term limits; instead, the incumbent party either runs with a new non-incumbent candidate, or does not run and there is no incumbent party in the race.

Control Group
- A party wins at $t-1$, so it is the incumbent party at t.
- The incumbent party's candidate who won at $t-1$ runs for reelection at t and (barely) loses.
- We analyze outcomes for the party at $t+1$, when it is no longer the incumbent party (because it barely lost the t election), and some other first-term incumbent party either has an incumbent candidate who runs for reelection, or has a new candidate, or does not have a candidate and there is no incumbent party in the race.

TABLE 5. Description of Treatment and Control Groups in Open Seat Sample

Treatment Group
- A party wins at $t-1$, so it is the incumbent party at t;
- The incumbent party's candidate who won at $t-1$ does not run for reelection at t, but the party runs with another candidate and (barely) wins;
- We analyze outcomes for the party at $t+1$, when it is still an incumbent party (because it barely won election t) and it either runs with an incumbent candidate who seeks reelection or with a new non-incumbent candidate, or it does not run and there is no incumbent party in the race.

Control Group
- A party wins at $t-1$, so it is the incumbent party at t.
- The party's candidate who won at $t-1$ does not run at t, but the party runs with another candidate and (barely) loses.
- We analyze outcomes for the party at $t+1$, when it is no longer the incumbent party (because it barely lost the t election), and some other first-term incumbent party either has an incumbent candidate who runs for reelection, or has a new candidate, or does not have a candidate and there is no incumbent party in the race.

Lame Duck Incumbents Versus Freshman Incumbents

The first implication of our theory is that when parties are weak, the negative effects of incumbency for parties should be larger in those municipalities where their lame-duck mayor has concluded his second and final term, compared to those municipalities where this does not occur—for example, where the party is running with a freshman (reelection-eligible) incumbent. To test this prediction, we create two mutually exclusive subsets of our data. The Incumbent sample is composed of all municipalities where the candidate who got elected at $t-1$ for a given party runs for reelection at t under the same party.[15] In contrast, the Open Seat sample is composed of all municipalities where the candidate who got elected at $t-1$ for a given party does not run for reelection at t.[16] Note that the incumbent candidates' decision to run for reelection, although clearly endogenous, is made before election t is held. Thus, we are subsetting our data based on a pretreatment variable. We describe the Incumbent sample in Table 4, and the Open Seat sample in Table 5, in the context of the incumbent party analysis (the description for the individual parties is analogous).

The most important difference between the two samples is whether the party has a lame-duck mayor who is ineligible to run in the $t+1$ election. The Open Seat sample contains a combination of incumbent candidates and nonincumbent candidates in both the treated and control groups. In contrast, in the Incumbent sample, the same combination of incumbent and nonincumbent candidates exists in the control group, but the treatment group is composed exclusively of nonincumbent candidates who are running immediately after the party's previous incumbent has finished his second (and last) term and is therefore prohibited from running at $t+1$.

Our model predicts that the negative effects of incumbency should occur primarily in the Incumbent sample rather than in the Open Seat sample. Naturally, we cannot be certain that the differences we observe between the subsamples are caused by the fact that lame-duck mayors just retired in one sample but not the other, rather than by some other related factor. Nonetheless, since the subsample analysis is entirely

[15] We exclude cases where the candidate who got elected at $t-1$ for a given party runs for reelection at t under a different party.

[16] Related to our approach of comparing the effects in elections with and without an eligible incumbent candidate, Fowler and Hall (2014) use the variation in term limits across states in the United States to decompose the overall incumbency advantage into a partisan component and personal component (see also Erikson and Titiunik 2015). However, their approach requires that the partisan advantage be equal in lame-duck and open seat elections, an assumption that is ruled out by our framework due to the presence of weak parties, as shown formally in Proposition 1.

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TABLE 6. RD Effect of Winning at t on Victory at $t+1$ (Unconditional on Running) for Various Parties, Open Seat vs. Incumbent sample—Brazil Mayoral Elections, 1996–2012

	Outcome: Unconditional Victory $t+1$						
	Estimate	95% CI	p val	h	n_{tr}	n_{co}	Difference
Incumbent Party							
Incumbent sample	−0.21	[−0.287, −0.158]	0.000	14.23	1,823	1,513	−0.174
Open seat sample	−0.04	[−0.150, 0.044]	0.282	16.80	996	1,107	[−0.286, −0.054]
PMDB							
Incumbent sample	−0.23	[−0.355, −0.110]	0.000	17.58	716	567	−0.134
Open seat sample	−0.09	[−0.167, −0.036]	0.002	13.72	2,180	2,467	[−0.270, 0.008]
PSDB							
Incumbent sample	−0.15	[−0.251, −0.040]	0.007	16.49	541	432	−0.163
Open seat sample	0.01	[−0.062, 0.065]	0.962	23.59	1,969	2,224	[−0.271, −0.024]
DEM							
Incumbent sample	−0.12	[−0.248, −0.025]	0.017	23.46	544	463	−0.028
Open seat sample	−0.10	[−0.191, −0.030]	0.007	11.60	1,296	1,467	[−0.164, 0.112]
PP							
Incumbent sample	−0.33	[−0.507, −0.200]	0.000	13.89	310	215	−0.225
Open seat sample	−0.11	[−0.216, −0.026]	0.012	13.51	1,098	1,183	[−0.413, −0.052]

Note: Running variable is party's margin of victory at t, outcome is dummy =1 if party wins the following election at $t+1$, =0 otherwise. Estimate is average treatment effect at cutoff estimated with local linear regression with triangular kernel and MSE-optimal bandwidth. Columns 2–6 report, respectively, 95% robust confidence interval, robust p-value, main optimal bandwidth, treated observations within bandwidth, and control observations within bandwidth. Last column reports difference in point estimates between Incumbent and Open Seat sample and corresponding 95% confidence interval.

informed by our theory, showing that our hypotheses are consistent with the observed data is an important first step to offer empirical support for our hypothesized explanation.

Indeed, as we report in Table 6 for (unconditional) victory at $t+1$, the differences between the two subsamples are striking and in the direction predicted by our model.[17] For the incumbent party analysis, the point estimate in the Incumbent sample is −21 percentage points with p-value less than 0.001 and a 95% robust confidence interval ranging from roughly −29 to −16 that rules out both positive and small negative effects. In sharp contrast, the point estimate in the Open Seat sample is −4 percentage points and cannot be distinguished from zero (p-value 0.28). Importantly, the illustration of both effects in Figure 2 shows that the effect for the control groups is approximately equivalent in both subsamples: in both Figures 2a and 2b, the intercept at zero of the regression function to the left of the cutoff is around 30 percentage points (it is somewhat larger in the Open Seat sample). In contrast, the effects for the treatment groups are dramatically different across the two samples, with the intercept for the treatment group in the Incumbent sample less than one third the size of the treated intercept in the Open Seat sample. This indicates that the difference between the samples is driven by the treatment group—municipalities where the party barely wins at t, as our model predicts.

A similar pattern holds for the individual party analysis. For all the parties considered, PMDB, PSDB, DEM and PP, the point estimate in the Incumbent sample is more negative than the point estimate in the Open Seat sample and, with the exception of the DEM party, the difference between the estimates is statistically different from zero at conventional levels.

A natural alternative explanation for the differences we find between the samples is that after a two-term mayor is forced to retire, the mayor's party finds it more difficult to stay in office due to the loss of the incumbent mayor's personalistic support, name recognition, experience, etc. Basic facts about the Brazilian party system can in principle support this hypothesis. In local elections, political networks are highly personalistic. In this context, the forced retirement of mayors who have proven successful enough to be reelected may result in losses for his party.

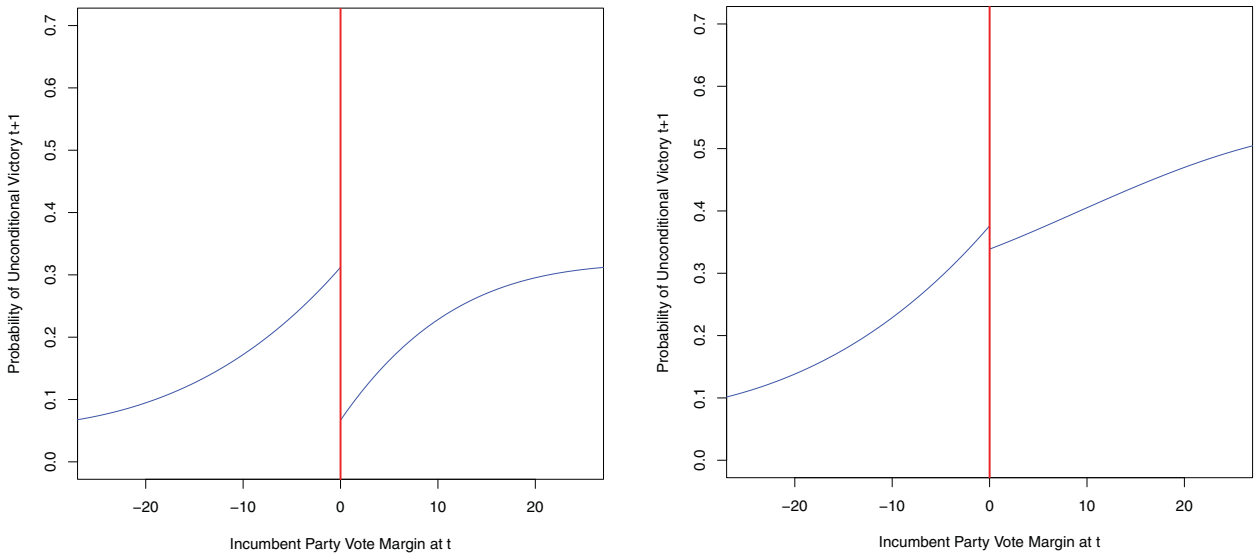
However, following Erikson and Titiunik (2015), in Section S9 of the Online Appendix we show that a mechanism that centers on the loss of the mayor's personalistic support induced by term limits may explain why the effects of incumbency are larger in the Open Seat than in the Incumbent sample, but it cannot explain why the effects are negative. If the difference between the samples were caused by the loss of the mayors' personal appeal, the effects in the Open Seat sample would be large and positive and the effects in the Incumbent sample would be positive but smaller. In addition, the overall effect in the full sample would be positive, in contrast to what we observe in the data.

Another rival explanation is that mayors who are barely elected are perceived as weak and encourage strong challengers to enter the race in the following election. Since the negative effects are very large in

[17] We report the results for conditional victory at $t+1$ in Section S7 of the Online Appendix.

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FIGURE 2. RD Effects of Winning at t on Victory $t+1$ (Unconditional on Running) for Incumbent Party—Incumbent Sample vs. Open Seat Sample, Brazil Mayoral Elections, 2000–2012



(a) Incumbent Sample (b) Open Seat Sample

the Incumbent sample and null (or negative but much smaller in absolute value) in the Open Seat sample, this phenomenon can explain our results only if, relative to the control group, the perceived weakness of the party of barely elected mayors in the Incumbent sample (who are reelected for a second consecutive term) is larger than the perceived weakness of the party of barely elected mayors in the Open Seat sample (who are elected for a first consecutive term).

Although we cannot entirely rule out this explanation, there are several factors limiting its plausibility. First, as we discuss in our concluding section, the majority of mayoral elections are decided by small margins, diminishing the intensity of the "weakness signal" sent by an incumbent's close reelection. Second, stronger challengers typically enter races where no incumbent candidates are running in electoral contexts where incumbents are believed to have a strong personal incumbency advantage. However, as our Open Seat results show, there is no evidence of such an advantage in Brazilian mayoral elections. Third, as we show in the next section, an explanation centered solely on the strategic entry of challengers cannot account for the different pattern we observe for the PT, where there seems to be no difference between the samples. Moreover, the mechanism we hypothesize does allow for stronger challengers to enter strategically at $t+1$ in the Incumbent sample's treatment group in response to the lame-duck mayor's poor performance (which would be more likely to occur where parties are weak). This is simply another way in which the lame-duck's poor performance may lead to a decrease in support for their (weak) party, and can be accommodated by our explanation.

A final alternative explanation we consider is that mayors who are barely elected are less competent than candidates elected by bigger margins, and it is this incompetence, not lack of effort, that lowers the likelihood that the mayor's party wins again. However, the larger negative effects observed in the Incumbent sample suggest that barely winning mayors would be disproportionately more incompetent in this sample than in the Open Seat sample, contradicting the natural expectation that candidates who have survived two elections are no worse, everything else equal, than candidates who have survived only one election. Consistent with this expectation, Table S19 in Section S12 of the Online Appendix shows that, in our overall sample, the incumbent party wins in 60% of the municipalities where the incumbent mayor is running for reelection, but in only 45% of the municipalities where it runs with a nonincumbent candidate. Moreover, as mentioned above and discussed further below, close races are typical in Brazil's mayoral elections, suggesting that the competence of barely elected mayors might not be very different from the competence expected of an average mayor.

Patterns of Public Good Provision

The second empirical implication of our theory concerns public good provision. In the absence of reelection incentives, lame-duck incumbent candidates from weak parties will shirk due to the weak party's inability to enforce the incumbent candidates' discipline. Since in the context we study there are many weak parties, we expect that public good provision should be on average lower under mayors serving their last term than under freshman mayors. To test this implication, we follow the approach adopted above and compare public good provision in the Incumbent sample (where the mayor serving between t and $t+1$ is term-limited) and the

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TABLE 7. RD Effect of Incumbent Party's Winning at t on Five Indicators of Public Good Provision at $t+1$—Open Seat vs. Incumbent sample, Brazil Mayoral Elections, 2000–2012

	Outcome: Various Proxy Measures of Public Good Provision						
	Estimate	95% CI	p-val	h	n_{tr}	n_{co}	Difference
Share HESA Expend.							
All seats	−0.62	[−1.69, 0.40]	0.23	15.80	3,049	2,807	
Incumbent sample	−1.26	[−2.59, 0.01]	0.05	15.85	1,963	1,612	–1.54
Open seat sample	0.28	[−1.71, 2.28]	0.78	16.11	979	1,068	[−3.96, 0.80]
Adm. Employment Growth							
All seats	−2.89	[−7.09, 1.83]	0.25	18.88	2,283	1,989	
Incumbent sample	−6.28	[−12.33, −0.43]	0.04	16.07	1,236	923	–5.88
Open seat sample	−0.40	[−8.77, 7.43]	0.87	15.72	738	811	[−15.76, 4.34]
Social Assistance Expend.							
All seats	−3, 099.99	[−8, 551.93, 2, 137.95]	0.24	16.33	1,381	1,284	
Incumbent sample	−6, 599.67	[−16, 111.74, 1, 212.62]	0.09	16.09	804	609	–9,512.87
Open seat sample	2,913.20	[−4, 156.70, 10,848.08]	0.38	11.98	444	520	[−22, 254.91, 664.42]
Housing Program							
All seats	−0.01	[−0.06, 0.04]	0.64	17.27	3,248	2,961	
Incumbent sample	−0.02	[−0.08, 0.05]	0.60	16.83	2,064	1,674	–0.02
Open seat sample	0.01	[−0.07, 0.08]	0.85	16.59	985	1,093	[−0.12, 0.07]
Housing Materials Program							
All seats	−0.01	[−0.07, 0.06]	0.84	16.85	3,013	2,718	
Incumbent sample	−0.06	[−0.13, 0.01]	0.11	19.98	2,176	1,668	–0.12
Open seat sample	0.06	[−0.04, 0.17]	0.22	15.81	926	1,007	[−0.25, 0.00]

Note: Running variable is party's margin of victory at t, outcome is public good provision indicator as indicated in row group label. Estimate is average treatment effect at cutoff estimated with local linear regression with triangular kernel and MSE-optimal bandwidth. Columns 2–6 report, respectively, 95% robust confidence interval, robust p-value, main optimal bandwidth, treated observations within bandwidth, and control observations within bandwidth. Last column reports difference in point estimates between Incumbent and Open Seat sample and corresponding 95% confidence interval.

Open Seat sample (where the mayor serving between t and $t+1$ is reelection-eligible).

Testing this implication empirically is challenging. Although in our stylized model there is a single public good, measuring public good provision in practice requires considering multiple dimensions, such as provision of services and infrastructure in areas as varied as education, health and social assistance. Moreover, since our model assumes that voters can perfectly observe whether the public good has been provided, our empirical focus should be on phenomena that are particularly salient to voters.

Because a single measure is unlikely to capture the complexity of public good provision, we provide empirical evidence for different variables taken from two different data sources. We first examine a broad measure of public good provision: the share of a municipality's total fiscal expenditures allocated to health, education or social assistance (HESA). The data come from the annual publication of municipal public accounts.[18] Since this information is available annually, we compiled the 1997-2012 series and calculated the average annual share of HESA expenditures during each mayoral term. The second set of variables focuses somewhat more narrowly on social assistance and public administration. The data come from a different source, an annual municipal-level survey.[19] For social assistance, we study whether the municipality has any housing programs, as well as a housing program that provides materials for housing improvements in particular. In addition, we study the amount spent in social assistance programs as reported by the municipality. To examine the functioning of the public administration, we focus on the growth in the number of public employees working for the municipal administration. Our choice of survey variables is partly dictated by the fact that, unlike a number of other potentially useful variables, these variables are relatively consistently worded and represented across the different survey waves.

The results are presented in Table 7, where the columns are analogous to those in Table 6. Thus, we report the effect of the incumbent party barely winning at t versus the incumbent party barely losing at t on each of the outcome variables. The results are shown separately for the entire sample (All Seats), the Incumbent sample and the Open Seat sample. All of the outcomes occur after the t election and before the $t+1$ election.

[18] "Finanças do Brasil—Dados Contábeis dos Municípios" (FINBRA), compiled by Brazil's National Treasury Secretariat (Secretaria do Tesouro Nacional).

[19] Perfil dos Municípios Brasileiros, Pesquisa de Informações Básicas Municipais, run by the Instituto Brasileiro de Geografia e Estatística (IBGE).

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The first row of the top panel of Table 7 reports the average annual share of total municipal expenditures devoted to health, education or social assistance (HESA). In the overall sample, the incumbent party's victory has an effect indistinguishable from zero. However, this share is significantly smaller (by about 1.25 percentage points) in the treatment group than in the control group in the Incumbent sample, but the analogous difference is indistinguishable from zero in the Open Seat sample. This pattern is as predicted by our model.

The remaining panels of Table 7 report the results for the municipal survey variables. In the second panel, we see that the effect of the incumbent party winning on the growth in the number of employees in the municipal administration (expressed in percentage points) is indistinguishable from zero in both the overall and the Open Seat samples, but significantly lower in the Incumbent sample, where the number of employees grows on average 6 percentage points more slowly in municipalities where a lame-duck incumbent is in office. A similar pattern is seen in the third panel for the social assistance expenditures (expressed in current thousand reais). Finally, we see that there seems to be no difference between the Incumbent and Open Seat samples in the effect of the incumbent party winning on whether the municipality has any kind of housing program, but the pattern appears again when we look specifically at whether the municipality has a housing program that provides materials for house improvement. The treatment group in the Incumbent sample appears on average 6 percentage points less likely to have the latter type of housing program. The p-value associated with this effect is 0.11, but the difference between the point estimates in both subsamples (reported in the last column) is statistically significant at level just above 5%.

In sum, while each individual measure captures the phenomenon of public good provision only partially and the effects vary in terms of strength and significance, the pattern across the variables seems broadly consistent. In municipalities where the incumbent party is reelected with a lame-duck incumbent, public good provision seems lower than in comparable municipalities where the incumbent party loses and a freshman, reelection-eligible mayor takes office. Such a difference does not seem to appear when a similar comparison is made between reelection-eligible mayors on both sides in the Open Seat sample.[20]

The Outlier PT

We now consider the final empirical implication of our model: that the strong parties within a weak party system should exhibit null or smaller negative effects of winning office, and that for such parties there should be no difference between the Incumbent and Open Seat samples. We focus on the PT because various scholars have documented that during the period of our study (1996–2012), unlike most of the other Brazilian parties, the PT was a programmatic party with high levels of party discipline and stronger attachments in the electorate (e.g., Mainwaring 1999; Samuels and Zucco 2014). In an extensive study of the evolution of the PT over time, Hunter (2010) has argued that despite the pressures to become a "catchall" party in recent decades, the PT preserved many of its early organizational features and remained the most disciplined party in the Brazilian party system in the period we study.[21]

We corroborate these features at the municipal level by analyzing the career path of PT mayors between 1996 and 2012. Although our sample size is somewhat limited, Table 8 shows that the rate of party switching among lame-duck PT mayors is much lower (in fact it is close to zero) than among lame-duck mayors from other parties.[22] For example, as shown in the first row, of the 2092 mayors (2052 + 40) who in 2000 are reelected to their second consecutive term, 46 (6 + 40) belong to the PT and 2046 (34 + 2012) belong to other parties. As shown in the last two columns of the 2008 panel, of these 2046 mayors who do not belong to the PT, 1084 run again in 2008—but only 505 of these do so under their previous party. In contrast, the third and fourth column in the 2008 panel shows that, of the 46 lame-duck PT mayors elected in 2000, 25 run again in 2008, and 23 of those do so under their previous party. Thus, the rate of party switching among the lame ducks in 2000 who run again in 2008 is 8% (2/25) for the PT and 53% (579/1084) for all other parties, a very large difference.

According to the explanation that we have proposed, these features of the PT should result in greater control over elected mayors and less punishment by voters. In other words, the overall negative effect of becoming the incumbent party should be diminished for the PT, and there should be no difference in the effects between the Incumbent and Open Seat samples. As Table 9 below shows, this is what we observe. The overall effect of −8 percentage points in the full sample (p-value 0.06) is about half the size of the effect we found in our Incumbent Party analysis in Table 2. Moreover, the last column of Table 9 shows that the difference between the point estimates in the Incumbent and Open Seat samples, both around −9 percentage points, cannot be distinguished from zero.

Finally, when we examine the patterns of public good provision, we fail to find consistent evidence of lower public good provision in the Incumbent sample at conventional levels of significance in all but one of the public good provision variables, and the differences between the Incumbent and Open Seat samples are also mostly insignificant. To save space, the full results

[20] The results would be considerably more informative with measures of public good provision that captured the mechanism behind our explanation more accurately—e.g., measures based on public opinion data about the incumbent's performance. This is a fruitful topic of future research that we hope to undertake.

[21] As suggested by the ongoing Petrobras corruption scandal, the organizational strength and discipline of the PT may have been on the decline of late.

[22] See Section S10.2 in the Online Appendix for the analogous tables for the remaining cohorts.

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TABLE 8. Career Path of Mayors Reelected in 2000 to Second Consecutive Term: PT vs Other Parties

	All		PT		Other Parties	
2002	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Runs	40	2052	6	40	34	2012
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Wins	14	26	4	2	10	24
Runs with same party	18	22	6	0	12	22
Runs and wins with same party	9		4		5	
2004	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Runs	38	2054	1	45	37	2009
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Wins	14	24	1	0	13	24
Runs with same party	22	16	1	0	21	16
Runs and wins with same party	7		1		6	
2006	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Runs	281	1811	17	29	264	1782
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Wins	100	181	7	10	93	171
Runs with same party	137	144	17	0	120	144
Runs and wins with same party	57		7		50	
2008	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Runs	1109	983	25	21	1084	962
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Wins	302	807	7	18	295	789
Runs with same party	528	581	23	2	505	579
Runs and wins with same party	146		6		140	
2010	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Runs	152	1940	6	40	146	1900
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Wins	69	83	5	1	64	82
Runs with same party	67	85	6	0	61	85
Runs and wins with same party	33		5		28	
2012	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Runs	664	1428	14	32	650	1396
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Wins	301	363	10	4	291	359
Runs with same party	270	394	12	2	258	392
Runs and wins with same party	131		10		121	

Note: All cells report counts, i.e., the number of mayors in every category. First two columns (labeled *All*) report results for all mayors who were reelected in 2000 for their second consecutive term, while the sets of columns labeled *PT* and *Other Parties* subset these results by type of party. Columns labeled *PT* report results for PT mayors who in 2000 were reelected to their second consecutive term, while columns labeled *Other Parties* report results for mayors from all other parties who were reelected in 2000 for their second consecutive term.

are given in the Online Appendix (Table S18). In sum, the overall negative effect on the probability of victory in the $t+1$ election in the full sample is considerably smaller for the PT than for most other parties, and the comparison between the Incumbent and Open Seat samples indicates no difference in the effects for either the future electoral success or most public good provision measures. These three findings are all consistent with our theoretical explanation.

DISCUSSION: IMPLICATIONS AND GENERALITY OF FRAMEWORK AND FINDINGS

We explored how access to office affects political parties' future electoral success in Brazil. Analyzing all Brazilian mayoral elections since 1996 to the present using an RD design, we showed that (barely) becoming the incumbent mayoral party results in large and

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TABLE 9. RD Effect of Winning at t on Victory at $t+1$ (Unconditional on Running) for PT—Brazil Mayoral Elections, 1996-2012

	Outcome: PT Unconditional Victory $t+1$						
	Estimate	95% CI	p-val	h	n_{tr}	n_{co}	Difference
All seats	−0.08	[−0.190, 0.003]	0.058	19.80	909	1,176	
Incumbent sample	−0.09	[−0.336, 0.165]	0.504	15.72	170	104	–0.006
Open seat sample	−0.09	[−0.211, 0.014]	0.085	16.92	651	900	[−0.261, 0.288]

Note: Running variable is party's margin of victory at t, outcome is dummy =1 if party wins the following election at $t+1$, =0 otherwise. Estimate is average treatment effect at cutoff estimated with local linear regression with triangular kernel and MSE-optimal bandwidth. Columns 2–6 report, respectively, 95% robust confidence interval, robust p-value, main optimal bandwidth, treated observations within bandwidth, and control observations within bandwidth. Last column reports difference in point estimates between Incumbent and Open Seat sample and corresponding 95% confidence interval.

widespread subsequent electoral losses. We proposed an explanation for these findings where the key elements are the weakness of political parties, reflected in their inability to control politicians' actions, and the lack of electoral accountability induced by term limits. A descriptive analysis of an original dataset on the career paths of Brazilian mayors is consistent with our assumption that politicians are weakly attached to their parties at the local level, and we also find evidence consistent with several of our theoretical model's empirical implications.

Our explanation highlights that party weakness may affect the careers and incentives of individual politicians in a feedback loop. Weak parties lack mechanisms to enforce discipline and constrain politicians' actions. In turn, this gives politicians incentives to shirk, particularly when reelection is not an option and it is easy to continue a political career with a different party. However, if voters sanction the poor-performing candidate's party after the candidate's last-term performance, the result may be increased volatility—which may in turn erode voters' party attachments and hinder the legitimacy of parties and elections. This works against the consolidation of the party system as a whole, which in turn encourages the continuation of the cycle.

A natural question is whether our results and framework are generalizable beyond the case we study. Within Brazil, since our results come from an RD design based on close elections, a natural worry is that these races may be unrepresentative of the majority of Brazilian municipal elections and that the negative effects we report might be unnoticed by most voters and politicians. Although all RD-based effects are inherently local, close races are in fact common in Brazilian mayoral elections. As illustrated in Figure S4 in Section S13 of the Online Appendix, the majority of Brazilian mayoral elections between 1996 and 2012 are highly competitive. In this period, the median margin of victory by the winning party was just 11.3 percentage points, and roughly a quarter of the races were decided by five percentage points or less. This is in stark contrast to noncompetitive settings such as the U.S. House elections where, in a similar time period, the median margin of victory by the winning party was 33.8 percentage points, and only about five percent of races were decided by less than five percentage points. Thus, the RD effects we study in Brazil are informed by a large share of the total universe of municipal elections, enhancing the generalizability of our findings within Brazil.

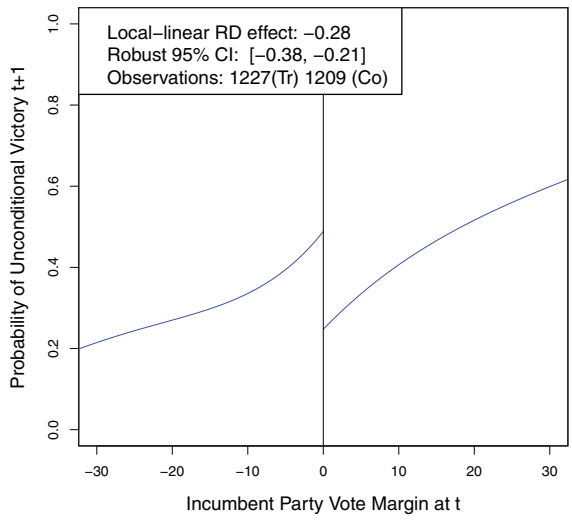
We also believe that our study has empirical and theoretical generality beyond Brazil. From a theoretical perspective, the two central characteristics of our conceptual framework, weak parties and term limits, are hardly exclusive to Brazil. The instability and even complete collapse of party systems has plagued many countries in Latin America and elsewhere in recent decades (e.g., Lupu 2016; Roberts 2012), and many developing democracies limit reelection for executive offices. Thus, our theoretical emphasis on the interaction between institutional restrictions on reelection and the strength of party organizations—and on the effects of this interaction on electoral accountability—is generally applicable, and may inform the study of a number of current democracies.

In order to address the generality of our empirical results, we conducted a preliminary analysis based on mayoral elections data from five additional Latin American countries: Chile, Colombia, Costa Rica, Mexico, and Peru.[23] For each of these countries, we conducted an incumbent party analysis analogous to the one reported for Brazil in the first row of Table 2, studying the effect of barely winning at t on the unconditional victory in the following $(t+1)$ election, for the party elected at $t-1$. The results are illustrated graphically in Figure 3, where we also report the local-linear RD effects and the associated 95% robust confidence intervals. In Mexico and Colombia, an incumbent party that is barely reelected sees a reduction in the probability of winning the following election of 20–28 percentage points. In contrast, the effect is

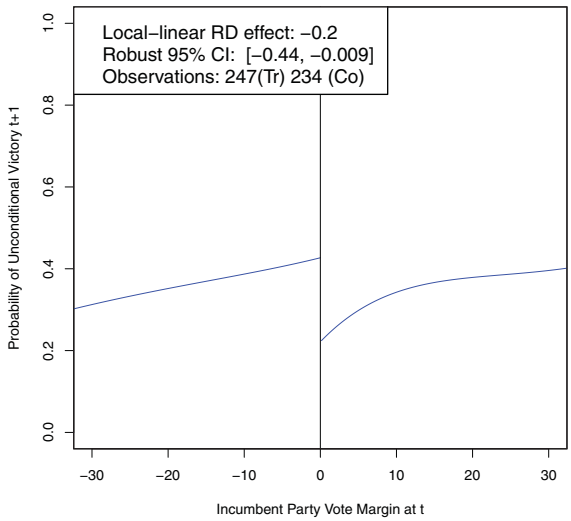
[23] We collected the data from Peru, Costa Rica and Chile directly from primary sources. We thank the authors in Castillo, Mejía, and Restrepo (2014) for kindly sharing their data on Mexican elections. We obtained the data on Colombian elections from the Centro de Estudios sobre Desarrollo Económico (CEDE) at Universidad de Los Andes (Pachón and Sánchez 2014).

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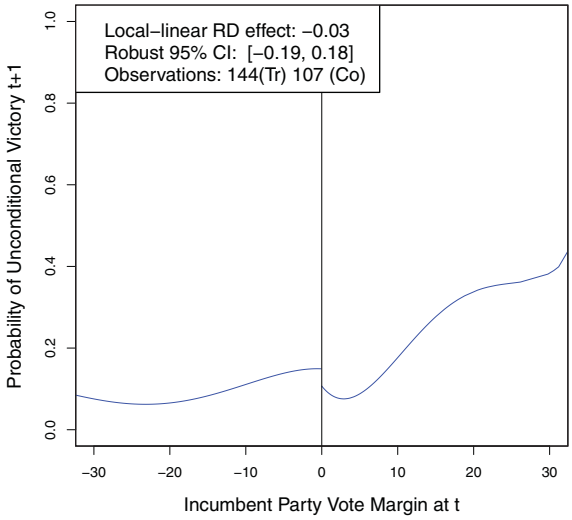
FIGURE 3. RD Effect of Winning at t on Victory at $t+1$ (Unconditional on Running) for Incumbent Party—Mayoral Elections in Various Countries



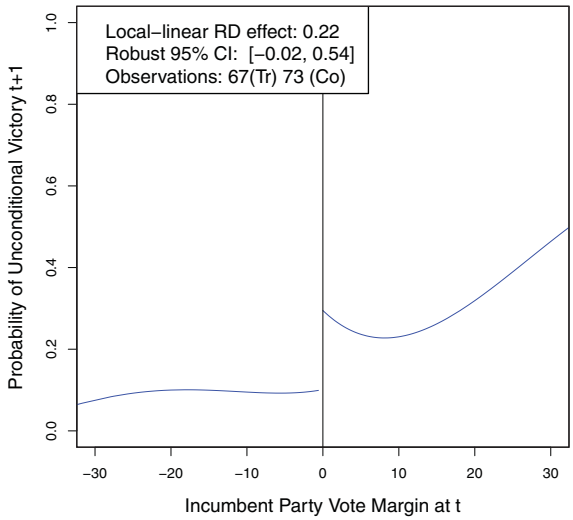
(a)Mexico, 1997-2009



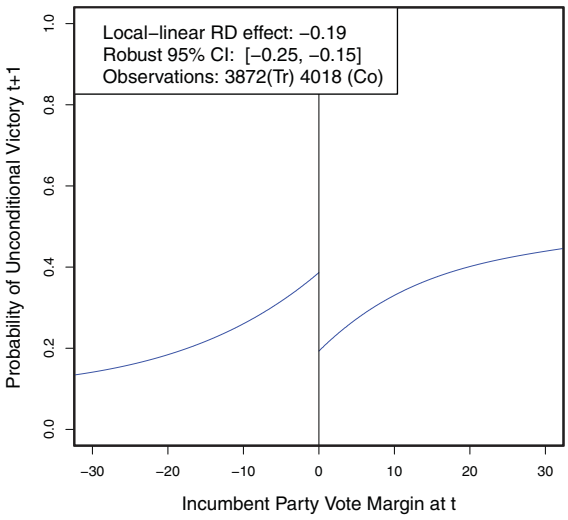
(b)Colombia, 2003-2011



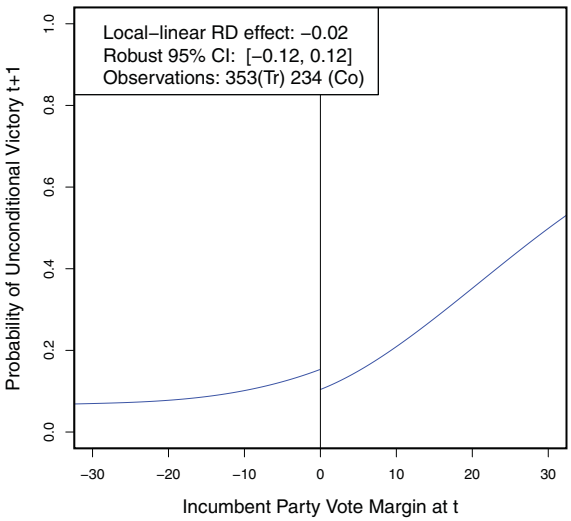
(c) Peru, 2006-2014



(d) Chile, 2004-2012



(e) Countries with term limits



(f) Countries with indefinite reelection

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statistically indistinguishable from zero in both Peru and Chile.[24]

These findings underscore two important points. First, the negative effects we found in Brazilian mayoral elections are not an aberration in a single country but rather part of a broader phenomenon.[25] Second, in line with our theoretical framework, there is a strong correlation between incumbent electoral losses and whether incumbent mayors are allowed to run for reelection. In the periods we analyzed, mayors could be indefinitely reelected in Peru and Chile, the two countries where we find null effects, but were not allowed to be reelected in Mexico and Colombia, the two countries where we find large negative effects—effects that are similar in magnitude to those found in the Incumbent sample analysis in Brazil.[26] In order to increase statistical power and further illustrate the correlation between term limits and incumbent party losses, in Figure 3e we report the results of an analysis that pools all the countries in our sample where mayors face term limits—Brazil, Colombia, and Mexico, and in Figure 3f we report an analogous analysis pooling all the countries where mayors have no reelection restrictions—Peru, Chile, and Costa Rica. These pooled results exhibit the same pattern, showing a large negative effect for the term-limited countries and a null effect for the non-term-limited countries.

Exploring whether these negative effects are concentrated among the weaker political parties in each country's party system is more challenging, since it would require an in-depth analysis of the career paths of politicians in each party, as we did for Brazil. Although such an analysis is beyond the scope of this paper, in Section S14 of the Online Appendix we present a preliminary and exploratory analysis that shows that a proxy measure of party weakness is positively associated with an incumbent party suffering subsequent electoral losses. We hope this preliminary evidence about the potential generality of our results will encourage the continued study of the connections between individual politician's career paths, party organizations, electoral accountability, and political performance.

[24] We do not report individual results for Costa Rica because there are too few observations for the period we analyze. But we do include observations from Costa Rica in the pooled analysis reported in Figure 3f.

[25] Related evidence on incumbency disadvantage has been found in other parts of the world, such as Romania (Klašnja 2015) and India (Uppal 2009).

[26] The smaller number of observations in Chile and Peru relative to Mexico and Colombia demands caution in interpreting the null results. In particular, Chile has the smallest number of observations and exhibits a large gap; however, the point estimate is large and *positive*, suggesting that adding observations would likely lead to a statistically significant *positive* effect of incumbency on future victory, consistent with our theoretical expectations. Concerns about statistical power partly motivate the pooled analysis reported in Figure 3f, where the number of observations is considerably higher.

SUPPLEMENTARY MATERIALS

To view supplementary material for this article, please visit https://doi.org/10.1017/S0003055416000575

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