

# Highway Politics in a Divided Government

Evidence from Mexico

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## Abstract

This paper combines local election results and geo-referenced road construction data over 1993–2012 to investigate political bias in road infrastructure investment in a democratic setting, focusing on the case of Mexico. Using a regression discontinuity design, the paper finds strong evidence of partisan allocation of federally-funded highways

to municipalities that voted for the president's party in legislative races, nearly doubling the stock of highways compared to opposition municipalities. The extent of political favoritism in highway provision is stronger under divided government when the president has no majority in the legislature, suggesting political efforts to control the Congress.

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# Highway Politics in a Divided Government: Evidence from Mexico

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# I. Introduction

Recent empirical research, especially in the context of developing countries, argues that democracy mitigates political favoritism (Hodler and Raschky, 2014; Burgess et al., 2015). Burgess et al. (2015), for example, document the prevalence of political bias in the geographic distribution of roads in post-colonial Kenya and conclude that “favoritism disappears during periods of democracy.” These findings, however, contrast with a large literature linking distributive politics to electoral competition, a defining feature of representative democracy.<sup>1</sup> In a democracy, politicians can often resort to opportunistic budget allocation by rewarding specific electorates or special interest groups in exchange for votes and rents (Grossman and Helpman, 1996).

In this paper, we combine geo-referenced road and election data to investigate the extent of distributive politics in the spatial allocation of federal highways in Mexico. Specifically, we examine whether municipalities that vote for legislative candidates from the president’s party subsequently receive a disproportionate share of federally-funded highways. We focus on the post-1990 period, an era that many commentators portray as one of genuine political competition in Mexico (Font et al., 2003). During the same period, the country also embarked on an aggressive public investment strategy marked with the implementation of the National Solidarity Program (Pronasol) in the 1990s and the launch in 2007 of the first National Infrastructure Program (NIP).<sup>2</sup> This unique institutional and policy context over more than two decades gives us the opportunity to shed light on the interplay between politics and public investment.

To identify political bias in the geographic distribution of federal highways (*‘Highway*

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<sup>1</sup> See Golden and Min (2013) for a comprehensive review of literature on distributive politics in different institutional environments.

<sup>2</sup> The National Solidarity Program (Pronasol) is a poverty reduction program launched in 1988, which devoted US\$15 billion to highway construction and improvement projects. The National Infrastructure Program (NIP) is a half-decade long and multi-sectoral infrastructure development project aiming at boosting the competitiveness of infrastructure and generate wider economic and social benefits. The first phase of the program was estimated to cost between US\$156 and US\$312 billion over the period 2007-2012. The second NIP was launched in 2014 and is expected to cost about US\$600 billion dollars, 17% of which will be devoted to transportation projects.

*Politics'*) in Mexico, we employ a close election regression discontinuity (RD) approach. Using nearly 10,000 direct legislative elections in over 2,000 municipalities between 1993 and 2012, we compare municipalities where the presidential party barely won the legislative elections with municipalities where it barely lost. We find a striking pattern between presidential party status and new federal highway construction. In municipalities where the president's party secured the majority in closely contested legislative races, the length of federal highway built more than doubled—relative to locations lost to the opposition—in the subsequent 4 to 5-year period. Our RD results are stable across a variety of specifications and robustness checks. As expected, for roads under the authority of local governments, including state and rural roads, we find that party alignment between the president and the legislature has no effect. We also test and rule out the possibility that presidential election outcomes induce a disproportionate distribution of highways.<sup>3</sup> Together, these findings suggest that it is only the interaction between the executive and the legislature that is systematically related to variation in federal highway construction across Mexican constituencies.

We further examine a potential explanation underpinning this interaction by exploring the idea that *divided government*—the division of the executive and legislative branches between different parties or coalitions—can stimulate distributive spending and fiscal pork (McCubbins, 1991; McCarty, 2000). McCarty (2000) formalizes this theory in a model of presidential pork and predicts that when “the size of the president’s party in the legislature... is small (such as divided government), spending should be more distributive than when it is stronger (unified government)” (see pages 123-124). Consistent with McCarty’s model, we find a striking pattern of political bias in the geographic distribution of federal highways when the size of the president’s party in the legislature is relatively smaller than the size of the opposition (divided government). Since

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<sup>3</sup> We collect data on presidential election results at the municipality-level and compare constituencies barely won by the president with constituencies he narrowly lost to the runner-up contestant. We find no evidence that more highways were constructed in municipalities that voted for the president.

the two parties (PRI and PAN) in power during our study period had large plans for infrastructure development, we also examine whether they similarly resorted to *machine politics* (Dixit and Londregan, 1996; Cox and McCubbins, 1986) using the distribution of federal highway spending. We find no differential effect of political bias in highway investment between the PRI and PAN.<sup>4</sup> This is consistent with the idea that any party will just make use of the possibility it has to influence local public spending allocations as a tool to strengthen its political position. Overall, our findings indicate that in addition to electoral competition, legislative stability—a rather understudied topic in the political economy literature applied to developing countries—is an important determinant of the geographic distribution of public capital.

To our knowledge, we make four contributions to the literature. First, to overcome misreporting issues inherent to road expenditure data that most studies rely on, we combine election outcomes with actual physical investments at a politically-relevant geographic scale. The granularity of our data allows us to consider heterogeneity effects based on primary funding sources (federal vs. non-federal) for different types of roads. Second, our quasi-experimental approach makes it possible to causally infer the impacts of political incentives on road construction projects. Our paper is one of the rare studies, if not the first, to establish a causal relationship between tangible highway construction and political outcomes.<sup>5</sup> Third, we offer new insights into the debate about the institutional and political environment in which political favoritism thrives. While the development literature acknowledges the role of democracy (Hodler and Raschky, 2014; Burgess et al., 2015) and electoral competition (Brollo and Nannicini, 2012; Asher and Novosad, 2017), we provide strong evidence that a divided government is a significant

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<sup>4</sup> The Institutional Revolutionary Party (PRI) and the National Action Party are two major political parties in Mexico. The PRI held the executive power uninterruptedly from its creation in 1929 to 2000. In 2000, a coalition led by a candidate from the PAN won the presidential election allowing the PAN to rule Mexico until 2012.

<sup>5</sup> Burgess et al. (2015) document a strong relationship between ethnic favoritism and road construction in Kenya, using both road expenditure data and the actual physical extent of roads, but acknowledge the limitations of their data to address potential challenges to causal identification.

determinant of distributive politics. Finally, we contribute to the debate about political bias toward durable projects (see for example Glazer, 1989; Gersbach, 1993; Brueckner and Selod, 2006; Glaeser and Ponzetto, 2018). By documenting biased allocations of public capital under limited executive control of the legislature, our finding echoes the idea that inefficiencies in the allocation of public capital are likely when risk-averse politicians face the threat of losing power (Gersbach, 1993).

The remainder of the paper is organized as follows. Section II provides the institutional background on the political and legislative systems in Mexico. Section III describes the main data sources. Section IV reviews the RD method and its validity in the context of this study. Section V presents the main findings and Section VI examines some of the potential mechanisms. Section VII concludes.

## **II. Institutional Background**

### **A. The Political System in Mexico**

Mexico is a federal democracy based on a presidential system. The 1917 Constitution establishes three levels of government: the federal union, states, and municipalities. The country has 32 independent states—including a federal district—that are subdivided into 2,457 municipalities. The federal government is separated into three branches: executive, legislative, and judicial. The president, elected for a single six-year term and assisted by his appointed secretaries of state, is the head of state and government. The legislative branch consists of two chambers: the Chamber of Deputies and the Senate of the Republic. The Congress of the Union, the bicameral legislature, has 128 senators and 500 deputies. The senators are elected for a 6-year term renewable twice, while the deputies can have up to four 3-year terms.<sup>6</sup> Of the 628 congressmen, 300 deputies and 96

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<sup>6</sup> From 1932 to 2014, a constitutional provision imposed a one-term limitation on the president and members of congress. Although this provision has changed after 2014, in the context of this study, all members of congress were barred from seeking reelection after one term.

senators are directly elected by popular vote. The remaining legislators are designated through a party-based proportional representation.

The political landscape of the country has long been dominated by the *Partido Revolucionario Institucional* (PRI). From its creation in 1929 until 1990, the PRI exerted a quasi-absolute control over the federal, state, and municipal governments. Over the same period, the PRI won the majority in all presidential and legislative elections, monopolizing both the executive and legislative branches. Consequently, the president—the PRI's *de facto* leader—overshadowed the legislature in policy making, despite the separation of power enshrined in the Constitution. In 1989, a dissent within the PRI over allegations of corruption and vote rigging resulted in the creation of the Partido de la Revolución Democrática (PRD).<sup>7</sup> The same year, the Partido de Acción Nacional (PAN) won the governorship of Baja California, defeating the PRI for the first time in a major electoral race. The rise of the PAN and PRD boosted electoral competition, resulting in PRI's defeat in the presidential election of 2000 and opening the prospects for episodes of divided government (Nacif, 2006).

## **B. Legislative Process and Policy Making**

Constitutionally, the president and members of the Chamber of Deputies (hereafter deputies) are the key players in the allocation of government input. The president has the exclusive power over the introduction of federal income and budget bills. The deputies are responsible for examining all budget and expenditure matters and can, with a few exceptions, amend the government's budget proposal. Controlling the chamber of deputies is therefore crucial for policy making. In 2002 for example, a year before federal legislative elections, the deputies authorized an extra 5.55% on the initial executive budget proposal (Abbott et al., 2017). More generally, despite institutional constraints such

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<sup>7</sup>Baker Institute for Public Policy. 2017, December 12. Political Parties in Mexico. Retrieved 2018, June 5, from <https://www.bakerinstitute.org/political-parties-mexico/>.



as formula-based allocations and term limitations, intergovernmental social transfers in Mexico are found to respond to political motivations (Abbott et al., 2017; Hernandez-Trillo and Jarillo-Rabling, 2008). Given the increased political interests for road infrastructure and its potentially transformative impact on the economy (Blankespoor et al., 2017), we focus on highway investment and political outcomes.

In fact, both the PRI and PAN presidencies were characterized by large road infrastructure programs. In 1988, President Carlos Salinas (PRI) launched the ambitious *Programa Nacional de Solidaridad* (Pronasol), which devoted \$15 billion USD to the construction of 5,800 km of highways in six years (Foote, 1997). Similarly, the PAN governments of Vicente Fox and Felipe Calderón’s road construction and rehabilitation investments were massive. Under President Calderón, for example, the first phase of the *Programa Nacional de Infraestructura* (NIP) allocated \$26.5 billion USD to highway projects over the 2007-2012 period. The second phase of the NIP (2014-2018) was initiated by the PRI government of President Enrique Peña Nieto and aimed at investing \$30 billion USD in road infrastructure. Our goal in the rest of the paper is to carefully examine whether political motivation affected the geographic distribution of these important infrastructure investments.

### III. Data

#### A. Road Data

Our data gathering effort begins with a collection of sheet maps produced by the American Automobile Association (AAA). These maps provide accurate information on major road segments in Mexico at different dates. We import the road type information from the paper maps into the digital DeLorme GIS layer road geometry for 2015.<sup>8</sup>

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<sup>8</sup> This provides precise GIS road information for major roads (those reported on AAA maps) that can be used in the analysis.

Intersecting these road data with the boundaries of Mexican municipalities allows us to obtain municipality-level panel data of differences in road length for four periods between 1993 and 2012, namely 1993-1998, 1998-2003, 2003-2008, and 2008-2012.<sup>9</sup> For each period, the differenced data capture the flows of new roads in each municipality. We are able to track different road classes from the AAA typology: multi-lane divided, two-lanes, divided, pavement, gravel, and earth. To illustrate the evolution of the road data over time, we show in Figure 1 the expansion of the road network for the four periods. The changes between 1993 and 1998 (panels A and B) occurred exclusively during the PRI presidency (1929-2000), while the changes between 2003 and 2012 occurred exclusively under the PAN presidency (2000-2012), as shown in panels C and D.

We present in Table 1 the length of new roads in kilometers built in each period. To

Table 1: New Physical Investment by Road Category, 1993–2012

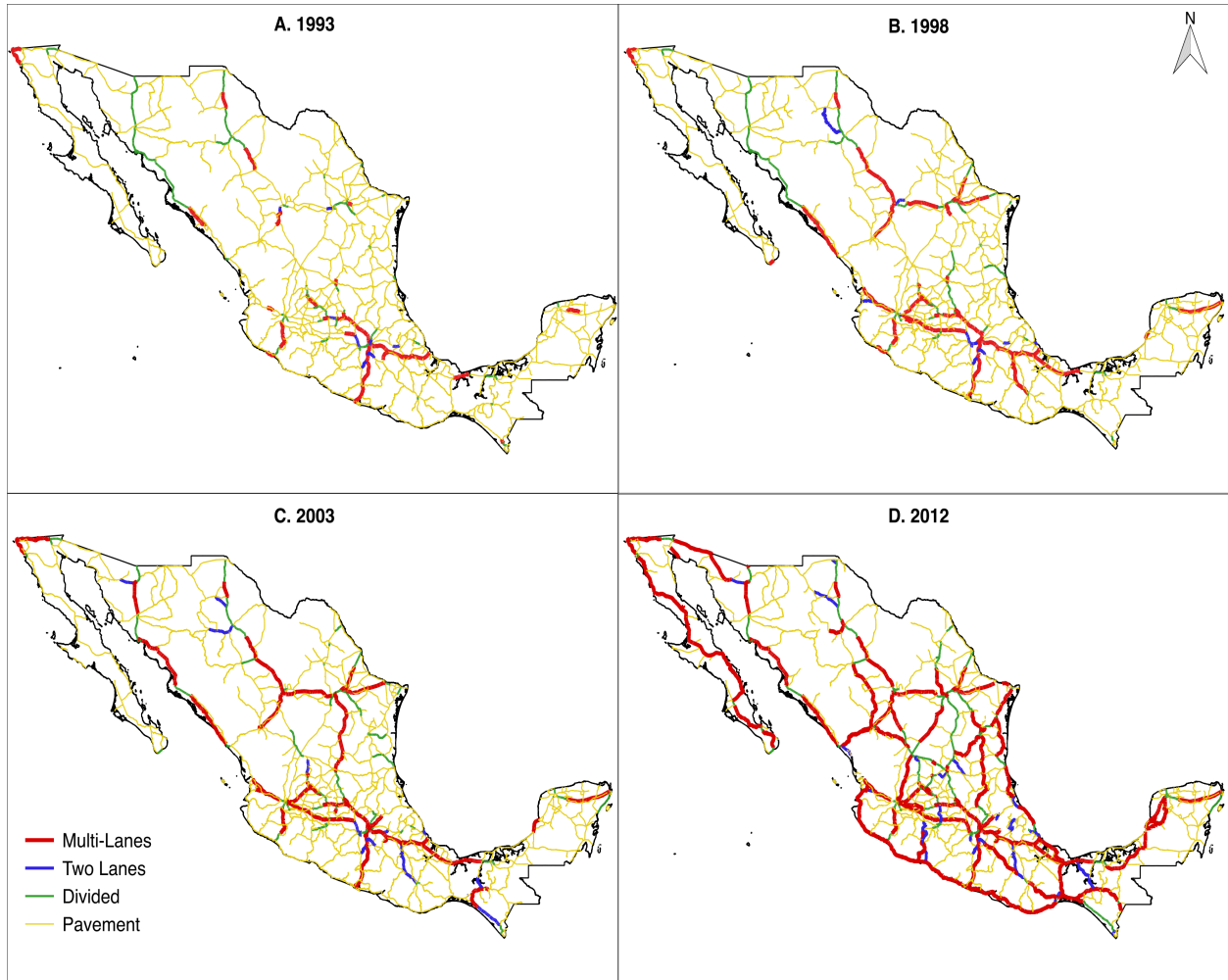
	Multi-lanes	Two Lanes	Divided	Pavement
1993–1998	2,259	421	514	2,541
1998–2003	1,814	786	1,189	3,647
2003–2008	9,697	1,452	960	1,606
2008–2012	434	169	911	1,553
Total	14,204	2,828	3,574	9,347

*Notes:* Authors' calculations based on DeLorme (2014) intersected with the AAA maps for the years 1993, 1998, 2003, 2008, and 2012.

calculate these changes, we first calculated changes in each road category in each municipality and summed them up. In doing so we dropped negative changes in road length that in some cases might reflect either an upgrade from low to high quality roads or the deterioration of existing networks. As this is what is most relevant to do, we thus restrict our analysis to positive changes in road construction. Our data on the physical extent of roads suggest that 14,204 km of multi-lanes, 2,828 km of two-lanes, and 3,574 of divided roads were built over the 1993-2012 period. As for other types of pavement, we are able to track 9,347 km of new roads over the same period. These important investments in

<sup>9</sup> To determine the municipality boundaries, we use the shapefiles from INEGI.

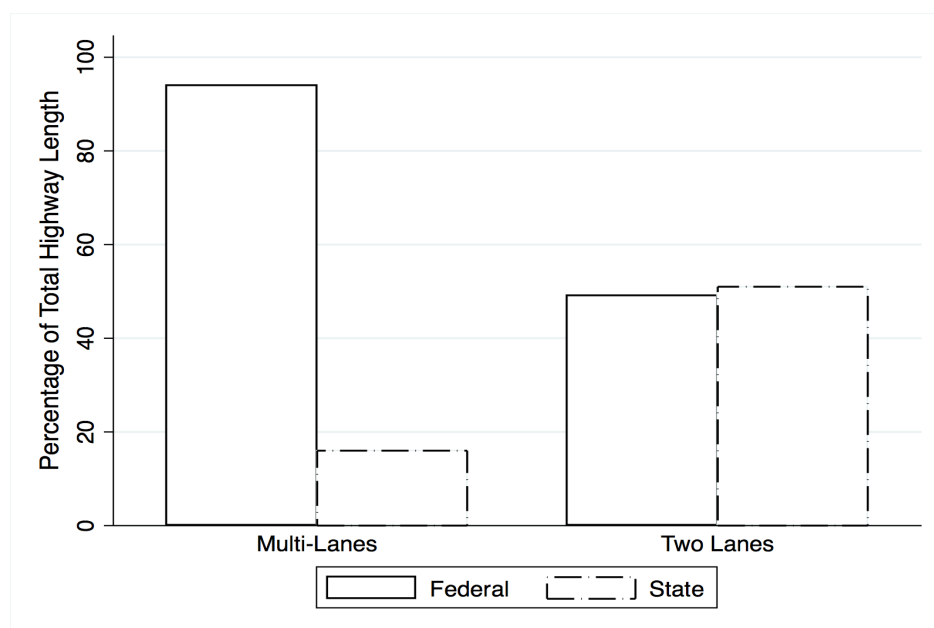
Figure 1: Road Network in Mexico, 1993-2012



*Notes:* Authors' Calculations based on the AAA maps (1993, 1998, 2003, and 2012) and DeLorme (2014).

high-capacity roads coincided with ongoing political enthusiasm for infrastructure development in Mexico, as reflected in the country's National Infrastructure Programs. We ascertain changes in federal highways by focusing on the highest capacity roads (labeled "multi-lane divided" in the original AAA map). This road category, as shown in Figure 2, falls almost entirely (over 90%) under the responsibility of the federal government.

Figure 2: Distribution of High-Capacity Highways by Government Entity, 2015



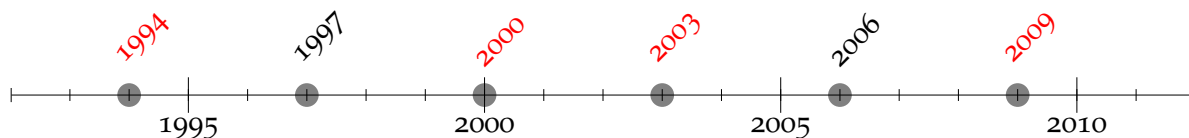
Notes: Authors' calculations based on official road statistics from INEGI (2015). Highways under the responsibility of the federal government includes self-administered roads and concessions to the private sector.

## B. Election Data

To understand the politics of road investment in Mexico, we complement our road data with legislative election outcomes. We focus on the single ballot plurality election results for deputies using municipality-level data compiled by the Federal Electoral Institute (IFE). There were six legislative electoral cycles between 1993 and 2012 held in the years 1994, 1997, 2000, 2003, 2006, and 2009. To combine the election outcomes with the road data, we match each sequential pair of the difference in road length to the earliest election that occurred in the period. This leaves us with the following relevant election years (and corresponding road data periods): 1994 (1993-1998), 2000 (1998-2003), 2003 (2003-2008), and 2009 (2008-2012). We depict in Figure 3 the legislative election dates, highlighting (in red) the years we match to the road data. Given our primary goal to estimate the effect of the president's party status on road construction, we contrast municipalities where the president's party won versus locations where the president's party failed to secure the simple majority. Furthermore, in the spirit of the RDD, we construct

the forcing (running) variable using the margin of victory between the winner and the runner-up candidate.

Figure 3: Timeline Legislative Elections in Mexico, 1993-2012



Notes: The legislative election years included in our analysis are highlighted in red. They correspond to the earliest elections that occurred between the baseline and final road data points.

We track more than 8,000 unique legislative election outcomes at the municipality-level between 1994 and 2009. Specifically, we use the IFE data that match each municipality to the congressional district in which it is located. Given the sensitivity of congressional districts to politically-motivated redistricting, municipality-level data seem appropriate for our analysis. This stems from the fact that municipality boundaries are more stable, allowing the analysis of relatively constant geographic unit. Furthermore, while the INEGI regularly publishes GIS data on municipality boundaries at different periods of time, similar time-varying data are not available for congressional districts. Finally, because there are typically several municipalities in one congressional district, having municipalities as the unit of analysis makes it possible to account for locally targeted pork within district.

## IV. Empirical Analysis

### A. Identification Strategy

Given the non-randomness of public investment, municipalities where the president's party was successful, and their counterparts won by the opposition, may differ in many unobservable ways that influence the distribution of roads. To address the *selection bias* inherent to these unobserved differences, we rely on a close election RD design. The

rationale is that elections decided with razor-thin margins involve a random component that makes it reasonable to assume similarities between locations with closely contested races (Lee and Lemieux, 2010).

To illustrate our approach, let  $v_{it}^L$  and  $v_{it}^O$  be the vote shares in municipality  $i$  at time  $t$  for the presidential party and opposition candidates, respectively (where L and O stand for leader and opposition). We define  $v_{it}^* = v_{it}^L - v_{it}^O$  as the margin of victory, which is positive when the winner is the candidate of the presidential party and negative, otherwise. For each municipality  $i$ , we also denote the potential outcomes (say new road construction  $R_{it}$ ) at time  $t$  as  $R_{it}^1$  and  $R_{it}^0$  when  $v_{it}^* > 0$  (treatment status) and  $v_{it}^* < 0$  (control status), respectively. Under the standard assumption of continuity of potential outcomes at the margin of victory threshold  $v_{it}^* = 0$ , we can identify the local average treatment effect as the population estimate  $\tau$  of the causal effect of the presidential party status on road investment as given by:

$$\tau = \lim_{\epsilon \rightarrow 0^+} E[R_{it} | v_{it}^* = \epsilon] - \lim_{\epsilon \rightarrow 0^-} E[R_{it} | v_{it}^* = \epsilon], \quad (1)$$

where  $R_{it}$  is the observed road outcome in the period immediately following the election held at time  $t$ .

In practice, the discontinuity  $\tau$  at  $v_{it}^* = 0$  can be evaluated by regressing on either side of the threshold the outcome variable on the margin of victory. To achieve this, we follow Imbens and Lemieux (2008) and employ both a local linear regression (LLR) and a polynomial regression. In the local linear specification, we exclude observations far from the threshold and restrict the sample to municipalities within a narrow interval  $v_{it}^* \in [-h, h]$ . We then run variants of the following regression model using different optimal bandwidths  $\hat{h}$  calculated according to Calonico et al. (2017):

$$R_{it} = \sigma_0 + \sigma_1 v_{it}^* + \mathbf{1}(v_{it}^* > 0)(\tau_0 + \tau_1 v_{it}^*) + \varepsilon_{it}, \quad (2)$$

where both  $R_{it}$  and  $v_{it}^*$  are defined as before,  $\sigma_0$  is the intercept, and  $\varepsilon_{it}$  is the error term clustered at the municipality level. The main coefficient of interest is  $\tau_0$ , which captures the extent to which the geographic distribution of roads responds to political support to the president's party. To improve the efficiency of the estimation, we add state, time, and state-interacted-with-time fixed effects (although, for simplicity, we omit these fixed-effects in the description of equation 2). We also include, in an augmented version of equation 2, pre-treatment covariates (log population, a measure for higher education and a proxy for employment) and time-invariant characteristics (the area of the municipality and an indicator for state capital).

Alternatively, we use the entire sample of municipalities and consider a polynomial function of different orders  $p$  to fit the relationship between the outcome variable  $R_{it}$  and the margin of victory  $v_{it}^*$ . Specifically, we estimate the following equation:

$$R_{it} = \sum_{k=0}^p \sigma_k v_{it}^{*k} + \mathbf{1}(v_{it}^* > 0) \sum_{k=0}^p \tau_k v_{it}^{*k} + \varepsilon_{it}, \quad (3)$$

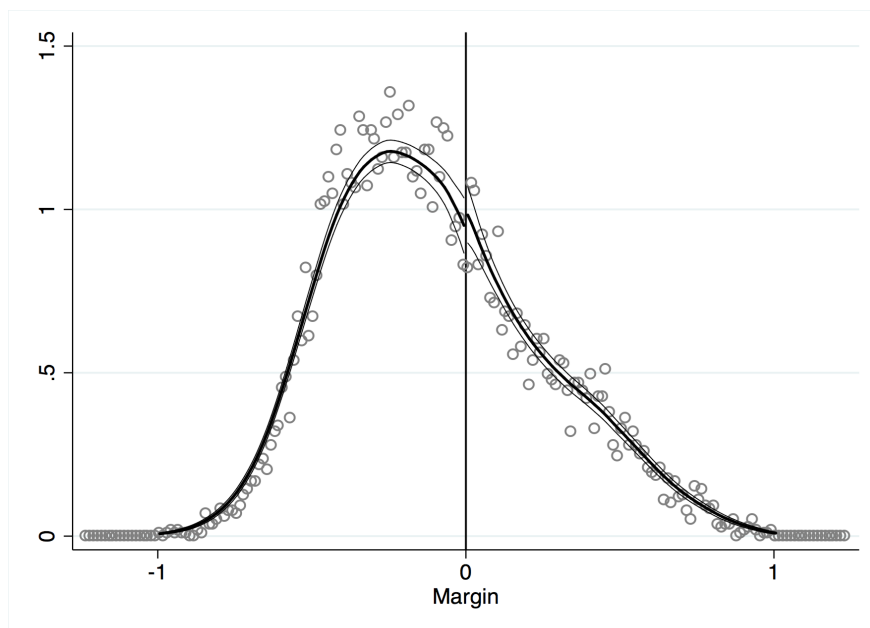
where all the variables are defined as before and  $v_{it}^{*k}$  is  $v_{it}^*$  to the power  $k$ . As in equation 2,  $\tau_0$  provides a consistent estimate of the impact of the presidential party status on road outcomes. To show the robustness of our results, we include the battery of fixed effects described previously, and estimate variants of equation 3 with the set of time-invariant and pre-treatment (beginning of period) municipality characteristics.

## B. Validity of the RD

The above RD approach would generate credible causal estimates only if no party with a stake in the race can manipulate the results near the threshold. This is a corollary of the continuity assumption, which would be violated if influential parties can use an

unobservable characteristic to alter close election outcomes (Grimmer et al., 2011).<sup>10</sup> To ascertain that this is not the case in our empirical setting, we follow McCrary (2008) and conduct a test of continuity in the density of the forcing variable around the threshold. As shown in Figure 4, the McCrary test does not reject the assumption of continuity in the forcing variable at the zero threshold.

Figure 4: McCrary Test of Density Distribution of Win Margin



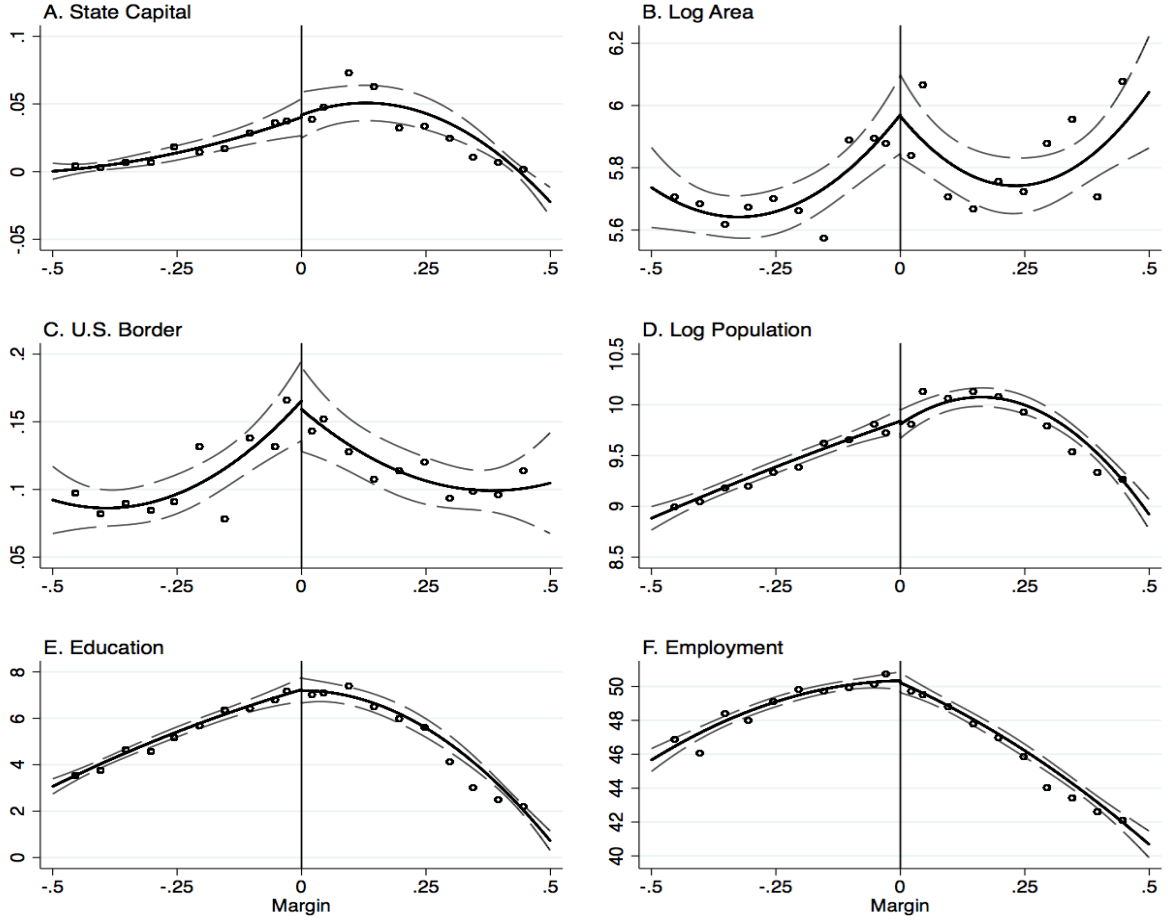
Notes: Following McCrary (2008), the graph shows the distribution of the margin of victory across the sample of legislative election on either side of the zero threshold.

It is also possible to detect the presence of nonrandom selection by looking at the characteristics of municipalities at baseline. To cross-validate the McCrary test, we therefore conduct a balance test of the available time-invariant and pre-treatment covariates. Under the standard continuity assumption of the RD, treated and untreated municipalities near the threshold should be similar along these baseline characteristics. For time-invariant characteristics, we examine the area of the municipality in  $\text{km}^2$ , an indi-

<sup>10</sup> According to Grimmer et al. (2011), a structurally advantaged party is a party that can mobilize extra resources such as legal challenge, campaign effort and money, and even vote rigging to influence the outcome of close elections. These authors argue, using data from the US, that the possibility of this *sorting* around the threshold is a serious threat to the validity of the continuity assumption in the RD design.



Figure 5: Balance Tests on Baseline Covariates



*Notes:* These graphs show, as indicated in each panel, the mean pre-treatment (log area, log population, education, employment) and time-invariant municipality characteristics, conditioning on the win margin of the president's party in legislative elections. Points to the right of zero indicate the outcomes in municipalities won by the president's party, while points to the left of zero indicate the outcomes in municipalities lost by the president's party. The central line is a spline second-order polynomial in the margin of victory of the president's party fitted over the interval  $[-0.5, +0.5]$ ; the lateral lines represent a 95 percent confidence interval of the polynomial. Scatter points are averaged over a 0.05 margin of victory intervals.

cator for state capital, and a dummy that is one if the municipality is located in a state bordering the United States. We also evaluate the continuity around the threshold of pre-treatment covariates such as education, employment, and population size. As shown in Figure 5, for both time-invariant and pre-treatment characteristics, there is no discernible discontinuity around the threshold between treated and untreated municipalities.

Overall, both the McCrary and balance tests suggest that it is unlikely that the close election outcomes we analyze were subject to an unobservable influence, and may thus constitute a credible setting to quasi-experimentally evaluate the political determinant of road investment in Mexico.

## V. Main Results

### A. Highway Politics in Mexico

Table 2: Impact of Ruling Party Status on Federal Highways, RD Estimates

	LLR with bandwidth $\hat{h}$			Polynomial of order $p$		
	$\hat{h}_1 = .3$ (1)	$\hat{h}_2 = .2$ (2)	$\hat{h}_3 = .1$ (3)	$p = 2$ (4)	$p = 3$ (5)	$p = 4$ (6)
A. No covariates						
President	1.066** (0.453)	1.062* (0.565)	2.436*** (0.880)	1.039** (0.426)	1.371*** (0.525)	1.396** (0.631)
Observations	4,988	3,400	1,752	9,220	9,220	9,220
R-squared	0.374	0.359	0.392	0.346	0.346	0.346
B. Covariates included						
President	1.018** (0.447)	1.118** (0.548)	2.303*** (0.838)	0.943** (0.425)	1.470*** (0.524)	1.529** (0.631)
Observations	4,877	3,332	1,715	8,905	8,905	8,905
R-squared	0.391	0.374	0.406	0.365	0.365	0.365
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* The table shows the regression discontinuity estimates of the presidential party status in legislative elections on multi-lane road (federal highway) outcomes. The estimation methods include: local linear regression in columns 1-3 with two MSE-optimal bandwidth choices ( $\hat{h}_1$  and  $\hat{h}_2$ ) and one CER-optimal bandwidth choice ( $\hat{h}_3$ ), calculated according to Calonico et al. (2017); spline polynomial approximation in columns 4-6 with second, third, and fourth polynomial, respectively. Estimations in panel A has no covariates while estimations in panel B include the following covariates: state capital dummy, US border dummy, log area size, log population size, and proxies for higher education and employment. Robust standard errors clustered at the municipality level are reported in parentheses. All specifications include state, time, and state-interacted-with-time fixed effects.

\*\*  $p < 0.01$ , \*  $p < 0.05$ , \*  $p < 0.1$ .

Table 2 presents the extent of presidential pork in federal highway construction from

estimating different specifications of equations 2 and 3. The reported coefficients measure the differences in road length between municipalities that the president's party barely won and municipalities barely won by opposition candidates. We structure our findings into specifications without covariates in panel A, and specifications including both time-invariant and pre-treatment municipality characteristics in panel B. The available time-invariant features include a state capital dummy and the size of the municipal area in  $\text{km}^2$ . The predetermined municipality features come from the Census, and include the share of the population aged 25 and over with higher education, the percentage of economically active people aged 15 and over, and log population size. Throughout the analysis, we also account for state, time, and state-interacted-with-time fixed effects and report robust standard errors clustered at the municipality level.

Columns 1-3 report coefficient estimates of a local linear regression using different bandwidths, while the remaining columns 4-6 present estimates of a spline polynomial approximation of various orders. Overall, estimates from specifications with and without covariates are both qualitatively and quantitatively similar. We find striking patterns of presidential pork in the geographic distribution of federal highways. The coefficients on the president's party status are positive, statistically significant, economically meaningful, and robust across bandwidths and polynomial orders. For example, estimates from the fourth spline polynomial approximation with covariates suggest that municipalities voting for the president's party in closely contested legislative races receive on average 1.5 km of extra highway, nearly doubling the length of federal highway built in opposition constituencies.

To ensure that our findings reflect the influence of the federal government, as reflected in the executive-legislative relationship, we now examine how party alignment between the president and legislative candidates potentially affects the spatial distribution of non-federal roads. Because these roads are not primarily under the responsibility of the executive branch, we should expect no significant outcome differentials near the

Table 3: Impact of Ruling Party Status on Non-Federal Roads, RD Estimates

	LLR with bandwidth $\hat{h}$			Polynomial of order $p$		
	$\hat{h}_1 = .3$ (1)	$\hat{h}_2 = .2$ (2)	$\hat{h}_3 = .1$ (3)	$p = 2$ (4)	$p = 3$ (5)	$p = 4$ (6)
A. Two-lanes						
President	0.016 (0.169)	0.113 (0.215)	-0.198 (0.289)	-0.059 (0.152)	0.009 (0.208)	0.116 (0.250)
Observations	5,017	3,436	1,777	9,084	9,084	9,084
R-squared	0.059	0.102	0.164	0.059	0.059	0.059
B. Divided						
President	-0.038 (0.206)	0.102 (0.258)	0.513 (0.362)	-0.018 (0.204)	0.051 (0.245)	0.115 (0.287)
Observations	4,927	3,361	1,742	8,989	8,989	8,989
R-squared	0.160	0.180	0.198	0.112	0.112	0.113
C. Other pavement						
President	-0.309 (0.391)	-0.175 (0.481)	-0.091 (0.795)	-0.144 (0.382)	-0.228 (0.482)	0.115 (0.597)
Observations	4,233	2,884	1,460	7,763	7,763	7,763
R-squared	0.171	0.208	0.238	0.154	0.154	0.154
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

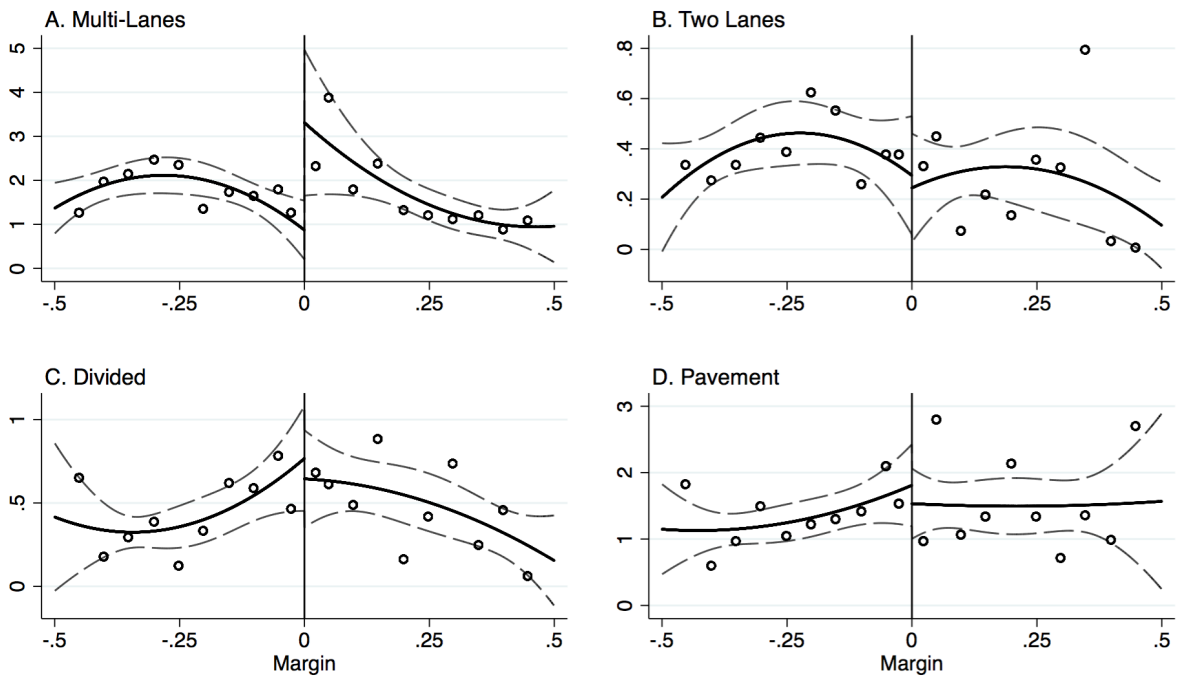
*Notes:* The table shows the regression discontinuity estimates of the presidential party status in legislative elections on two-lane road (panel A), divided road (panel B) and other paved road (panel C) outcomes. The estimation methods include: local linear regression in columns 1-3 with two MSE-optimal bandwidth choices ( $\hat{h}_1$  and  $\hat{h}_2$ ) and one CER-optimal bandwidth choice ( $\hat{h}_3$ ), calculated according to Calonico et al. (2017); spline polynomial approximation in columns 4-6 with second, third, and fourth polynomial, respectively. Covariates include state capital dummy, US border dummy, log area size, log population size, and proxies for higher education and employment. Robust standard errors clustered at the municipality level are reported in parentheses. All specifications include state, time, and state-interacted-with-time fixed effects.

\*\*  $p < 0.01$ , \*  $p < 0.05$ , \*  $p < 0.1$ .

cutoff between constituencies that favor the president's party and those where the opposition is successful. Table 3 presents the RD estimates of the president's party effects on differences in two-lane roads (panel A), divided roads (Panel B), and other types of paved roads (panel C). Although we use similar specifications as in Table 2, we only report the estimation results including the relevant covariates and fixed effects. We also report both the local linear and polynomial regressions with the previously defined op-

timal bandwidths and polynomial orders. As expected for all other roads besides the multi-lane road category, we find no statistically significant differences in road outcomes between municipalities where the president's party barely won and municipalities where it barely lost to opposition candidates. The results are consistent across road types and functional forms.

Figure 6: Impact of Ruling Party on Road Construction



*Notes:* These graphs show the mean of multi-lane (panel A), two-lane (panel B), divided (panel C), and other paved (panel D) roads, conditioning on the win margin of the president's party in legislative elections. Points to the right of zero indicate road outcomes in municipalities won by the president's party, while points to the left of zero indicate road outcomes in municipalities lost by the president's party. The central line is a spline second-order polynomial in the margin of victory of the president's party fitted over the interval  $[-0.5, +0.5]$ ; the lateral lines represent a 95 percent confidence interval of the polynomial. Scatter points are averaged over a 0.05 margin of victory intervals.

Figure 5 summarizes and confirms via graphical representation the results of Tables 2 and 3. As is discernible in panels B-D, the scatterplots and the fitted spline second-order polynomials show no discontinuity around the treatment threshold of zero for non-federal road segments. However, the discontinuity at the zero cutoff becomes relevant and statistically significant for multi-lane roads, our proxy for federal highways (panel

A). Overall, our quasi-experimental setting provides strong evidence of presidential pork in the geographic distribution of federal highways across Mexican municipalities. Before we investigate some of the potential underlying mechanisms, we now turn to examining whether these results are driven by the president alone or the majority party status.

## **B. Ruling Out Alternative Political Outcomes**

To further substantiate the evidence that the interaction between the executive and the legislature matters for the distribution of public capital, we separately analyze how federal highway construction responds to: (1) alignment with the majority party in the Chamber of Deputies for legislative elections, and (2) presidential election outcomes. Formally, we examine new versions of equations 2 and 3 using legislative (as before) and presidential election outcomes. We extract the information on presidential elections compiled at the municipality level from the IFE database for the years 1994, 2000, and 2006. We then match these presidential election outcomes with changes in road length over the periods 1993-1998 (1994), 1998-2008 (2000), and 2008-2012 (2006). In both the presidential and legislative cases, we compare as before changes in road outcomes in municipalities barely won by the ruling party (the president or the majority party in the Chamber of Deputies) vs. municipalities barely won by opposition candidates. For consistency and ease of comparison with previous results, we consider the polynomial specifications similar to those reported in Panel A of Table 2.

As shown in Table 4, there is no evidence of a disproportionate allocation of new federal highways in municipalities narrowly won by the president or the House majority party. Our RD estimates even point to fewer highways, albeit statistically insignificant, associated with both the president and majority party status. Taken together with our previous findings in the previous subsection, these results confirm that the president's influence over the distribution of federal spending is inherent to the legislative process.

Table 4: Impact of President and House Majority on Federal Highways, RD Estimates

	Presidential Elections			Legislative Elections		
	$p = 2$ (1)	$p = 3$ (2)	$p = 4$ (3)	$p = 2$ (4)	$p = 3$ (5)	$p = 4$ (6)
Winner	-0.222 (0.574)	-0.478 (0.742)	-1.019 (0.885)	-0.188 (0.404)	-0.166 (0.404)	-0.286 (0.446)
Observations	6,808	6,808	6,808	9,220	9,220	9,220
R-squared	0.395	0.396	0.396	0.346	0.346	0.346
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* The table shows the regression discontinuity estimates of the winner of presidential (columns 1-3) and legislative (columns 4-6) elections on multi-lane road (federal highway) outcomes. The estimation method is a spline polynomial approximation with second, third, and fourth polynomial, respectively. Robust standard errors clustered at the municipality level are reported in parentheses. All specifications include state, time, and state-interacted-with-time fixed effects.

\*\*  $p < 0.01$ , \*  $p < 0.05$ , \*  $p < 0.1$ .

## VI. What Explains Highway Politics in Mexico?

### A. Testing for Potential Motives

To help understand the president's inclination to provide particularistic benefits in highway construction, we employ the above-mentioned RD framework to test two theories. The first hypothesis reflects a bargaining mechanism between the executive and the legislature that influences the strategic distribution of federal outlays. In such an environment, the president also resorts to distributive politics to compromise the election prospects of opposition candidates (Berry et al., 2010), and influence the composition of the legislature (McCarty, 2000). A key prediction of this theory is that presidential pork is large when the size of the president's party in the legislature is small (McCarty, 2000). The second hypothesis is consistent with *machine politics* which consist in targeting constituents with public expenditure reflecting common ideological interests and policy priorities (Cox and McCubbins, 1986; Alesina, 1988; Dixit and Londregan, 1996; Besley and Coate, 1997). For example, evidence from the U.S. suggests that federal pro-

grams tend to systematically mirror partisan lines, with more education spending under Democrats and extra defense spending under Republicans (Albouy, 2013).

We exploit two attractive features of our institutional and empirical contexts to examine these predictions. First, during our study period, we are also able to contrast instances of opposition majority in the House (divided government) with periods where the president’s party held the majority in the House (unified government). Therefore, we can empirically evaluate whether the size of distributive politics in highway construction depends upon the president’s party control of the legislature. Second, we also observe presidential terms under two of the main political parties in Mexico: the PRI and PAN. This allows us to examine partisan reward differences in infrastructure provision across both parties.

To formally examine these predictions, we follow Ferreira and Gyourko (2009) and estimate the following polynomial regression model:

$$R_{it} = \sum_{k=0}^p \sigma_k v_{it}^{*k} + \mathbf{M}_{it} \sum_{k=0}^p \delta_k v_{it}^{*k} + \mathbf{1}(v_{it}^* > 0)(\tau_0 + \tau_1 \mathbf{M}_{it}) + \varepsilon_{it}, \quad (4)$$

where  $\mathbf{M}_{it}$  is an indicator measuring the political mechanism of interest. In the case of *divided government*  $\mathbf{M}_{it}$  takes the value one when the government is divided—that is an opposition majority in the Chamber of Deputies—and zero otherwise. Alternatively, for *machine politics*,  $\mathbf{M}_{it}$  equal to one under the PAN presidency, and zero otherwise. In each specification, the coefficient of interest is  $\tau_1$  which indicates whether the mechanism under scrutiny is a relevant mediating factor. Specifically, in the case of a divided government,  $\hat{\tau}_1$  shows how an opposition-controlled House affects the provision of roads in municipalities that vote for the president’s party in closely contested races. In the case of *machine politics*,  $\hat{\tau}_1$  reflects the relative preference of the PAN for pork-barrel politics when it comes to highway investment. As in equation 3, we estimate equation 4 with time, state, and state-interacted-with-time fixed effects, time-invariant and pre-treatment



covariates, and cluster the error term at the municipality level. We also check the robustness of the estimates using polynomials of different orders.

## B. The Role of Divided Government

Our empirical context allows us to examine two of the possible mechanisms that might explain presidential pork in the allocation of highways. As outlined in the previous section, we are able to discriminate between: (1) an executive-legislative bargaining mechanism in which the size of the president's party in the legislature influences the extent of distributive politics; and (2) a partisan or taste-based mechanism that incentivizes the executive branch to reward its core supporters for political survival. To test each of these predictions, we incorporate in our RD design the identification strategy suggested by Ferreira and Gyourko (2009) and estimate various specifications of equation 4. The coefficients estimating the impacts of the presidential party status on highway construction under each political condition are displayed in Table 5.

Table 5: Potential Motives: Divided Government and Machine Politics

Order of Polynomials	Machine Politics			Divided Government		
	$p = 2$ (1)	$p = 3$ (2)	$p = 4$ (3)	$p = 2$ (4)	$p = 3$ (5)	$p = 4$ (6)
President x Mechanism	0.949 (0.725)	0.823 (0.793)	0.994 (0.887)	1.170* (0.721)	1.279* (0.761)	1.675** (0.848)
Observations	8,905	8,905	8,905	8,905	8,905	8,905
R-squared	0.365	0.365	0.365	0.365	0.365	0.365
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* The table shows the regression discontinuity estimates of the impact of presidential party status interacted with each of the two mechanisms (PAN presidency in columns 1-3, and divided government in columns 4-6) on multi-lane road (federal highway) outcomes as described in equation 4. In each case, we use a spline polynomial approximation with second, third, and fourth polynomial, respectively. Covariates include state capital dummy, US border dummy, log area size, log population size, and proxies for higher education and employment. Robust standard errors clustered at the municipality level are reported in parentheses. All specifications also include state, time, and state-interacted-with-time fixed effects.

\*\*  $p < 0.01$ , \*  $p < 0.05$ , \*  $p < 0.1$ .

Columns 1-3 report estimates of the impacts on highway provision when the presidential party status is interacted with a dummy equal to one if the PAN is in power, and zero otherwise (i.e. the PRI is in power). The coefficient estimates on the interaction term are statistically insignificant at standard confidence levels, regardless of the order of the spline approximation. In other words, by focusing only on closely contested elections, there is no statistical evidence of political bias in highway construction when we contrast a PAN presidency with a PRI presidency. This is not surprising given that both parties expressed similar taste for public spending on infrastructure as evidenced by their large infrastructure investment programs. What our results show is that they both resort with the same intensity to pork-barrel politics.

Table 6: Potential Motives: Divided vs. Unified Government

	LLR with bandwidth $\hat{h}$			Polynomial of order $p$		
	$\hat{h}_1 = .3$	$\hat{h}_2 = .2$	$\hat{h}_3 = .1$	$p = 2$	$p = 3$	$p = 4$
	(1)	(2)	(3)	(4)	(5)	(6)
A. Divided						
President	1.364*	1.972**	3.979***	1.593*	2.779***	3.107***
	(0.729)	(0.879)	(1.342)	(0.822)	(1.023)	(1.131)
Observations	2,751	1,930	1,037	4,496	4,496	4,496
R-squared	0.402	0.371	0.407	0.397	0.398	0.398
B. Unified						
President	0.245	-0.204	-0.085	0.034	0.322	0.306
	(0.497)	(0.614)	(0.864)	(0.491)	(0.586)	(0.671)
Observations	2,126	1,402	678	4,409	4,409	4,409
R-squared	0.336	0.430	0.448	0.173	0.173	0.173
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* The table shows the regression discontinuity estimates of the presidential party status in legislative elections on multi-lane road (federal highway) outcomes during periods of divided (panel A) and unified (panel B) government. The estimation methods include: local linear regression in columns 1-3 with two MSE-optimal bandwidth choices ( $\hat{h}_1$  and  $\hat{h}_2$ ) and one CER-optimal bandwidth choice ( $\hat{h}_3$ ), calculated according to Calonico et al. (2017); spline polynomial approximation in columns 4-6 with second, third, and fourth polynomial, respectively. Estimations in panel A has no covariates while estimations in panel B include the following covariates: state capital dummy, US border dummy, log area size, log population size, and proxies for higher education and employment. Robust standard errors clustered at the municipality level are reported in parentheses. All specifications include state, time, and state-interacted-with-time fixed effects.

\*\*  $p < 0.01$ , \*  $p < 0.05$ , \*  $p < 0.1$ .

In columns 4-6, we present the coefficient estimates from testing our alternative mechanism. In this case, the presidential party status is interacted with a dummy equal to one when the government is divided (opposition majority in the lower House), and zero when the government is unified (ruling party majority in the lower House). Our findings point to larger highway investments in municipalities barely won by the president’s party when the opposition has the majority in the legislature. These results are robust across different polynomial orders and consistent with McCarty’s (2000) predictions of large presidential pork when the size of the president’s party in the legislature is small. To further check this result, we split our observations into periods of divided versus unified governments and estimate equations 2 and 3 on each subsample. We report the estimates in Table 6, which consistently confirms the prevalence of political bias in the distribution of highways when the opposition controls the Chamber of Deputies (panel B).

## VII. Conclusion

Given its potential economic benefits, physical infrastructure plays a key role in economic development policies (see surveys by Redding and Turner (2015); Berg et al. (2017)). Over 2012-2017, the World Bank Group loaned US\$42 billion—about 17% of its total lending—to help improve transportation systems in developing countries. Yet, many observers fear that public infrastructure investment decisions often reflect political rather than economic objectives (Crain and Oakley, 1995).

In line with these concerns, this study documents the prevalence of political bias in road infrastructure investment in a democratic setting, focusing on the case of Mexico. Using a close election regression discontinuity approach, the paper finds strong evidence of partisan allocation of federally-funded highways in constituencies electing legislators from the incumbent president’s party. The effect is stronger under divided government,

when the president has no majority in the legislature, which is consistent with political efforts to control the Congress.

These findings suggest that infrastructure investments may not be optimized (i.e., they may not be equalizing regional returns on investment). In other words, political bias could result in allocative inefficiency. Although, to some extent, pork could be viewed as a manifestation of the democratic game, assessing the size of associated economic inefficiencies will be important, especially in developing economy contexts. We leave this important question for future research.

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