

Political Turnover, Bureaucratic Turnover, and the Quality of Public Services^{*}

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Abstract

We study how political turnover in mayoral elections in Brazil affects public education provision. Exploiting a regression discontinuity design for close elections, we find that municipalities with a new party in office subsequently have test scores that are .05–.08 standard deviations lower. Party turnover leads to a sharp increase in the replacement rate of headmasters and teachers in schools controlled by the municipality. In contrast, turnover of the mayor’s party does not impact local (non-municipal) schools. These findings suggest that political turnover can adversely affect the quality of public services when the bureaucracy is not shielded from the political process.

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1 Introduction

Countries differ in the extent to which politicians have discretion or control over the bureaucracy, in particular the extent to which politicians control the appointment and turnover of public employees within the bureaucracy. One of the first cross-country datasets on bureaucratic structure (Evans and Rauch, 1999) documents that in many East Asian countries, as well as in India and in Argentina, only the top chiefs and vice-chiefs in the core administrative agencies of the country are appointed by the president (or its equivalent). On the other end of the spectrum, in Israel, Haiti, Nigeria, and Brazil, almost all of the top 500 positions in the core government agencies are politically appointed by the president. Furthermore, political control over the bureaucracy can extend beyond the highest positions in the administration. In the country we study, Brazil, the president, state governors, and mayors make anywhere from 15,000 to 105,000 appointments to the federal, state, and local bureaucracy, respectively, once they enter office.¹

A potential cost of having civil service positions at the discretion of politicians may arise from the fact that this kind of discretion links together bureaucratic turnover and political turnover. Given that the bureaucracy is the central agency responsible for the provision of public services, what is the effect of political turnover, and any subsequent disruptions to the bureaucracy, on the provision of public services?

We study this question in the context of public education provision by local governments in Brazil. We focus on this particular public service and context for several reasons. First, education is a key public service and it is a significant contributing factor to macroeconomic growth and individual earnings (Barro, 1991; Card, 2001). Second, local governments in Brazil are the main providers of primary education and spend 30% of their budget on education provision. Furthermore, local politicians in this context have considerable discretion over the public education system and the appointment of public school personnel, such as headmasters and teachers (Ferraz et al., 2012). Additionally, our main outcome of interest, test scores, is a welfare relevant measure and is tightly linked to the performance of the public employees responsible for public education provision. These factors allow us to analyze the research question of interest: In an environment where the municipal government has considerable influence over the education bureaucracy, what is the effect of a change in the political party in power at the municipal level on the provision of public education?

To estimate the causal effect of political turnover on education quality, we rely on a regression discontinuity design that uses close elections as an exogenous source of variation in political party turnover. We use this identification strategy because a comparison of outcomes in municipalities

¹See Evans (1995) for presidential political appointees and the survey of bureaucratic structure (*Pesquisa de Informações Básicas Estaduais/Municipais*) conducted by the Brazilian Census Bureau (*IBGE*) in 2012 for state and municipal political appointees.

that experience a change in the ruling party to those that do not may give biased estimates of the impact of political party turnover. For instance, in a municipality with an incompetent ruling party, quality of public services are likely trending down and, hence, the constituency is likely to vote for a change in the ruling party during elections. In this case, there would be a negative relationship between political party turnover and public service quality, however, such a relationship would not capture the causal effect of political turnover on public services. To identify the causal impact of political party turnover, we compare outcomes in municipalities where the incumbent party barely loses (and, hence, there is political party turnover) to outcomes in municipalities where the incumbent political party barely wins (and, hence, there is no political party turnover). In order for this regression discontinuity design to identify the causal effect of party turnover, we essentially need party turnover to be as good as random in municipalities with close elections. Indeed we find empirical evidence in support of this identification assumption.

We find that political party turnover reduces the quality of education in Brazilian municipalities. Party turnover lowers test scores, as measured one year after the election, by .05–.08 standard deviation units in terms of the individual-level national distribution of test scores. Some of the most successful education interventions, such as reducing classroom size (Krueger, 1999) or providing teacher incentives (Muralidharan and Sundararaman, 2011), impact test scores between .17 to .28 standard deviation units. Hence, the magnitude of the effect of political turnover on test scores, which is approximately one third of the impact of such successful interventions, is substantial. We also find that party turnover increases the replacement rate of headmasters and teachers by 28 and 11 percentage points, respectively, one year after the election. Since prior work has found that low-income voters in Brazil do not prioritize investments in public education (Bursztyn, 2016), we explore the heterogeneity in our results with respect to municipal-level income. The effect of political turnover on the replacement rate of school personnel is approximately two to three times larger in low-income municipalities. Political parties appear to exercise considerably more discretion over school personnel in low-income areas, where the political cost of having worse schools is likely lower. This suggests that politicians face a trade-off between exercising discretion over appointment of school personnel and the political costs associated with disrupting schools and, potentially, having worse quality schools.

Does the disruption in the assignment of school personnel cause the negative impact of political turnover on students' test scores or does party turnover lead to other changes in the municipality that then drive the negative effect on test scores? To understand this better, we exploit the fact that the municipal government does not control all schools to conduct a “placebo” exercise. We find that for local schools not controlled by the municipal government, i.e. non-municipal schools, a change in the political party of the municipal government does not impact the replacement rate of school personnel or student test scores. This finding rules out an effect of political turnover

on student achievement due to any shocks that are common to the entire municipality, such as municipal-level changes in income or crime. Instead, the placebo exercise shows that political turnover negatively impacts student outcomes due to the discretion of the municipal government over the municipal education bureaucracy and the resulting disruptions in the assignment of school personnel.

In addition to ruling out municipal-level shocks as the driver of how political turnover impacts student achievement, we also rule out an alternative explanation for how political turnover may affect students: changes in the allocation of financial resources. One could argue that when new parties come to power, their candidate is less experienced or they undergo a transition period in raising revenue or managing resources – and this in turn impacts the quality of public education. However, we do not find evidence that overall spending in the municipality is lower. In fact, municipalities that experience political turnover have a short-run increase in the share of the budget allocated to education as well as an increase in the share of personnel related expenses. The increased education expenditures is likely a byproduct of the costs associated with the greater replacement rate in school personnel that happens soon after the election. Consistent with the fact that personnel replacement occurs within a year of the election, the increased education expenditures level off in the subsequent years. Beyond financial resources dedicated to education, we also rule out that party turnover impacts students due to a change in political resources dedicated to education: political party turnover reduces test scores and increases the replacement rate of school personnel regardless of whether the winning party is ideologically to the left or to the right. This finding implies that the effect of party turnover on test scores and personnel replacements is not driven by general shifts in political ideology and associated changes in policy priorities in the particular elections we study.²

We then present evidence of how party turnover may impact student achievement through the politically caused disruption in the school. First, school personnel in municipalities with a new political party have worse attributes: Headmasters are less experienced as headmasters and teachers are less educated. Using the cross-sectional correlation between these attributes and test scores, we find, however, that the deterioration in personnel attributes does not entirely explain the magnitude of the decrease in test scores. High teacher turnover rates are linked to lower test scores possibly due to channels other than teacher quality (Ronfeldt et al., 2013). School personnel in municipalities with a new political party are more likely, compared to those in municipalities with

²If in the particular elections we study, 2008 and 2012, there were overwhelming shifts from the right to the left, for example, one could argue that our estimated effect of political party turnover on educational provision is picking up the effect of an ideological shift. Given that previous work has shown a link between party ideology and adoption of policies/economic outcomes (Pettersson-Lidbom, 2008), this would be a valid concern. However, by showing that the effect of political party turnover on outcomes is independent of the ideology of the winning political party, we can rule out such an argument and provide evidence that we are indeed estimating the effect of a change in *any* political party.

no party change, to answer negatively to a series of survey questions regarding the offering of school programs for students, the availability of and participation in teacher training and teacher council meetings, and the degree of collaboration between school personnel. It is likely that the politically caused changes in the assignment of school personnel disrupt school operations and management and, hence, negatively impact test scores. Taken together, the placebo exercise, the lack of evidence that a change in financial or political resources drives the impact on test scores, and the surfacing of problems in school operation and management suggest that party turnover affects student achievement through the (politically caused) disruption in the school.

Prior literature has highlighted patronage and short-horizoned incentive structures as potential costs of political control over the bureaucracy (Weber, 1922; Rauch, 1995); our paper highlights another cost of such bureaucratic structure. By tying the turnover of service delivery personnel to the turnover of politicians, political discretion over the bureaucracy means that political turnover will *disrupt* the process of public service provision. One component of this disruption is closely linked with patronage: newly-elected politicians may use their discretion over the bureaucracy to award public employment based on political affiliation rather than merit (Folke et al., 2011; Colonnelli et al., ?). In fact, in our setting, we suspect some patronage is at play since, as we discussed, municipalities with a new party in power have less experienced headmasters and less educated teachers. However, independent of this patronage component of political control, the linking of political and bureaucratic turnover creates instability in the process of public service provision. In our study, political turnover and the subsequent turnover of school personnel disrupt school programs, teacher training, and relationships within the school. Of course, political control over the bureaucracy has potential benefits as well. One such benefit is that it allows politicians to form cohesion between the executive and the administration (Gulzar and Pasquale, 2016). But this benefit of political discretion over the bureaucracy is often mentioned in relation to high-ranking bureaucrats. It is less clear why cohesion between politicians and low-level personnel involved in public service delivery (such as school headmasters and teachers) would ease policy implementation. There are other potential benefits of political control over the bureaucracy, such as providing incentives and accountability or fighting bureaucratic entrenchment (Raffler, 2016; Ferraz and Finan, 2011).³ However, our results show that in this setting, the net effect of political turnover in an environment with political discretion over the bureaucracy is negative and economically meaningful.⁴ Overall, our study contributes to the literature about the design of bureaucratic structures by

³Raffler (2016) directly studies how political discretion over the bureaucracy can provide accountability to bureaucrats using a randomized control trial in Uganda. Ferraz and Finan (2011) show that politicians respond to electoral incentives by reducing corruption. Presumably, this requires the cooperation of bureaucrats and the administration. Hence, politicians who are held accountable can in turn hold bureaucrats accountable if they have control over the bureaucratic structure.

⁴Related to our findings, Ferreira and Gyourko (2009) find that changes in the political party of the mayor in the U.S. do not impact crime rates. This finding is consistent with our results given that political turnover in and of itself

highlighting that, within a system where the bureaucracy is not shielded from the political process, political turnover disrupts the process of public service delivery and has a negative net impact on a welfare relevant outcome: student test scores.

The remainder of the paper is structured as follows. Section 2 describes the relevant institutional details of Brazilian municipal governments, the education system, and the link between the political process and the education system. Section 3 describes the data sources used and the steps we take to select our sample. Section 4 outlines the empirical strategy, discusses the identification assumption, and provides evidence in support of the identification assumption. Section 5 shows the main results of the effect of political party turnover on student achievement, the effect of political party turnover on the replacement of school personnel, and the connection between these two findings. Section 6 sheds light on the mechanisms by which political turnover translates to worse outcomes for students. Section 7 concludes.

2 Context

We use party changes in mayoral elections in Brazil to study the effect of political party turnover on the provision of a key public service, education. This section provides relevant details on municipal elections and municipal governments in Brazil. It also describes the education system and the link between municipal governments and the education system.

2.1 Brazilian Municipalities

There are 5,563 Brazilian municipalities (as of 2008). Municipalities are highly decentralized, autonomous, and responsible for key public services such as education, health, transportation, and sanitation.⁵ Mayors are elected in municipal elections that are held every four years on the same day across the country.⁶

Municipal employment is a large part of public sector employment and has been growing in recent years. Municipal employment was 47% of public employment in 2002 and 52.6% of public employment in 2010 (Instituto de Pesquisa Econômica Aplicada, 2011). The appointment of personnel to municipal employment takes two forms. Approximately 68% of municipal employees are civil servants (Relação Anual de Informações Sociais, 2010). They have passed a civil service exam (*concurso público*) and have tenure. The remainder of municipal employees are hired on

does not drive the negative impact we find on public service quality, rather political turnover *coupled* with political discretion over the administration has a negative net impact on student achievement.

⁵Brazil is highly decentralized in terms of the provision of public services. However, in terms of raising revenue, municipalities rely mostly on transfers from the higher (state and federal) levels of government (Gardner, 2013).

⁶Mayors are term-limited: they can hold office for two consecutive terms. Political parties are, of course, not term-limited.

contract. The use of contract workers is meant to allow municipalities more flexibility and control so that personnel can be hired faster or with particular qualifications that are missing from the pool of those who have passed the civil service exam. However, the mayor must be able to provide justification for hiring contract workers and may be investigated if misconduct is detected.⁷

2.2 Brazilian Education

One of the main responsibilities of municipal governments is the provision of public education. Under Brazil's Law of Educational Guidelines (Law 9394) municipalities are responsible for basic education (early childhood and elementary education), while states and the federal governments are responsible for providing higher levels of education. Depending on the population size, municipalities can also provide middle schools. We focus on primary education (elementary and middle schools) due to the availability of test score data. Overall, 14% of primary schools are private schools, less than 1% are controlled by the federal government, 18% are controlled by states, and 68% are controlled by municipalities.⁸ For municipal schools, the municipal government serves as the school district. However, the funding of education comes primarily from higher levels of government. Most of the funds for education, especially those funds that ensure the daily operations of schools, come from a federal fund called FUNDEF/FUNDEB, a non-discretionary fund that pays a fixed rate per enrolled student. Thus, the funding of the daily operations of schools is unlikely to be affected by political cycles or political alliances.⁹

The municipality is responsible for all decisions regarding the daily operations of the school: distribution of school lunches, providing school transportation, and the hiring, paying, and training of school personnel (teachers, headmasters, and administrators). Similar to the municipal bureaucracy more generally, 66% of teachers have passed an exam and have job security (although they can be transferred across schools). The remainder of teachers are hired on contract, at the discretion of the municipal government, and do not have job security. The mayor's office is allowed to hire teachers on contract to fill vacancies or find people with the appropriate qualifications.

Furthermore, approximately 60% of headmasters in municipal schools are politically appointed, as opposed to being selected through a competitive process or being elected by the school community. In Brazil, the position of headmaster is considered a "position of trust" (*cargo de confiança*), which means that politicians (can and do) appoint someone they trust to this position and hold

⁷For instance, mayors in 86 cities in the state of Paraíba had criminal and civil complaints filed against them for hiring 20,000 contract workers under the guise of exceptional public interest in 2012 [<http://www.diariodosertao.com.br/noticias/paraiba/79267>, accessed March 2014].

⁸The vast majority of students in Brazil, 76.8% are enrolled in public schools (Brazilian National Household Survey, 2011).

⁹This is important in our setting given that we are studying the effect of political party turnover on education. Nonetheless, we investigate the effect of party turnover on education resources in Section 6.

considerable discretion over it. There are several reasons why local politicians may care about the school headmaster position. First headmasters are the managers of schools and the municipal government may want to provide incentives and accountability to such managers. Second, headmasters play a key role in enforcing the conditionality of the *Bolsa Familia* conditional cash transfer program. School-aged children must be in attendance for 85% of school-days in order for their family to receive this transfer and headmasters have discretion over whether school absences count towards non-compliance (Brollo et al., 2015). And lastly, the headmaster position may be used to reward political supporters.¹⁰

3 Data

We combine electoral outcomes for local governments with data on several aspects of public education. We first provide a brief timeline of when elections take place and when data is collected and then describe each of the data sources used in more detail.

Timeline. We focus on the 2008 and 2012 elections because some of our key outcome variables (student test scores and teacher assignments), become available starting in 2007. As the timeline shows in Figure 1, municipal elections are held in October (every four years) and the mayor takes office in January of the following year.¹¹ The academic year begins in March and ends in December. We use two main sources to measure the quality of education provision: the School Census (*Censo Escolar*), which is conducted annually in May, and the nation-wide, standardized exam *Prova Brasil*, which is proctored every two years in November.

Electoral Data. The electoral data come from the Brazilian Superior Electoral Court (*Tribunal Superior Eleitoral, TSE*), which oversees all local, state, and federal elections in Brazil. We use electoral data from 2004, 2008, and 2012 to determine the incumbent party, the winning party, and each party's vote share in the 2008 and the 2012 municipal elections. This allows us to compute the running variable in our regression discontinuity design: the incumbent political party's vote margin, defined as the vote share of the incumbent political party minus the vote share of the incumbent party's strongest opponent.

Education Data. The data on education comes from two sources made available by the National Institute for Research on Education (*Instituto Nacional de Estudos e Pesquisas Educacionais*

¹⁰The headmaster position may be used to reward political supporters directly (i.e. patronage) or indirectly. Since school management in Brazil involves an abundance of resources for food, transportation, and textbook programs, there is some anecdotal evidence that the headmaster position is used as a way to provide contracts to political supporters in the process of acquiring school supplies. See, for example, the following interview with the outgoing secretary of education for the state of Rio de Janeiro: <http://oglobo.globo.com/sociedade/educacao/o-pais-nao-tem-mais-tempo-perder-discutindo-obvio-diz-wilson-risolia-14892991>, accessed October 2016.

¹¹Federal and state elections also take place every four years, but they are staggered to occur two years apart from municipal elections.

Anísio Teixeira, INEP). The first is the School Census (*Censo Escolar*), an annual survey of every school in Brazil (private and public). A large share of the educational budget is determined based on the enrollment figures in this census. Hence, the federal government frequently checks and audits the information in this census and misreporting has serious consequences. Therefore, this survey is a reliable source of information. We use the School Census from 2007, 2009, 2011, and 2013 to build a panel of schools with the following information: characteristics of the school (such as the quality of its infrastructure and whether the school is located in an urban or rural area), school-level dropout rates, school-level enrollment figures, school-level student characteristics (such as gender and whether the location of birth and residency are urban or rural), school-level teacher characteristics (such as gender, age, and education), and the movement of individual teachers. This last measure is one of our main outcome variables and is computed by comparing teacher rolls from the year before the election and the year after the election. More precisely, we compute the share of teachers that are new to the school by taking the pool of teachers in a given school the year after the election and checking to see if those teachers were present in the same school the year before the election. We also compute the share of teachers that have left a school by taking the pool of teachers in a given school the year before the election and checking to see if those teachers are present in the same school the year after the election.¹² The School Census is conducted in May and, therefore, any outcome measure from the Census should be thought of as an assessment of the education system five months after the new party has been in power.

Our second source of education data is *Prova Brasil*, a nation-wide, standardized exam administered every two years since 2007 to all 4th and 8th graders in public schools that have at least 20 students enrolled in that particular grade-level. We use *Prova Brasil* data from 2007, 2009, 2011, and 2013 to measure student achievement and the movement of headmasters. For each student, we average her math and Portuguese language test scores. To ease interpretation, we then standardize student test scores according to the individual-level distribution of test scores for students in municipalities that did not experience political party turnover in the most recent election cycle. When students take the exam, all students, the proctoring teachers, and the headmaster of the school complete a survey. We use the student surveys to obtain demographic characteristics of students (race, gender, and family background), which we use as controls in some specifications. We use the headmaster survey to construct our measure of headmaster replacement. The survey asks headmasters “How many years have you been a headmaster in this school?” We consider new headmasters to be those who report being the headmaster of their current school for less than two years. The exam is administered in mid-November and, therefore, any outcome measure from *Prova Brasil* should be thought of as an assessment of the education system eleven months after the new party has been in power.

¹²We cannot say whether teachers who have left the school did so voluntarily or were fired/transferred.

Municipal Characteristics and Political Ideology Data. We supplement our core election and education data with municipal characteristics from the census (*Instituto Brasileiro de Geografia e Estatística, IBGE*). We use this source to gather information on municipal population and municipal median income. We also use municipal-level public finance data, drawn from Ministry of Finance (*Ministerio da Fazenda*) to obtain data on municipal-level educational resources. Finally, we use data from *Atlas Político – Mapa do Congresso* to identify party ideology as belonging the left, center, or right.

3.1 Sample Selection and Summary Statistics

We take a number of steps to select municipalities into our sample. We start with 5,553 municipalities.¹³ We consider only municipalities where political parties compete in *regular* elections. This means we drop 147 and 111 municipalities in 2008 and 2012, respectively, that had irregular elections due to, for instance, the death of a candidate or possible detection of fraud ahead of election-day. We also drop municipalities that can potentially go to second-round elections. Second-round elections can only occur if the municipality is above the 200,000 population threshold *and* no candidate wins the majority of the votes. Given that the average municipal population in Brazil is 33,000, this restriction drops a small number of municipalities: 124 and 132 municipalities in 2008 and 2012, respectively.¹⁴

Since the incumbent party’s vote margin is the running variable in our regression discontinuity design, the incumbent political party must run for re-election to be included in our estimation sample.¹⁵ This is the case in approximately half of the municipalities. There are 35 political parties in Brazil and it is not uncommon for a political party to support the candidate of another party in a particular election instead of running its own candidate. Overall, we are left with 2,500 municipalities in 2008 and 3,114 municipalities in 2012. These municipalities constitute our sample.

Appendix Table A4 shows some descriptive statistics of the data. The unit of observation in this table is a municipality-election cycle. Column 1 shows municipal and school characteristics for

¹³We lose ten municipalities because we are not able to match their electoral data to their education data.

¹⁴We exclude municipalities with irregular elections or ones that can potentially go to second-round in order to simplify the presentation of the empirical results. Keeping such municipalities in the sample would require a fuzzy RD with an IV where the incumbent party’s vote margin from the first-round of elections is used as an instrument for whether the municipality ultimately experiences political turnover. By focusing on municipalities with regular elections, the incumbent party’s vote margin is the sole determinant of political party turnover (i.e. the first stage coefficient from a regression of party turnover on incumbent party’s vote margin is equal to 1) and, therefore, we can present our empirical results using a (sharp) regression discontinuity framework. In Appendix Tables A1 and A2, we show that our results do not change if we include *all* municipalities and use a fuzzy RD with the incumbent party’s vote margin from the first-round of elections as an instrument for political party turnover.

¹⁵In Appendix Table A3, we show that our results do not change if our running variable is defined as the incumbent candidate’s vote margin instead of the incumbent party’s vote margin. We use the vote margin of the incumbent political party as individual candidates are term limited while political parties are not, resulting in a larger sample.

all municipalities and Column 2 shows these same characteristics for municipalities in our sample. Our sample of municipalities is similar to Brazilian municipalities overall, with the exception that municipalities in our sample are smaller in terms of population and, therefore, have fewer and smaller schools. Column 3 of Appendix Table A4 shows descriptive statistics for municipalities in our sample that have at least one school that participates in the *Prova Brasil* (PB) exam. A school must have at least 20 students enrolled in the 4th or 8th grade to participate in the national exam for that particular grade-level. This means that schools with *Prova Brasil* data are large schools and are more likely to be located in urban areas. The variables measured from the School Census (for instance, teacher replacement or dropout rates) are available for all schools in our sample (Column 2). Any measures that come from the *Prova Brasil* exam (student test scores or headmaster replacement) are available only for larger, more urban schools (Column 3).

4 Empirical Strategy

To estimate the effect of political party turnover on educational outcomes, we rely on a regression discontinuity design (RDD) using close municipal elections in Brazil. This section describes the details of our RDD identification strategy and provides evidence in support of the identification assumption.

4.1 Identification Strategy

To identify the effect of a change in the political party, we compare outcomes in municipalities where the incumbent party barely loses (thus there is political party turnover) to outcomes in municipalities where the incumbent political party barely wins (and there is no political party turnover). That is, we use a sharp regression discontinuity design for close elections.

Our main specification is a linear regression for close elections, where “close” is defined according to the optimal bandwidth selection of Calonico et al. (2016). We estimate the effect of political party turnover on outcomes of interest by estimating the following equation at the individual-level or the school-level, depending on the outcome, for municipalities with close elections:

$$Y_{jmt+1} = \alpha + \beta \mathbb{1}\{IncumbVoteMargin_{mt} < 0\} + \gamma IncumbVoteMargin_{mt} + \delta \mathbb{1}\{IncumbVoteMargin_{mt} < 0\} \times IncumbVoteMargin_{mt} + X'_{jmt} \Lambda + \epsilon_{jmt}, \quad (1)$$

where Y_{jmt+1} is the outcome variable of interest (individual-level test scores or school-level headmaster/teacher replacements) in municipality m , measured one year after the election (election time t is either 2008 or 2012). The running variable of the RD is the incumbent vote margin, $IncumbVoteMargin_{mt}$, and it is computed as the vote share of the incumbent political party

minus the vote share of the incumbent party’s strongest opponent. The treatment variable is $\mathbb{1}\{IncumbVoteMargin_{mt} < 0\}$, which is an indicator variable equal to one if the incumbent political party lost the election and, hence, the municipality experienced political party turnover. X_{jmt} is a set of controls that includes school-level baseline test scores and individual-level demographics (when the outcome variable is test scores), school-level characteristics, and an election-cycle dummy to control for a general time trend between the two election cycles.¹⁶ Standard errors are clustered at the municipality level.

4.2 Identification Assumption

For Equation (1) to estimate the causal effect of political party turnover, the key identification assumption is that potential outcomes are continuous around the cutoff $IncumbVoteMargin = 0$ and, thus, any discontinuity in outcomes at the cutoff is the result of political party turnover. Essentially, the identification assumption is that in competitive elections, whether the incumbent political party wins or loses is “as good as” randomly assigned. To provide support for this identification assumption, we show that there is no evidence of sorting of the running variable, $IncumbVoteMargin$, around the zero threshold and there is no evidence of discontinuity in covariates at the zero threshold.

Appendix Figure A1 shows the distribution of the running variable in our RDD, $IncumbVoteMargin$, for municipalities in our sample in both elections cycles. Municipalities with $IncumbVoteMargin < 0$ are those where the incumbent party lost its re-election bid and, hence, the municipality experienced political party turnover in the respective election cycle. Municipalities with $IncumbVoteMargin > 0$ are those where the incumbent party won re-election and, hence, the municipality did not experience political party turnover in the respective election cycle. The distribution of $IncumbVoteMargin$ seems fairly smooth around the $IncumbVoteMargin = 0$ threshold. In fact, a formal test for manipulation of the running variable fails to reject the null hypothesis that $IncumbVoteMargin$ is continuous at the zero threshold. Figure 2 shows this formal test, the McCrary Test (McCrary, 2008). The estimated discontinuity at the zero threshold is $-.0019$ (log difference in height) with a standard error of $.0607$.¹⁷

Further evidence that lends support to our identification assumption is that we do not find evidence of discontinuity in covariates at the $IncumbVoteMargin = 0$ threshold. Columns 1

¹⁶We do not have a panel of students. We observe 4th and 8th graders every two years. We have a panel of schools and, therefore, control for the baseline, school-level average test score of the school we observe a particular student in.

¹⁷Further confirming our finding of no manipulation in the running variable is a study done by Eggers et al. (2015). They analyze data from 40,000 close races in many different electoral settings, including Brazilian mayors in 2000-2008. They find no systematic evidence of sorting or imbalance around electoral thresholds and confirm that the relevant actors do not have precise control over election results in these settings (with the exception of U.S. House of Representative in the second half of the 20th century).

and 2 in Table 1 and Appendix Table A5 show the mean value of 42 variables at baseline (one year prior to the election) for municipalities that did not have party turnover and municipalities that did have party turnover the year of the election in a close election. “Close” is defined as $|IncumbVoteMargin| < .09$ in this table.¹⁸ This bandwidth corresponds to the winning party receiving at most 54.5% of the votes and the losing party receiving at least 45.5% of the votes if there were two parties running in the elections.¹⁹ The balance of covariates is not sensitive to the chosen bandwidth. Column 3 shows the p-value corresponding to the coefficient on $\mathbb{1}\{IncumbVoteMargin < 0\}$ in Equation (1) with the corresponding variable at baseline used as the outcome variable. As the p-values in Column 3 suggest, among 42 covariates, there is only one that displays a discontinuity at the $IncumbVoteMargin = 0$ threshold. Importantly, there is no discontinuity in our main outcomes of interest (test scores and replacement rate of school personnel) at baseline. We present the corresponding graphs of test scores at baseline as a function of incumbent vote margin in Appendix Figure A2. The absence of a discontinuity at the relevant threshold for baseline characteristics lends credibility to our identification assumption that political party turnover is “as good as randomly assigned.”²⁰

5 Results

Our main results, which we present below, show that political party turnover reduces students’ test scores. The negative effect of political party turnover on student achievement is not driven by selection or shifts in party ideology and persists up to three years after the election, at which point there is another election. Additionally, political party turnover increases the replacement rate of school personnel. This replacement occurs soon after the election (within a year) and seems to have a political component: political party turnover induces replacement of headmasters amongst politically appointed headmasters and municipalities that experience a change in the political party have lower quality school personnel (in terms of experience and education). Finally, we use a

¹⁸Approximately 40% of the municipalities in our sample fall within this bandwidth. Local elections in Brazil are quite competitive.

¹⁹There were between 1-12 candidates/parties running in the mayoral elections we study with an average of 2.7 and a median of 2 candidates.

²⁰An additional threat to the validity of our empirical strategy is the possibility of manipulation of vote shares in close elections in a way that correlates with our outcomes of interest *but* does not result in sorting of the running variable around the threshold or a jump of covariates at the threshold. For instance, incompetent incumbent parties may be the least successful at manipulating close elections in their favor *and* the least effective at provision of public services. Therefore, municipalities where incumbent parties barely lose may have particularly bad public education. To address this concern, we check whether mean baseline characteristics shown in Tables 1 and A5 are systematically different in municipalities with and without party turnover in close elections – essentially a comparison of means instead of checking for a discontinuity in the $IncumbVoteMargin$ at the zero threshold (what Tables 1 and A5 show). Among 42 covariates, there are 6 variables with a significant mean difference across control and treated municipalities (results not shown). Therefore, it is unlikely that such a threat to our identification is valid.

placebo exercise to provide evidence that political party turnover impacts student achievement due to political discretion over the education bureaucracy.

We show the RD plots using the optimal bandwidth for each outcome. Since we have several outcomes of interest and the optimal bandwidth is different for each of these outcomes, we also show the corresponding regression tables using the optimal bandwidth for the particular outcome under study and two other bandwidths (0.07 and 0.11) in an effort to keep the estimation sample fixed and, also, to show that our point estimates are not sensitive to the using bandwidth.

5.1 Political Turnover and Student Achievement

We estimate Equation (1) separately for 4th and 8th graders because all municipalities offer elementary schools but not all municipalities offer middle schools (usually larger municipalities offer both elementary and middle schools).

Effect on 4th Graders. Figure 3a shows 4th grade test scores one year after the election (in 2008 or 2012) in municipalities with close elections.²¹ Test scores for 4th graders are lower in municipalities where a new political party has barely won (right hand side of the figure) compared to municipalities where the incumbent political party has barely stayed in power (left hand side of the figure). As Table 2 shows, municipalities with a new party in office have test scores that are 0.08 standard deviations lower than comparable municipalities with no change in the political party. The estimated effect of political party turnover is robust to the inclusion of individual-level demographic controls, school-level controls, a dummy for the 2012 election cycle, and varying the estimation bandwidth.

Effect on 8th Graders. The same pattern holds for 8th grade test scores one year after the election, as shown in Figure 3b. Eighth graders' test scores are lower in municipalities where a new political party has barely won compared to municipalities where the incumbent political party has barely stayed in office. Table 2 is the corresponding table and shows that test scores are 0.05 standard deviation units lower in municipalities with a new party in office. Again the effect of political party turnover on test scores for students in 8th grade is robust to the inclusion of controls and varying the estimation bandwidth. One potential issue with test scores for 8th graders as the outcome variable is that the optimal bandwidth is very large: 0.151. This is presumably the case because there are fewer municipal middle schools. Nonetheless, municipalities with $|IncumbVoteMargin| < 0.151$ constitute 60% of the municipalities in our sample. Reassuringly, even when we restrict the estimation bandwidth to smaller bandwidths (Columns 3-6 in Table 2), bandwidths that are closer to the optimal bandwidth for 4th grade test scores, we still find a negative

²¹Test scores are standardized based on the national distribution of test scores. Municipal schools are, on average, of lower quality compared to other public (state and federal) schools. Hence, the mean standardized test score for 4th graders in municipal schools is less than zero.

effect of political party turnover on 8th grade test scores.

Ruling out Selection. A particular explanation for the relationship between political party turnover and test scores observed so far may be that new parties often come to power on a platform to broaden access education. Hence, when new parties come to power, they systematically increase access to education *or* manage to reduce the dropout rate in a way that brings marginal students into the education system and, therefore, lowers test scores. Appendix Table A6 shows the effect of political party turnover on the composition of students one year after the election. In terms of observable characteristics, students are similar in municipalities where the incumbent party (barely) lost and those where the incumbent party (barely) won. Furthermore, we estimate the effect of political party turnover on school-level dropout rates. One benefit of this measure is that it is available for all schools (as compared to information from *Prova Brasil*, which is available only for larger schools). Appendix Figure A3 and Appendix Table A7 show these results. Municipalities with political party turnover have 12% higher dropout rates compared to municipalities without political party turnover. However, this estimate is not statistically significant. Importantly, we do not find evidence that political party turnover *decreases* the dropout rate and, hence, gives rise to a relationship between political turnover and test scores that is due to selection. If anything, our estimate of the effect of political party turnover on test scores is an underestimate given that party turnover has a slight positive effect on dropout rates (assuming that students at the bottom of the distribution are the most likely to dropout).

Heterogeneity with Respect to Party Ideology. Appendix Figures A4 and A5 show the effect of party turnover on test scores separately for municipalities where a left-leaning political party (barely) wins and those where a right-leaning political party (barely) wins. Political party turnover reduces test scores regardless of the ideology of the winning party. Thus, the effect of political party turnover on test scores cannot be explained by general shifts in ideology that have been shown to impact the adoption of policies and economic outcomes in previous work (Pettersson-Lidbom, 2008).²²

Persistence. Does the effect of political party turnover on test scores persist? This is an important question not only from a welfare perspective, but also to understand potential mechanisms. If political party turnover reduces student achievement initially but puts students on a better trajectory, then we would expect test scores to decrease the year after the election but begin to improve over time. Using the 2008 election, we can trace out the effect of political party turnover on test scores one, three, and five years after the election. We do not have a panel of students. Instead, we estimate the effect of party turnover in 2008 on 4th graders in 2009, 4th graders in 2011 (who were

²²There are municipalities that go from a left-leaning party to a right-leaning party and municipalities that move in the other direction in both election cycles. Thus it is not the case that there is persistence in the ideology of governing parties for a given municipality over time. This lack of persistence in ideology allows us to talk about “shifts” in ideology.

in the 2nd grade when the 2008 election took place), and 4th graders in 2013 (who were in kindergarten when the 2008 election took place). Appendix Table A8 shows how a change in the political party in 2008 affects 4th graders' test scores over time. The effect of political party turnover is most precisely estimated one year after the election.²³ Yet, as time passes, there is still a lingering negative effect of political party turnover on test scores. Although the estimated effect is not significantly different than zero in later years, we cannot reject that the effect of party turnover on test scores in 2009 is different than the effect in 2011 or 2013.²⁴

Interpreting the Magnitude. The cost of political party turnover for students in municipal primary schools is large. Previous literature has shown that the conditional cash transfer program in Brazil, *Bolsa Familia*, which covers about one fourth of Brazil's population, has increased enrollment, lowered dropout rates, and raised grade promotion, but has had *no* effect on student test scores – potentially due to the increases in enrollment rates (Glewwe and Kassouf, 2012; De Brauw et al., 2015). Quantifying the monetary value of our point estimate using interventions in the same context is difficult given the lack of an impact of the largest education policy in Brazil, *Bolsa Familia*, on test scores.²⁵ Hence, we look to another (similar) setting to benchmark our results. Angrist et al. (2002) finds that providing vouchers for private schools increases test scores by .2 standard deviation units at a total cost of \$195 per student. If the municipal governments in our sample tried to offset the effect of political party turnover for one cohort of affected students (who experienced party turnover in 4th grade and then again in 8th grade) by carrying out an intervention similar to that of Angrist et al. (2002), they would need to spend: \$25 million U.S. dollars.²⁶ This calculation underestimates the cost of political party turnover on student achievement as it does not take into account the effect of party turnover in municipalities with non-close elections.

²³Table 2 and Appendix Table A8 are different. The first table pools together the 2008 and 2012 elections and considers the effect of political turnover on test scores one year after the election (i.e. test scores in 2009 and in 2013). The second table shows the effect of political turnover in 2008 on test scores in 2009 in Columns 1-2.

²⁴Appendix Table A9 shows the same results for 8th graders. Because there are fewer municipal middle schools, we have significantly less observations (both in terms of individual students and in terms of clusters) when we limit our analysis to the 2008 election cycle. The negative effect of political party turnover on 8th grade test scores is negative and persistent; however, the standard errors are large and the estimates are noisy.

²⁵Mexico's conditional cash transfer program, *Progresa*, which was implemented as a randomized control trial unlike *Bolsa Familia* and, therefore, offers the opportunity for a more systematic analysis, has also been shown to have increased enrollment, with no significant impacts on test scores (Behrman et al., 2000).

²⁶This calculation is made using the following assumptions. We assume that raising one student's test scores in our setting would cost \$195 multiplied by how our point estimate compares to that of Angrist et al. (2002): $0.08/0.2=4$. We then count the number of students in treated municipalities from our main regression: Table 2, Column 1 (Panels A and B). In total, there are 324,885 students who experienced a change in the political party in a close election in 2008 and 2012. We arrive at \$22 million by making the following calculation: $(.08/.2) \times 195 \times 324,885=25,341,030$.

5.2 Political Turnover and School Personnel

Headmaster Replacements. Appendix Figure A6 shows how political party turnover affects headmaster replacements in all municipalities (not just those with close elections). This figure plots the share of headmasters that are new to their current school for schools in 4 different kinds of municipalities: municipalities that did not experience a change in the political party neither in 2008 nor in 2012, ones that experienced a change only in 2008, ones that experienced a change only in 2012, and ones that experienced a change in both election cycles. When a new party takes office, there is a sharp increase in the share of schools with a new headmaster the following year. This event-study analysis is striking, yet it may be that when an incumbent party gets voted out of office with a large margin, the new party comes to power on a mandate to change the education system and, therefore, there is a sharp increase in the replacement rate of headmasters. So we estimate the effect of political party turnover on headmaster replacements for municipalities with close elections. Figure 4a shows the share of schools with a new headmaster one year after the election in municipalities where a new political party (barely) wins compared to municipalities where the incumbent political party (barely) stays in power. Table 3 shows the corresponding regression results: political party turnover leads to an increase of 28 percentage points in the replacement rate of headmasters (64% of the mean headmaster replacement rate).²⁷

Headmaster Characteristics. Using the *Prova Brasil* headmaster questionnaire, we explore how political party turnover affects the characteristics of headmasters in treated and control municipalities. Appendix Table A11 shows that headmasters in municipalities that (barely) experience political party turnover are less experienced as headmasters (by 1.8 years or 35% of the mean years of headmaster experience) and slightly less likely to have graduate training (the equivalent of a masters degree).

In this context, another important headmaster characteristic is the headmaster's type of appointment. Headmasters in Brazil are chosen mainly by: selection through a competitive process (such as taking a civil service exam), election by the school community (i.e. parents and teachers), political appointment, or a combination of these (for instance, in Rio, the school community can vote among a few candidates who have passed the civil service exam).²⁸ The headmaster questionnaire

²⁷The event-study analysis shows that political turnover increases headmaster replacements the year after the election. To illustrate the timing of headmaster replacements with causal estimates, Appendix Figure A7 and Appendix Table A10 show how political party turnover in 2008 affects headmaster replacements one, three, and five years after the election for municipalities that had close elections in 2008. In municipalities with a (barely) new political party, there is a sharp increase in the share of schools with a new headmaster only the year after the election. It seems that the replacement of headmasters occurs soon after the new political party takes office in January.

²⁸There is heterogeneity within municipalities in terms of the mechanism by which the headmaster is chosen. We have not been able to fully understand where this heterogeneity comes from – although we suspect there is some historical dependence. Understanding this heterogeneity and its impact on the quality of public service provision would certainly make for interesting future research.

asks the headmasters “How did you get to the headmaster position in this school?” Based on this question, we categorize the manner by which the headmaster was chosen as: selection, election, or political appointment.²⁹ In municipal schools, the most common method for choosing the headmaster is political appointment: 65% of headmasters (that we can categorize) respond that they are political appointees. We divide headmasters into two types: those who are political appointees and those who are not political appointees (i.e. they were selected or elected). Then we construct a categorical variable to indicate whether the headmaster in school s , at time t , in municipality m is a new headmaster *and* politically appointed:

$$y_{smt} = \left\{ \begin{array}{l} \textit{No Change in Headmaster (base)} \\ \textit{Headmaster is new, not Political} \\ \textit{Headmaster is new, and Political} \end{array} \right\}$$

We use this categorical variable as the outcome in a multinomial logistic regression similar to our main estimation equation, Equation (1). Appendix Table A12 shows the results from this regression with the referent (base) category as those schools where there is no change in the headmaster. Political party turnover significantly increases the relative risk of experiencing a politically appointed headmaster change by a factor of 3.67, or $e^{1.301}$. Although political party turnover also increases the relative risk of experiencing headmaster replacement for non-politically appointed headmasters, the magnitude is considerably smaller (a factor of 1.52, or $e^{.418}$) and the coefficient is only marginally statistically significant. Overall, political party turnover induces headmaster replacement mostly amongst politically appointed headmasters, which is in line with new political parties appointing new, politically appointed headmasters to schools under the control of the municipality.³⁰

Teacher Replacements. Figure 4b shows that schools in municipalities with a (barely) new political party have a higher share of teachers that are new to the school one year after the election. Appendix Figure A8 shows that schools in municipalities with a (barely) new political party also have a higher share of teachers that have left the school one year after the election. The corresponding regressions are shown in Table 4, Panel A. Political party turnover increases the share of teachers that are new to a school by approximately 11 percentage points and increases the share of teachers that have left the school by approximately the same amount. Thus, it is not the case that

²⁹More precisely, the survey responses are: selection (8%), election only (18%), selection and election (7.5%), technical appointment (15%), political appointment (31%), other kinds of appointment (15%), and other means (6%). Based on our analysis of school characteristics and conversations with the Former Secretary of Education in Rio, we categorize *any* kind of appointment (technical appointment, political appointment, and other appointment) as political appointment. However, our results are similar if consider political appointees strictly as those headmasters who choose political appointment on the survey.

³⁰Anecdotally, such headmasters are often teachers within a school who are promoted to the headmaster position. Since they do not reach the headmaster position via civil service examination, they do not have job tenure as headmasters. Thus, when the political party that appointed them leaves office, they often return to being a teacher.

new teachers enter the school once a new political party takes office and there is an inflation in the size of the teaching staff. Rather it seems that there is “reshuffling” of teachers across schools.³¹ In fact, the number of teachers per school is not different in municipalities with and without political turnover (Appendix Table A14, Column 1).

Unfortunately, we cannot repeat the event-study analysis that we did for headmasters (Figure A6) with teachers because the School Census did not track teachers in 2005, hence, we cannot compute the share of teachers that are new to a school/have left a school in 2007. Instead, Appendix Figure A9 shows how political party turnover in 2008 affects teacher turnover one, three, and five years after the election to gain a better sense of how the effect of political party turnover propagates.³² The corresponding table, Appendix Table A13, shows that one year after a new party (barely) enters office, there is a sharp increase in the replacement rate of teachers. Three years after the election, the replacement rate of teachers is still higher in treated municipalities, so there is some persistence in the effect of party turnover on teacher assignments. However, the estimated coefficient is not statistically significant and the magnitude is half of the estimated coefficient for the effect immediately after the election. By 2013, at which time there has been another election, there is no effect of political party turnover in 2008 on teacher replacements.

Teacher Characteristics. The School Census contains demographic information on teachers: their age, gender, education-level, and type of contract (starting in 2011). Using this information, we test whether the composition of the pool of teachers in municipalities with and without political party change is different. Appendix Table A14 shows that the share of teachers with a B.A. is 7.3 percentage points (or 15% of the mean value) lower in municipalities that (barely) experience political party turnover.³³

Heterogeneity with Respect to Party Ideology. Appendix Figure A11 shows the effect of political party turnover on headmaster replacements separately for municipalities where a left-leaning party (barely) wins and those where a right-leaning party (barely) wins. Similar to the

³¹Baseline teacher turnover is very high: as Table 4 shows, the average share of teachers that are new to a school is 46% in our sample of control municipalities. There are two reasons for such a high rate. First, this rate is computed over a two year period. The second reason has to do with the way that the market for teachers is organized in Brazil. Once teachers pass the civil service exam, they are called to work at any school with a vacancy. This school is often not the teacher’s preferred location. Every year, there is an “internal selection process” (*concurso remoção*) which allows teachers to choose a different school than the one they were initially assigned to. Thus a 46% teacher turnover rate is not uncommon in Brazil. In fact, we found several newspaper articles that document similar high turnover rates throughout Brazil. For instance, “Secretary of Education of São Paulo, Maria Helena Guimarães de Castro stated [teacher] turnover of 40% in the state system:” <http://gestaoescolar.org.br/formacao/rotatividade-professores-483054.shtml>, accessed October 2016.

³²This figure shows teacher turnover in terms of the share of teachers that are new to a school and Appendix Figure A10 shows teacher turnover in terms of the share of teachers that have left a school. Both figures show similar patterns.

³³However, this does not mean that over time the education level of teachers in Brazil is declining. In fact, between 2007-2013, the share of teachers with a B.A. increased from 37% to 63%. Starting in the late 1990s/early 2000s laws began to pass that required a B.A. in pedagogy for teachers and as older generations of teachers retire, the share of teachers with a B.A. is increasing.

heterogeneity analysis for test scores, political party turnover increases the replacement rate of headmasters regardless of the ideology of the winning party. The corresponding figures for teacher replacements are shown in Appendix Figures A12 and A13 and show similar results. Thus, the effect of political party turnover on the replacement rate of school personnel cannot be explained by general shifts in ideology.

Heterogeneity with Respect to Municipal Income. Anecdotal evidence suggests that parents do object to the politically motivated replacement of headmasters.³⁴ Prior work (Bursztyn, 2016) has shown that low-income voters in the same context prefer direct transfers to investments in public education spending. Hence, it is possible that parental resistance occurs more in high-income areas and dampens the discretion of politicians over the assignment of school personnel. We divide our sample of municipalities into the subset of municipalities with below median income and the subset of municipalities with above median income and estimate the effect of political turnover on replacement of school personnel separately for low- and high-income municipalities.³⁵ Appendix Figure A14 and Appendix Table A15 show that political party turnover increases the rate of headmaster replacement by 39 percentage points in low income areas and by 13 percentage points in high income areas. This difference is statistically significant. The effect of political party turnover on teacher replacements is also higher in low-income municipalities compared to high-income ones (Appendix Figures A15 and A16, Appendix Table A16). The heterogeneity in the effect of political party turnover on assignment of school personnel suggests that political discretion over school personnel is higher in low-income municipalities.³⁶

5.3 Political Discretion over the Education Bureaucracy

So far, we have shown that a change in the political party of the mayor impacts the provision of public education in schools controlled by the municipality. In this section, we use local schools that are not controlled by the municipal government to perform a placebo exercise. We show that changes in the party of the mayor do not impact the rate of replacement of school personnel or

³⁴See for example: <http://www.saocarlosagora.com.br/cidade/noticia/2013/04/30/41314/vereadores-afirmam-que-cargo-de-diretor-de-escola-e-de-livre-escolha-do-prefeito>, accessed October 2016.

³⁵Our measure of income is the median of monthly household income within a municipality in 2000.

³⁶Despite this heterogeneity in the effect of political party turnover on school personnel replacements with respect to income, Appendix Figure A17 and Appendix Table A17 show that political party turnover reduces test scores in both low- (Panel A) and high- (Panel B) income areas. Although the estimated coefficients are more precisely estimated in low income areas, we cannot reject that the effect of political party turnover is the same in low and high income municipalities. Results for 8th graders are shown in Appendix Figure A18 and Appendix Table A18 and conclusions are similar. One could argue that the negative impact of political party turnover on test scores should be larger in low-income areas if the relevant mechanism by which political party turnover impacts students is through personnel replacements. However, test scores in low-income areas are already very low and, presumably, more difficult to reduce even further. Additionally, the cost of personnel disruptions in terms of student achievement may not be linear.

student test scores in these *non-municipal* schools.³⁷

Municipal governments control 68% of primary schools. The remainder of *public* primary schools are controlled by the state.³⁸ Most public elementary schools are controlled by the municipality, most public high schools are controlled by the state, and public middle schools are split half and half between municipal and state governments. When we consider the effect of changes in the mayor's party on headmaster replacement and student test scores in non-municipal schools, the set of non-municipal schools is comprised of state and federal schools (since only public schools participate in the *Prova Brasil* exam). When we consider teacher replacements as an outcome, the set of non-municipal schools is comprised of state, federal, and private schools (since all schools participate in the School Census).

School Personnel in Non-municipal Schools. Figure 5a and Table 5 (Panel A) show that when a new mayoral political party (barely) comes to power, there is no change in the share of non-municipal schools with a new headmaster. Figure 5b and Table 4 (Panel B) show the same results for the share of teachers that are new to non-municipal schools.³⁹ The share of teachers that are new to non-municipal schools is slightly higher, 1.1 percentage points, in municipalities with a new political party in power. However, this increase is noisily estimated and is one-tenth of the increase in the same measure for municipal schools. The fact that we observe a small effect, although not statistically significant, on teacher replacements in non-municipal schools is likely due to the fact that the teacher market for municipal and non-municipal schools is somewhat integrated and the disruption to the teacher market for municipal schools spills over into the market for teachers in non-municipal schools.⁴⁰ Overall, we see that changes in the mayor's political party have little to no effect on teacher and headmaster replacements in non-municipal schools.

Student Achievement in Non-municipal Schools. Figure 6 and Table 5 (Panel B) show the effect of political party turnover in mayoral elections on 4th grade test scores in non-municipal schools.⁴¹ When a new mayoral political party (barely) comes to power, there is no statistically significant decrease in test scores for students in non-municipal schools. Importantly, we can formally reject that the effect of mayoral political party turnover on 4th grade test scores in municipal and non-municipal schools is the same with an estimated difference in coefficients of 0.095 and a

³⁷State and federal elections are held every four years as well, but with a 2-year gap from municipal elections. Thus we do not have political turnover in higher levels of government that coincide with our treatment of local political party turnover.

³⁸The federal government controls less than 1% of primary schools. There are also private primary schools (14%).

³⁹Appendix Figure A19 show the results graphically for the share of teachers that have left non-municipals school.

⁴⁰In fact, 22% of teachers in non-municipal schools also teach in municipal schools. In Brazil, teachers may teach in more than 1 school since the school-day is only half of a day. In our sample, teachers teach in 1.3 schools on average.

⁴¹We show the corresponding analysis for middle schools (i.e. 8th graders) in Appendix Figure A20 and Appendix Table A19. The results are similar: political party turnover in mayoral elections does not significantly reduce 8th grade test scores. Although we cannot formally reject that the effect of party turnover for 8th grade test scores is the same in municipal and non-municipal schools.

p-value of .017.

One important issue is that municipal schools are worse quality schools than non-municipal schools: in 2007, for example, the average test score in municipal schools was .085 standard deviation units lower than in non-municipal schools. So it may be that political party turnover only reduces student achievement in low-quality schools. Appendix Figure A21 and Appendix Table A20 show the effect of political party turnover on test scores in low-quality municipal schools (Panel A of the table) and high-quality municipal schools (Panel B of the table). We see that the effect of political party turnover is negative in both low- and high-quality municipal schools. Although the coefficients are more noisily estimated in high-quality schools, we cannot reject that the effect of political turnover is the same in low- and high-quality schools. Therefore, the fact that we do not see an effect of political party turnover on student achievement in non-municipal schools cannot be explained by differences in school quality.⁴²

What the Placebo Shows. Political party turnover in mayoral elections does not translate into disruptions in the assignment of school personnel or deteriorations in student achievement in non-municipal schools. The absence of an effect of mayoral party changes on test scores in non-municipal schools is not due to the fact that non-municipal schools are of better quality. These findings rule out an effect of political party turnover on education provision due to any changes caused by party turnover that affect the entire municipality (such as municipal-level changes in crime or income). Instead, the findings of this placebo show that political turnover in Brazilian municipalities negatively impacts student outcomes through political discretion over the municipal education system, the key difference between municipal and non-municipal schools. The findings of this section also provide suggestive evidence that political party turnover impacts student achievement through the replacement of school personnel: when political party turnover is not accompanied by a disruption in the school, there is no negative effect of political turnover on student achievement. However, the municipal government controls aspects of municipal education provision besides appointment of headmasters and hiring/transferring of teacher. For instance, the municipal government also controls education administrators and the disbursement of funds. Therefore, other aspects of education provision, which are also under the control of the municipal government, may be affected by political party turnover as well. In the next section, we explore some other potential mechanisms by which political party turnover may affect student achievement.

⁴²We show the result of the heterogeneity analysis with respect to baseline test scores for 8th graders in municipal schools in Appendix Figure A22 and Appendix Table A21. Since there are fewer municipal middle schools to begin with, we lose power when we divide the sample of 8th graders based on baseline test scores. However, there is no evidence that the negative effect of political party turnover on 8th grade test scores is driven by low-quality schools.

6 Mechanisms

How does political turnover and political discretion over the education bureaucracy translate into lower student achievement? The most obvious mechanism, given our findings so far, is the replacement of school personnel. In this section, we explore to what extent three other mechanisms (quality of school personnel, school operations, and education resources) contribute to the negative impact of party turnover on test scores. Lower quality of school personnel and signs of problems with the operation and management of the school are two mechanisms that we find evidence for. We do not find evidence that political turnover negatively impacts the access to and allocation of education resources at the municipality or school-level.

School Personnel Quality. As discussed in Section 5.2 (Appendix Tables A11 and A14) school personnel in municipalities where a new political party (barely) comes to power are of worse quality (in terms of observable characteristics). Headmasters in municipalities with political party turnover are 1.8 years less experienced as headmasters. One additional year of headmaster experience is correlated with a .001 standard deviation unit improvement in test scores.⁴³ The share of teachers in a school with a B.A. located in a municipality with political party turnover is 7.3 percentage points lower compared to schools in municipalities with no political party turnover. A decrease of 7.3 percentage points in the share of teachers with a B.A. within a school is correlated with a .017 standard deviation decrease in test scores. Therefore the loss of headmaster experience and teacher education explain only a small share (0.0188 standard deviation units if we assume headmaster experience and teacher education impact test scores additively) of the (0.05–0.08 standard deviation unit) reduction in test scores due to political turnover.

School Operations. Ronfeldt et al. (2013) associate high teacher turnover with lower test scores for elementary school students in New York City. They suggest that there are disruptive effects of teacher turnover (beyond changing the distribution of teacher quality) such as: reduced school-specific human capital, disrupted school programs, and lessened teacher collaboration. Using the *Prova Brasil* surveys completed by headmasters, we find that political party turnover increases the share of headmasters who report negatively on a series of questions about how their school operates. Appendix Table A22 shows these results. Headmasters in municipalities with political turnover report holding fewer teacher council meetings and are less likely to report: having a coordinated curriculum within the school, having a curriculum that was developed jointly by the teachers and headmaster, receiving textbooks on-time, receiving the correct textbooks, offering programs for dropouts and failing students, and holding teacher training. They also report that less teachers participate in training conditional on holding teacher training. Appendix Table

⁴³The correlations in this subsection are estimated using the municipalities in our sample with close elections that did not have political turnover as to avoid including the causal effect of political party turnover in the correlations.

A23 reports the same results for questions regarding the operation of the school that were asked of teachers.⁴⁴ The results are similar. Moreover, teachers in municipalities with party turnover report negatively about their relationship with the headmaster and other teachers, but these point estimates are statistically insignificant. These patterns are consistent with political turnover (and potentially the subsequent replacement of school personnel) disrupting school programming and lessening collaboration between school personnel. These disruptions in school operations may partially explain how political party turnover impacts student achievement.

Education Resources. Education funding in Brazil is mostly non-discretionary and comes from a federal program (FUNDEF/FUNDEB) that pays a fixed rate per student.⁴⁵ Municipalities are mandated to spend 25% of their total revenue on education. If the combination of the federal transfers and the amount spent by municipalities does not amount to a minimum (pre-established) amount per pupil, the federal government complements educational resources to reach the set minimum.

We find that political party turnover does not affect the number of students enrolled (results not shown). So the non-discretionary component of municipal-level educational funding is likely not affected by political party turnover (or at least not supposed to be in theory). Yet, if new parties are less experienced in raising revenue or managing the disbursement of funds or if political turnover systematically changes the alignments between municipal and higher levels of government, then political turnover may impact education because of access to or allocation of educational funds. Table 6 shows that municipalities with and without political party turnover in close elections have similar total municipal expenditures 1-3 years after the election. However, as Panel A shows, the share of expenditures spent of education and on municipal personnel are higher in municipalities where a new political party (barely) wins the year after the election. This is consistent with a transitory increase in such expenditures due to the increase in the replacement of school staff, which levels off in the second and third year after the election, as shown in Panel B and Panel C.⁴⁶ Given that we observe a temporary increase in educational-related expenditures in municipalities with a new party in power, it is unlikely that a deterioration in financial resources drives the negative impact of political turnover on student achievement. The analysis of municipal expenditures so far establishes that financial resources do not change *at the municipality level* in a way that would result in lower test scores in municipalities with party turnover. However, the municipal govern-

⁴⁴However, the *Prova Brasil* teacher survey is filled out by the teacher who happens to be proctoring the exam. So it is unclear who the sample of respondents are for the *Prova Brasil* teacher survey.

⁴⁵Menezes-Filho and Pazello (2007) provide a detailed description of FUNDEF/FUNDEB.

⁴⁶This data is from the Federal Treasury FINBRA database. This database presents expenditure by sector (education, health, etc.) and by type of expense (personnel, interest payments, and investments). The share of expenditures on personnel refers to expenditures related to all municipal personnel, not only education personnel. Unfortunately, we are not able to measure expenditure on education personnel alone and, therefore, use expenditures on all municipal personnel as a proxy.

ment itself could re-allocate funds across its schools within a municipality in a way that would result in lower average test scores for the municipality. The *Prova Brasil* headmaster survey asks headmaster whether the school has experienced financial difficulties. Table 6, Panel D shows that political party turnover does not seem to impact school-level financial resources (as reported by the headmaster). Therefore, we do not find evidence that political turnover impacts the access to and allocation of resource at the municipality or school-level.

7 Conclusion

Using close mayoral elections as a source of variation in political party turnover, we document that student achievement is reduced and school personnel are replaced when the political party of the mayor in Brazil changes. We then use the set of local, non-municipal schools that are not under the discretion of the municipal government to conduct a placebo exercise: changes in the party of the mayor do not impact student achievement or the assignment of school personnel in non-municipal schools. Therefore, political party turnover negatively impacts student outcomes due to political discretion over the municipal education bureaucracy. The analysis of the mechanisms suggests that political turnover translates into lower student achievement due to the politically caused disruption in the assignment of personnel. We conclude that in an environment where the education bureaucracy is not shielded from the political process, political party turnover can adversely affect the quality of a welfare relevant outcome: student test scores.

Previous work has documented several potential costs of political discretion over the bureaucracy. The use of public service positions for patronage (Weber, 1922; Folke et al., 2011), the loss of autonomy (Rasul and Rogger, 2016), and short-horizoned incentive structures (Rauch, 1995) are some of the potential costs that the literature has studied. Our work highlights another potential cost of political discretion over the bureaucracy: by tying the turnover of public employees to political turnover, political discretion disrupts the process of public service delivery. One component of this disruption may be the (widely-studied) use of patronage, instead of merit, in making personnel decisions. Another component of this disruption, which our work points to, is the instability it creates in the process of public service delivery.

There are also potential benefits of political control over the administration. For instance, political discretion allows politicians: to align the incentives between the executive and the administration (Gulzar and Pasquale, 2016), provide accountability to public employees (Raffler, 2016), and fight bureaucratic entrenchment. In our current study, we are not able to explore the potential benefits of political control over the bureaucracy. A natural next step for research in this area would be to examine any potential benefits to society – and any potential private gains to politicians – of political control over personnel decisions in the bureaucracy.

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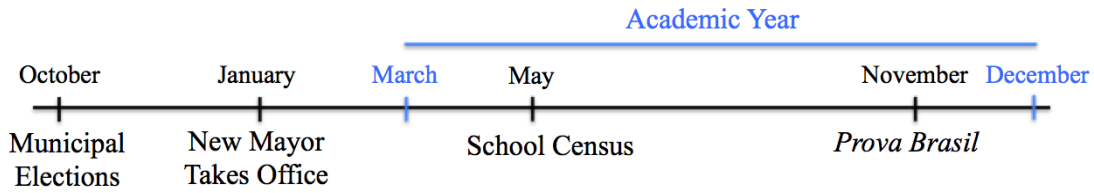
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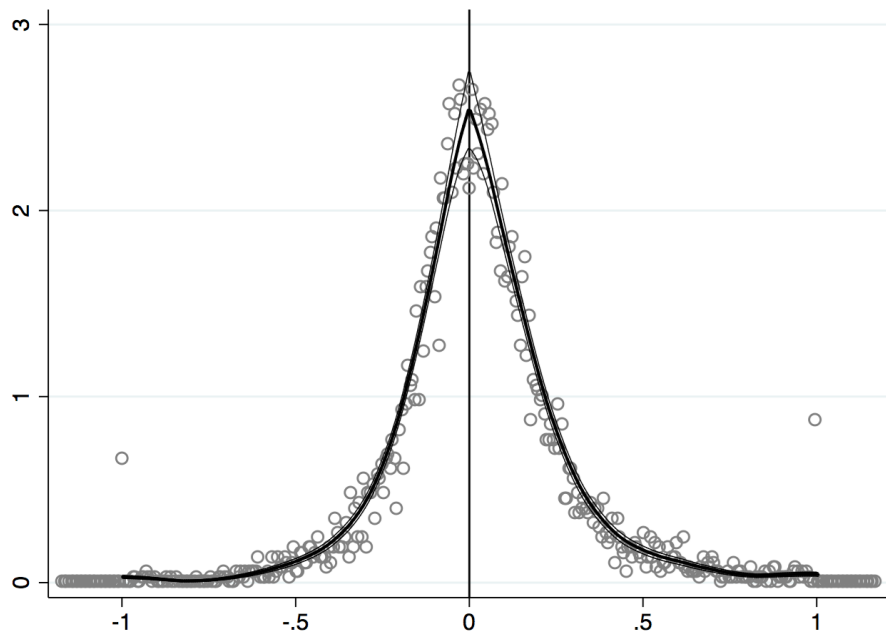
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Figure 1: Timeline of Election and Data Collection



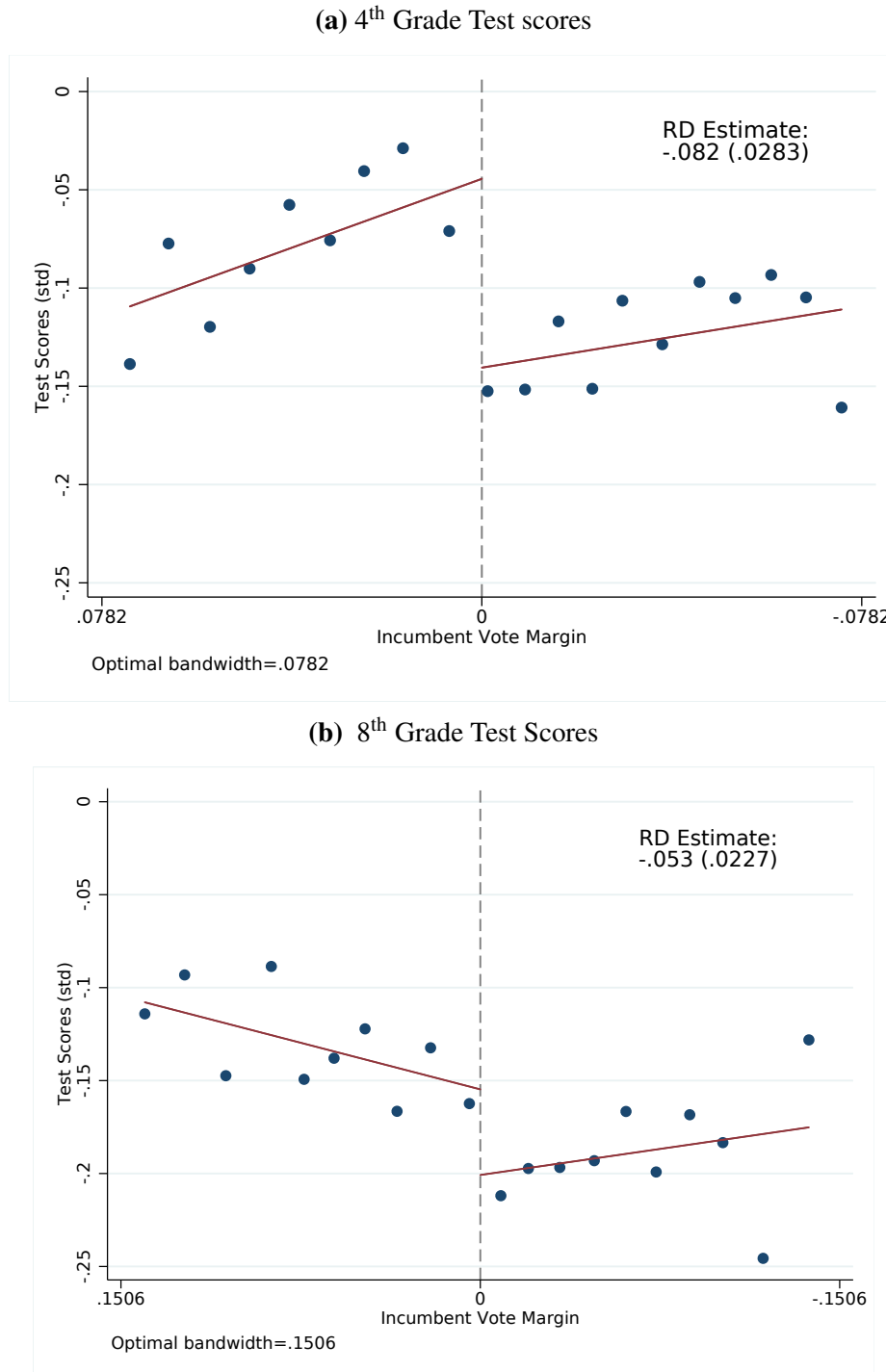
Notes: This timeline shows the timing of local elections and data collection. Municipal elections in Brazil are held in October every four years on the same day in all municipalities. The mayor takes office in January of the following year. The academic year runs from March to December. The School Census is collected annually in May and allows us to identify schools and measure the replacement rate of teachers. The *Prova Brasil* exam is a nation-wide, standardized exam and occurs every two years in November. We use *Prova Brasil* to measure student achievement, as well as the replacement rate of headmasters. Therefore, the measure of teacher replacement should be thought of as an evaluation of the education system 5 months after a new party has come to power and the measures of student achievement and headmaster replacement should be thought of as evaluations of the education system 11 months after a new party has come to power.

Figure 2: McCrary Test for Manipulation of Incumbent Vote Margin



Notes: This figure shows the McCrary Test for manipulation of the running variable in the RDD, *IncumbVoteMargin*. The test fails to reject the null hypothesis that *IncumbVoteMargin* is continuous at the zero threshold. The estimated discontinuity is -.0019 (log difference in height) with a standard error of .0607.

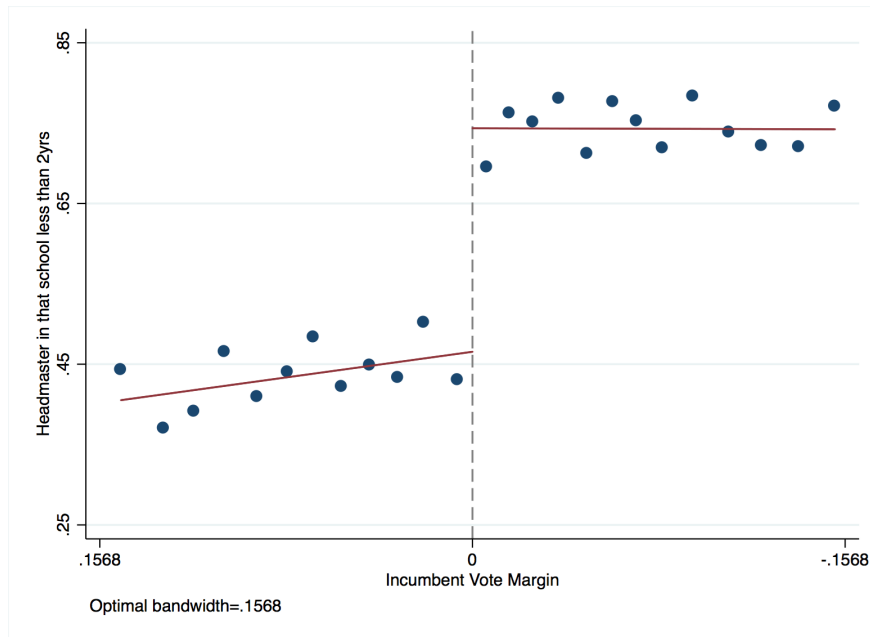
Figure 3: Political Turnover and 4th and 8th Grade Test Scores



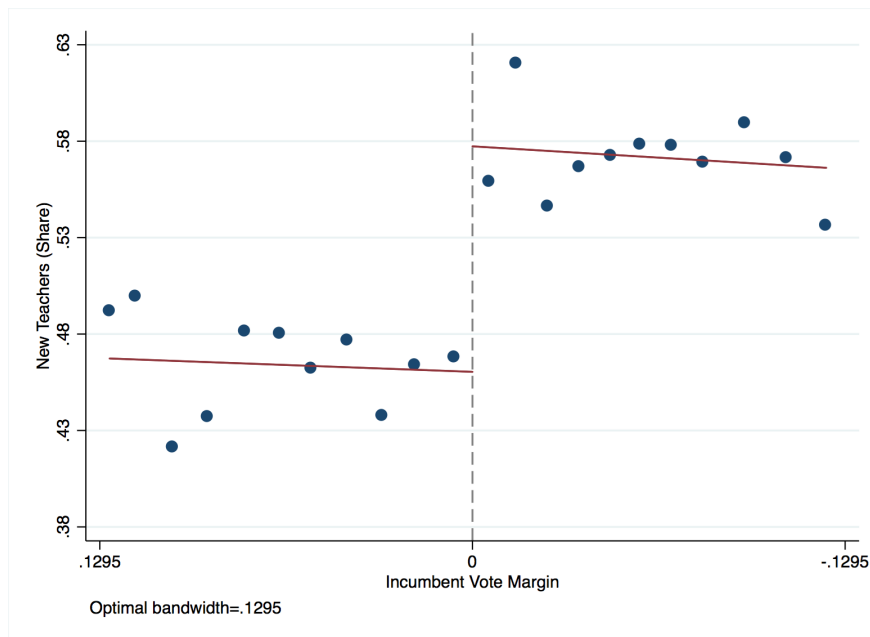
Notes: This figure shows the mean of individual-level 4th grade test scores (Panel A) and 8th grade test scores (Panel B) by bins of *IncumbVoteMargin*. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level test scores for the respective grade at baseline (the year before the respective election) is included as a control.

Figure 4: Political Turnover and School Personnel Changes

(a) Headmaster Replacement



(b) New Teachers



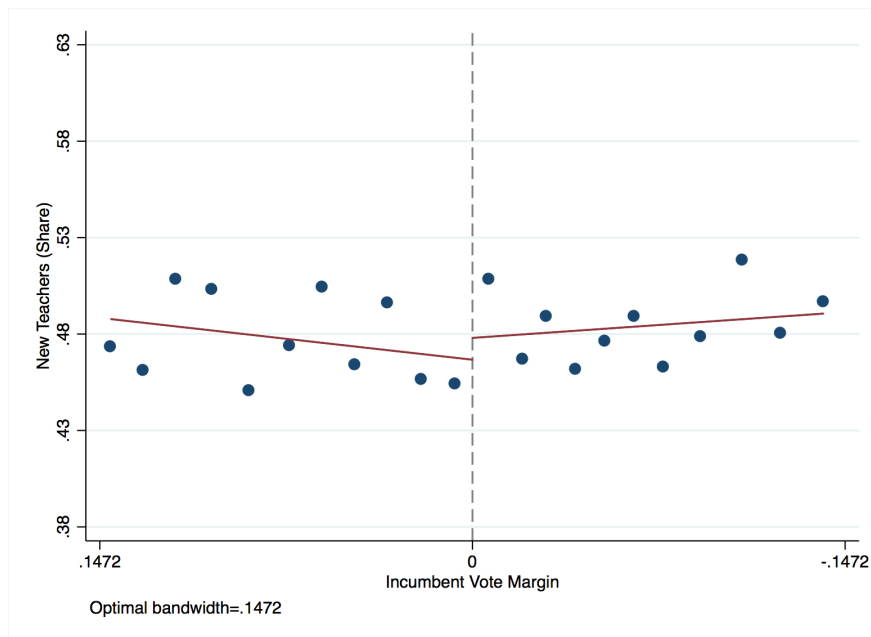
Notes: Panel A shows the share of schools with a new headmaster and Panel B shows the share of teachers that are new to the school by bins of *IncumbVoteMargin*. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire. The share of teachers that are new to a school is computed using the School Census and corresponds to the share of teachers in a school who are in that school at time t (one year after the respective election) but were not in that same school at time $t - 2$ (the year before the respective election).

Figure 5: Political Turnover and School Personnel Changes in Non-municipal Schools

(a) Headmaster Replacement

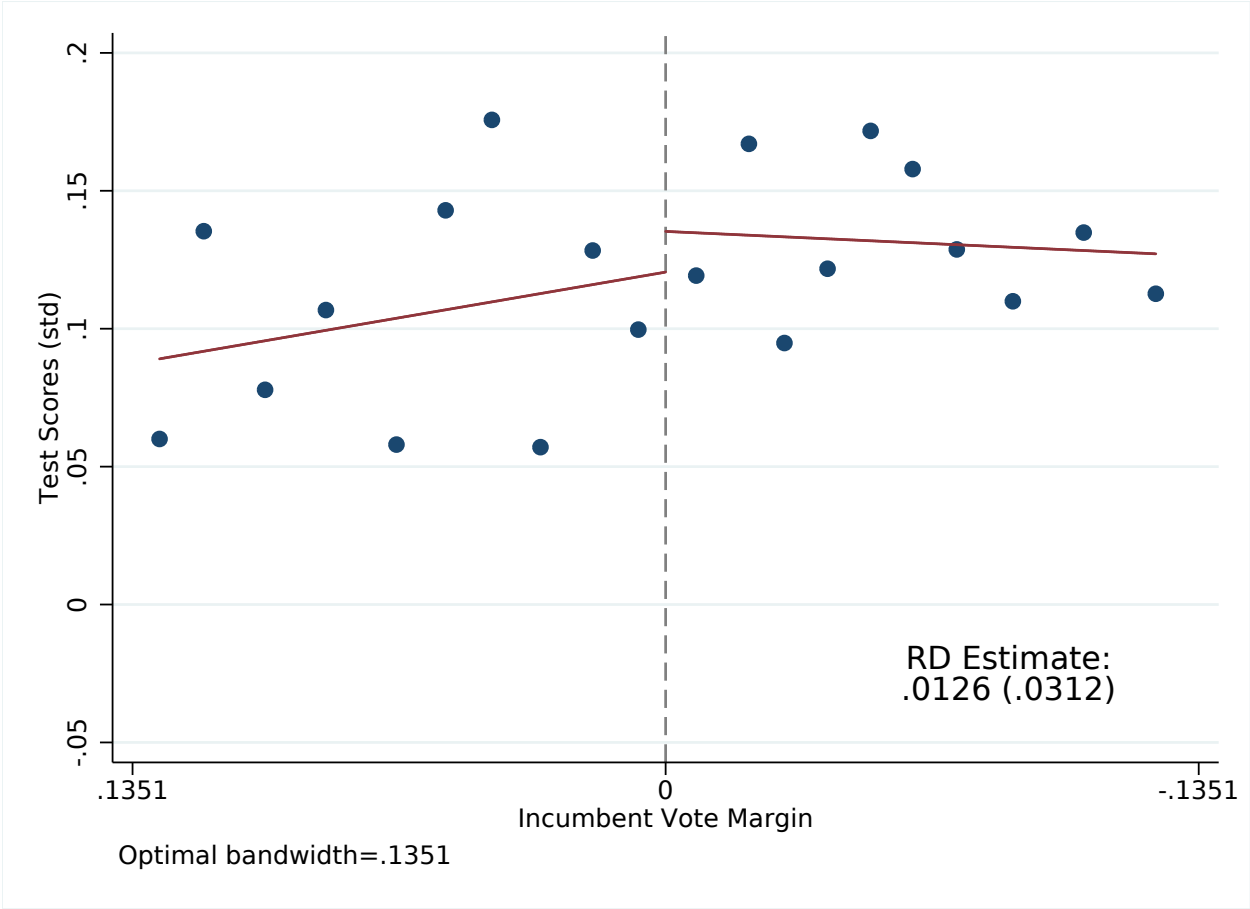


(b) New Teachers



Notes: This figure shows a similar analysis to that of Figure 4 with the key difference that the sample for this figure is *non-municipal* schools. The set of *non-municipal* schools is comprised of state and federal schools in Panel A (only public schools participate in the *Prova Brasil* exam) and state, federal, and private schools in Panel B (all schools participate in the School Census).

Figure 6: Political Turnover and 4th Grade Test Scores in Non-municipal Schools



Notes: This figure shows a similar analysis to that of Figure 3a with the key difference that the sample for this figure is *non-municipal* schools. The set of *non-municipal* schools for this outcome is comprised of state and federal schools, since only public schools participate in the *Prova Brasil* exam.

Table 1: Descriptive Statistics and Test for Discontinuity in Baseline Characteristics, $|IncumbVoteMargin| < .09$

| | (1) No Party Turnover | (2) Party Turnover | (3) P-value |
|---|--------------------------|-----------------------|----------------|
| Number of Municipalities | 1,233 | 1,195 | . |
| Municipal Characteristics | | | |
| Population | 18,299.92 | 20,095.88 | 0.72 |
| Ruling party from left | 0.25 | 0.23 | 0.78 |
| Winning party from left | 0.25 | 0.30 | 0.04 |
| Ruling party from right | 0.57 | 0.57 | 0.36 |
| Winning party from right | 0.57 | 0.52 | 0.57 |
| School Characteristics | | | |
| Share urban | 0.26 | 0.28 | 0.50 |
| Share connected to water network | 0.39 | 0.41 | 0.84 |
| Share connected to sewage system | 0.15 | 0.16 | 0.79 |
| Share with Internet | 0.17 | 0.20 | 0.21 |
| Number of school staff | 15.13 | 16.24 | 0.78 |
| Number of teachers per school | 7.58 | 8.05 | 0.95 |
| Teacher age | 36.57 | 36.60 | 0.44 |
| Share of female teachers | 0.82 | 0.82 | 0.17 |
| Share of teachers born in same municipality | 0.69 | 0.69 | 0.41 |
| Share of teachers with B.A. | 0.43 | 0.44 | 0.48 |
| Share of teachers who took <i>Concurso</i> | 0.66 | 0.68 | 0.20 |
| Share of teachers who are temporary | 0.33 | 0.31 | 0.20 |
| Number of classrooms taught per teacher | 1.87 | 1.90 | 0.25 |
| Number of schools taught per teacher | 1.29 | 1.29 | 0.50 |
| Share of teachers who teach only in municipal schools | 0.93 | 0.92 | 0.99 |
| Teacher experience (only in PB) | 12.46 | 12.40 | 0.88 |
| Share of female headmasters (only in PB) | 0.85 | 0.85 | 0.27 |
| Headmaster age (only in PB) | 40.91 | 41.44 | 0.70 |
| Headmaster education experience (only in PB) | 14.23 | 14.59 | 0.28 |
| Headmaster experience (only in PB) | 4.99 | 5.39 | 0.69 |
| Number of students per school | 152.24 | 160.96 | 0.74 |
| Share of students who use school transportation | 0.26 | 0.27 | 0.11 |
| Number classrooms per school | 7.02 | 7.41 | 0.73 |
| Students/class per school | 17.97 | 18.08 | 0.53 |
| Number of 4th graders per school | 18.55 | 20.16 | 0.93 |
| Number of 8th graders per school | 7.62 | 8.23 | 0.65 |
| Outcomes of Interest at Baseline | | | |
| 4th grade test scores (only in PB) | -0.16 | -0.12 | 0.10 |
| 8th grade test scores (only in PB) | -0.18 | -0.16 | 0.22 |
| Dropout rate | 0.04 | 0.04 | 0.85 |
| New headmaster (only in PB) | 0.36 | 0.33 | 0.80 |
| Share of teachers who are new to the school | 0.51 | 0.52 | 0.68 |
| Share of teachers who have left the school | 0.50 | 0.51 | 0.48 |

This table shows descriptive statistics for municipalities that did not have political party turnover and municipalities that did have political party turnover in close elections, $|IncumbVoteMargin| < .09$, in Columns 1-2. Column 3 tests for a discontinuity in baseline characteristics at the $IncumbVoteMargin=0$ threshold: This column reports the p-value corresponding to the coefficient on $\mathbb{1}\{IncumbVoteMargin < 0\}$ in our main specification, Equation 1, with the corresponding variable at baseline used as the dependent variable. Appendix Table A5 includes additional statistics for School Characteristics.

Table 2: Political Turnover and 4th Grade and 8th Grade Test Scores

| Panel A | Outcome: Individual 4 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|--|---------------------|----------------------|----------------------|----------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.082*** (0.028) | -0.064** (0.026) | -0.091*** (0.029) | -0.075*** (0.027) | -0.067*** (0.024) | -0.055** (0.022) |
| School-level baseline scores | 0.869*** (0.014) | 0.739*** (0.014) | 0.864*** (0.015) | 0.737*** (0.015) | 0.861*** (0.012) | 0.732*** (0.012) |
| N | 325,554 | 325,554 | 295,170 | 295,170 | 429,979 | 429,979 |
| R-squared | 0.218 | 0.252 | 0.213 | 0.248 | 0.218 | 0.252 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1669 | 1669 | 1538 | 1538 | 2101 | 2101 |
| Using Bandwidth | 0.0782 | 0.0782 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.0782 | 0.0782 | 0.0782 | 0.0782 | 0.0782 | 0.0782 |

| Panel B | Outcome: Individual 8 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.054** (0.023) | -0.042* (0.023) | -0.050* (0.030) | -0.046 (0.029) | -0.059** (0.025) | -0.049** (0.025) |
| School-level baseline scores | 0.789*** (0.012) | 0.729*** (0.013) | 0.783*** (0.016) | 0.725*** (0.017) | 0.783*** (0.013) | 0.722*** (0.014) |
| N | 245,302 | 245,302 | 126,855 | 126,855 | 191,169 | 191,169 |
| R-squared | 0.162 | 0.174 | 0.158 | 0.170 | 0.157 | 0.169 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1602 | 1602 | 965 | 965 | 1335 | 1335 |
| Using Bandwidth | 0.151 | 0.151 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.151 | 0.151 | 0.151 | 0.151 | 0.151 | 0.151 |

Notes: This table reports the coefficient on political party turnover from regressing individual-level 4th grade test scores (Panel A) and 8th grade test scores (Panel B) on the running variable of the RDD (*IncumbVoteMargin*), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < \text{Using Bandwidth}$. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. All specifications control for school-level, average test scores for the respective grader at baseline (one year before the respective election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet), individual-level controls (an indicator variable for gender, whether the student is white, and whether the student sees their mother reading), and a 2012 election-cycle indicator.

Table 3: Political Turnover and Headmaster Replacements

| Outcome: | Headmaster is new to the school (as Headmaster) | | | | | |
|--------------------------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.278*** (0.027) | 0.277*** (0.026) | 0.273*** (0.040) | 0.272*** (0.039) | 0.271*** (0.032) | 0.270*** (0.032) |
| N | 15,011 | 15,011 | 7,517 | 7,517 | 11,196 | 11,196 |
| R-squared | 0.099 | 0.103 | 0.090 | 0.096 | 0.096 | 0.100 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 2648 | 2648 | 1562 | 1562 | 2139 | 2139 |
| Mean Dep Var | 0.435 | 0.435 | 0.454 | 0.454 | 0.446 | 0.446 |
| Using Bandwidth | 0.157 | 0.157 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.157 | 0.157 | 0.157 | 0.157 | 0.157 | 0.157 |

This table reports the coefficient on political party turnover from regressing an indicator variable for whether the school has a new headmaster on the running variable of the RDD (*IncumbVoteMargin*), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < \text{Using Bandwidth}$. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire. Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table 4: Political Turnover and Teacher Replacements in Municipal and Non-municipal Schools

| | | Share of Teachers New to the School | | | | | Share of Teachers that have Left the School | | | | | |
|--------------------------------------|---------------------|-------------------------------------|---------------------|---------------------|---------------------|---------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Panel A: Municipal Schools | | | | | | | | | | | | |
| Outcome: | | | | | | | | | | | | |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.117*** (0.018) | 0.119*** (0.018) | 0.112*** (0.022) | 0.113*** (0.022) | 0.101*** (0.019) | 0.102*** (0.019) | 0.114*** (0.018) | 0.115*** (0.018) | 0.106*** (0.022) | 0.107*** (0.022) | 0.098*** (0.019) | 0.099*** (0.019) |
| N | 38,065 | 38,065 | 21,885 | 21,885 | 32,883 | 32,883 | 38,808 | 38,808 | 21,885 | 21,885 | 32,883 | 32,883 |
| R-squared | 0.026 | 0.032 | 0.027 | 0.031 | 0.030 | 0.035 | 0.024 | 0.028 | 0.025 | 0.028 | 0.027 | 0.031 |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Clusters | 2297 | 2297 | 1509 | 1509 | 2056 | 2056 | 2327 | 2327 | 1509 | 1509 | 2056 | 2056 |
| Mean Dep Var | 0.464 | 0.464 | 0.464 | 0.464 | 0.459 | 0.459 | 0.448 | 0.448 | 0.449 | 0.449 | 0.444 | 0.444 |
| Using Bandwidth | 0.130 | 0.130 | 0.0700 | 0.0700 | 0.110 | 0.110 | 0.133 | 0.133 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.130 | 0.130 | 0.130 | 0.130 | 0.130 | 0.130 | 0.133 | 0.133 | 0.133 | 0.133 | 0.133 | 0.133 |
| Panel B: Non-municipal Schools | | | | | | | | | | | | |
| Outcome: | | | | | | | | | | | | |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.011 (0.013) | 0.015 (0.013) | 0.037** (0.019) | 0.034** (0.017) | 0.021 (0.015) | 0.022 (0.014) | 0.015 (0.012) | 0.015 (0.012) | 0.039** (0.018) | 0.034** (0.017) | 0.023* (0.014) | 0.020 (0.013) |
| Observations | 13,819 | 13,819 | 7,449 | 7,449 | 10,774 | 10,774 | 14,427 | 14,427 | 7,449 | 7,449 | 10,774 | 10,774 |
| R-squared | 0.001 | 0.018 | 0.003 | 0.015 | 0.001 | 0.018 | 0.001 | 0.023 | 0.003 | 0.021 | 0.002 | 0.025 |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Clusters | 2466 | 2466 | 1521 | 1521 | 2064 | 2064 | 2551 | 2551 | 1521 | 1521 | 2064 | 2064 |
| Mean Dep Variable | 0.477 | 0.477 | 0.475 | 0.475 | 0.475 | 0.475 | 0.460 | 0.460 | 0.455 | 0.455 | 0.458 | 0.458 |
| Using Bandwidth | 0.147 | 0.147 | 0.0700 | 0.0700 | 0.110 | 0.110 | 0.156 | 0.156 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.147 | 0.147 | 0.147 | 0.147 | 0.147 | 0.147 | 0.156 | 0.156 | 0.156 | 0.156 | 0.156 | 0.156 |

This table reports the coefficient on political party turnover from regressing the share of teachers that are new to the school or the share of teachers that have left a school on the running variable of the RDD ($IncumbVoteMargin$), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $IncumbVoteMargin < 0$ Using Bandwidth separately for municipal (Panel A) and non-municipal (Panel B) schools. The share of teachers that are new to a school is computed using the School Census and corresponds to the share of teachers in a school who are in that school at time t (one year after the respective election) but were not in that same school at time $t - 2$ (the year before the respective election). The share of teachers that have left a school is also computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ (the year before the respective election) but are no longer in that same school at time t (one year after the respective election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator. The set of non-municipal schools for these outcomes is comprised of state, federal, and private schools (since all schools participate in School Census).

Table 5: Political Turnover and Non-municipal Schools

| Panel A | Outcome: Headmaster is new to the school (as Headmaster) | | | | | |
|--------------------------------------|--|-------------------|------------------|-------------------|------------------|------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.008 (0.027) | -0.016 (0.025) | 0.002 (0.039) | -0.019 (0.036) | 0.027 (0.032) | 0.008 (0.030) |
| N | 7,762 | 7,762 | 4,050 | 4,050 | 5,780 | 5,780 |
| R-squared | 0.001 | 0.023 | 0.001 | 0.029 | 0.000 | 0.025 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 2321 | 2321 | 1374 | 1374 | 1858 | 1858 |
| Mean Dep Var | 0.389 | 0.389 | 0.387 | 0.387 | 0.395 | 0.395 |
| Using Bandwidth | 0.158 | 0.158 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.158 | 0.158 | 0.158 | 0.158 | 0.158 | 0.158 |

| Panel B | Outcome: Individual 4 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.013 (0.031) | 0.024 (0.029) | -0.005 (0.044) | 0.024 (0.040) | 0.007 (0.035) | 0.025 (0.033) |
| School-level baseline scores | 0.805*** (0.016) | 0.707*** (0.016) | 0.806*** (0.020) | 0.707*** (0.020) | 0.816*** (0.018) | 0.716*** (0.018) |
| N | 152,086 | 152,086 | 89,753 | 89,753 | 126,439 | 126,439 |
| R-squared | 0.157 | 0.191 | 0.154 | 0.188 | 0.158 | 0.192 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1161 | 1161 | 755 | 755 | 1015 | 1015 |
| Using Bandwidth | 0.135 | 0.135 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 |

This table shows a similar analysis to that of Tables 2 and 3 with the key difference that the estimation sample for this table is *non-municipal* schools. The set of *non-municipal* schools for these outcomes is comprised of state and federal schools, since only public schools participate in the *Prova Brasil* exam.

Table 6: Political Turnover and Financial Resources

| Panel A | | | | | | | | | |
|--------------------------------------|--|--------------------|--------------------|-----------------------------------|----------------------|----------------------|-----------------------------------|----------------------|-----------------------|
| Outcome: | Municipal level Financial Resources: 1 year after the election | | | | | | | | |
| | Total Expenditures | | | Expenditures on Education (Share) | | | Expenditures on Personnel (Share) | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 1.7406 (2.4058) | 1.3853 (2.6110) | 2.5121 (2.1875) | 0.0177*** (0.0066) | 0.0180** (0.0080) | 0.0147** (0.0064) | 0.0205*** (0.0054) | 0.0153** (0.0077) | 0.0178*** (0.0061) |
| Observations | 2,509 | 1,939 | 2,790 | 2,606 | 1,939 | 2,790 | 3,362 | 1,938 | 2,789 |
| R-squared | 0.0091 | 0.0064 | 0.0087 | 0.0242 | 0.0252 | 0.0236 | 0.0891 | 0.0950 | 0.0915 |
| Mean Dep Variable | 23.99 | 23.56 | 23.99 | 0.299 | 0.296 | 0.298 | 0.497 | 0.498 | 0.497 |
| Using Bandwidth | 0.0963 | 0.0700 | 0.110 | 0.101 | 0.0700 | 0.110 | 0.141 | 0.0700 | 0.110 |
| Optimal Bandwidth | 0.0963 | 0.0963 | 0.0963 | 0.101 | 0.101 | 0.101 | 0.141 | 0.141 | 0.141 |

| Panel B | | | | | | | | | |
|--------------------------------------|--|--------------------|--------------------|-----------------------------------|--------------------|--------------------|-----------------------------------|---------------------|---------------------|
| Outcome: | Municipal level Financial Resources: 2 year after the election | | | | | | | | |
| | Total Expenditures | | | Expenditures on Education (Share) | | | Expenditures on Personnel (Share) | | |
| | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.3210 (2.7146) | 1.0522 (2.8499) | 1.3553 (2.4579) | 0.0030 (0.0067) | 0.0024 (0.0083) | 0.0025 (0.0067) | -0.0038 (0.0056) | -0.0102 (0.0076) | -0.0048 (0.0060) |
| Observations | 2,391 | 1,870 | 2,699 | 2,717 | 1,870 | 2,699 | 2,974 | 1,870 | 2,699 |
| R-squared | 0.0085 | 0.0050 | 0.0076 | 0.0129 | 0.0127 | 0.0128 | 0.0636 | 0.0666 | 0.0636 |
| Mean Dep Variable | 25.78 | 25.71 | 25.69 | 0.297 | 0.296 | 0.297 | 0.487 | 0.487 | 0.487 |
| Using Bandwidth | 0.0950 | 0.0700 | 0.110 | 0.111 | 0.0700 | 0.110 | 0.124 | 0.0700 | 0.110 |
| Optimal Bandwidth | 0.0950 | 0.0950 | 0.0950 | 0.111 | 0.111 | 0.111 | 0.124 | 0.124 | 0.124 |

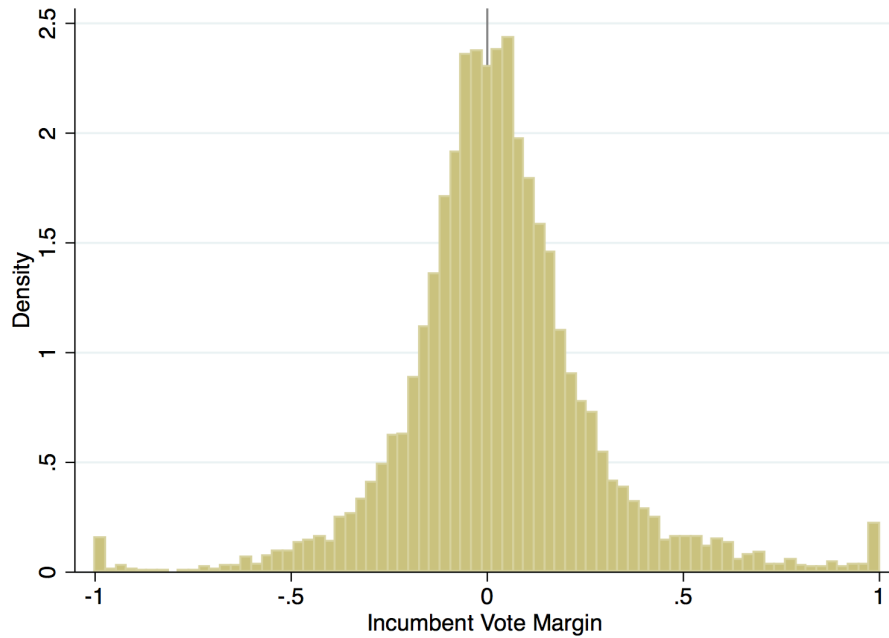
| Panel C | | | | | | | | | |
|--------------------------------------|--|--------------------|--------------------|-----------------------------------|--------------------|--------------------|-----------------------------------|---------------------|---------------------|
| Outcome: | Municipal level Financial Resources: 3 year after the election | | | | | | | | |
| | Total Expenditures | | | Expenditures on Education (Share) | | | Expenditures on Personnel (Share) | | |
| | (19) | (20) | (21) | (22) | (23) | (24) | (25) | (26) | (27) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 2.5311 (2.7393) | 1.9631 (2.9349) | 3.2540 (2.4938) | 0.0035 (0.0066) | 0.0048 (0.0087) | 0.0031 (0.0068) | -0.0091* (0.0048) | -0.0082 (0.0072) | -0.0085 (0.0056) |
| Observations | 2,478 | 1,894 | 2,733 | 2,852 | 1,894 | 2,733 | 3,543 | 1,894 | 2,733 |
| R-squared | 0.0037 | 0.0024 | 0.0029 | 0.0101 | 0.0113 | 0.0099 | 0.1624 | 0.1480 | 0.1539 |
| Mean Dep Variable | 26.04 | 25.58 | 25.86 | 0.303 | 0.301 | 0.302 | 0.503 | 0.505 | 0.504 |
| Using Bandwidth | 0.0972 | 0.0700 | 0.110 | 0.116 | 0.0700 | 0.110 | 0.157 | 0.0700 | 0.110 |
| Optimal Bandwidth | 0.0972 | 0.0972 | 0.0972 | 0.116 | 0.116 | 0.116 | 0.157 | 0.157 | 0.157 |

| Panel D | | | |
|--------------------------------------|---|------------------|------------------|
| Outcome: | School Level Financial Resources | | |
| | "Does your school experience financial problems?" | | |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.023 (0.024) | 0.038 (0.028) | 0.027 (0.023) |
| N | 10,813 | 7,389 | 11,011 |
| R-squared | 0.013 | 0.014 | 0.013 |
| Controls | Yes | Yes | Yes |
| Clusters | 2105 | 1563 | 2139 |
| Mean Dep Variable | 0.601 | 0.608 | 0.601 |
| Using Bandwidth | 0.108 | 0.0700 | 0.110 |
| Optimal Bandwidth | 0.108 | 0.108 | 0.108 |

This table reports the coefficient on political party turnover from regressing each of the variables on the running variable of the RDD ($IncumbVoteMargin$), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < Using\ Bandwidth$. It shows municipal-level regressions, using data from the Brazilian Federal Treasury for both election cycles 2008 and 2012 in Panels A-C. Panel A refers to different categories of municipal financial resources assessed one year after the election, Panel B refers to resources assessed two years after the election and Panel C refers to resources assessed three years after the election. Total Expenditures refer to a municipality's total budget, at 2008 Brazilian Reais price-levels scaled by a factor of 1,000,000. Expenditures on Education (share) is the share of the municipality's total budget spent on education and Expenditures on Personnel (share) is the share of the municipality's total budget spent on personnel and labor related expenses across all sectors in the municipality – not only education. Panel D shows school-level regressions, using data from the *Prova Brasil* headmaster questionnaire (for both election-cycles). Controls in Panel C include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

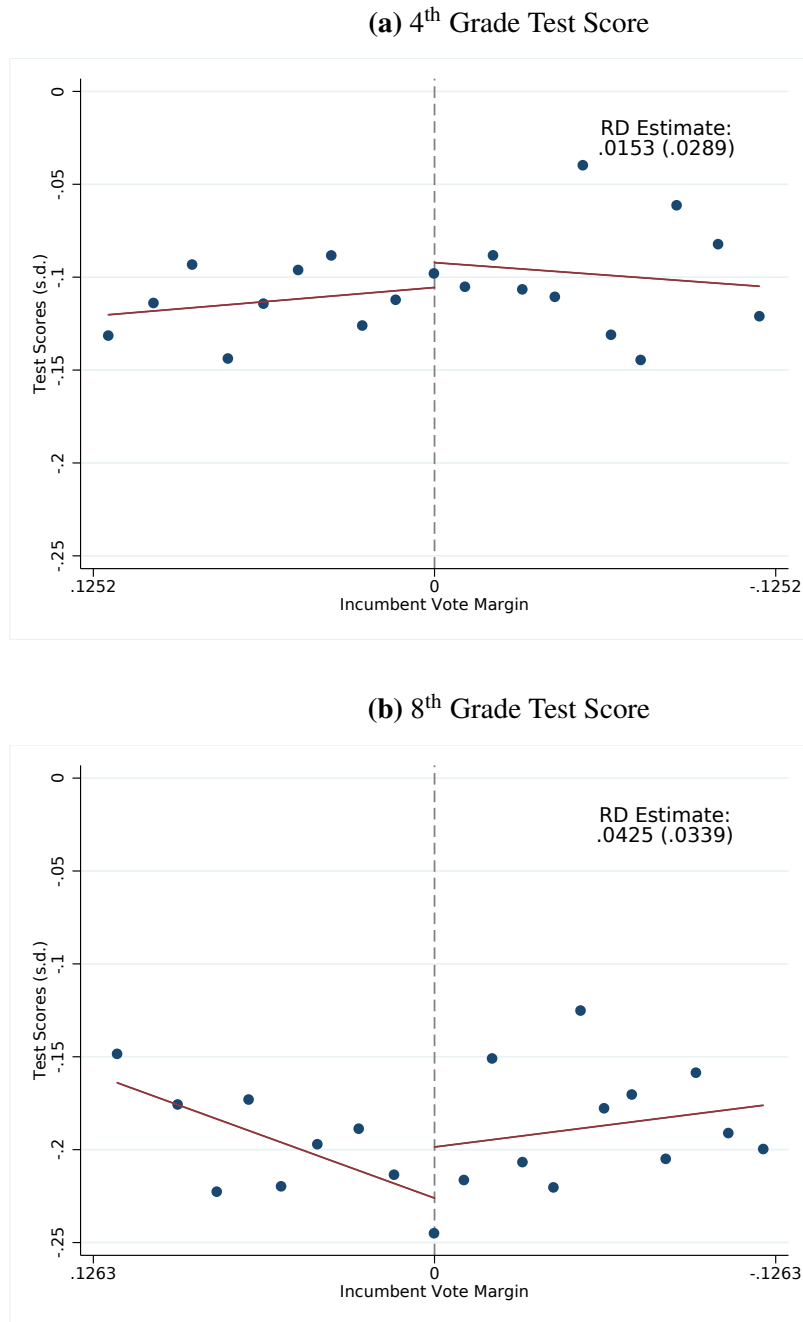
Appendix Figures and Tables (For online publication)

Figure A1: Distribution of Incumbent Vote Margin



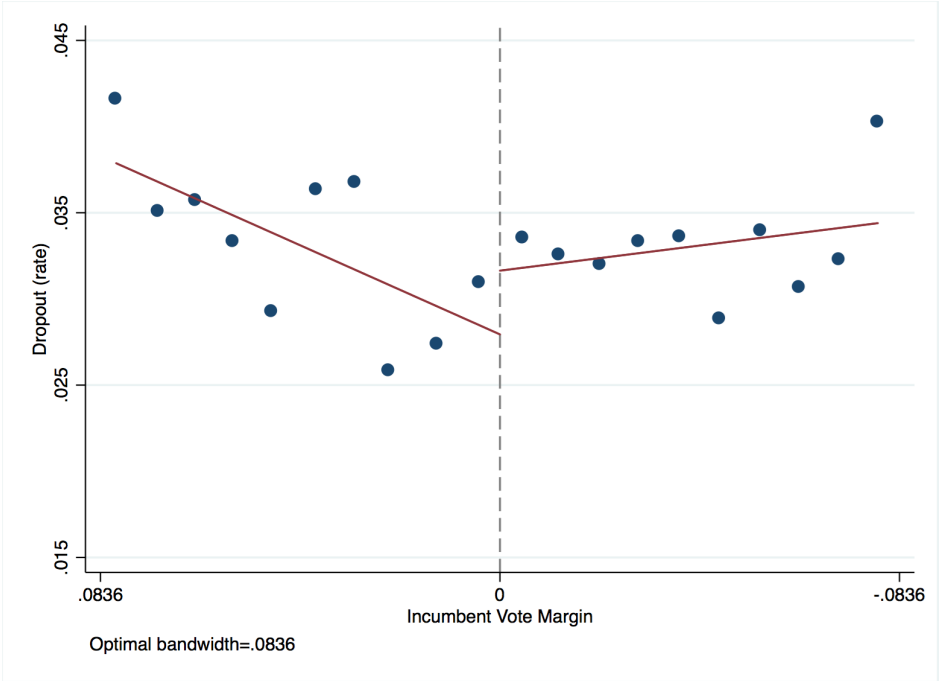
Notes: This histogram shows the distribution of the running variable in the RDD, *IncumbVoteMargin*, in our sample of municipalities in the 2008 and 2012 election cycle. *IncumbVoteMargin* is computed as the vote share of the incumbent political party minus the vote share of the incumbent party's strongest opponent.

Figure A2: Political Turnover and Test Scores at Baseline



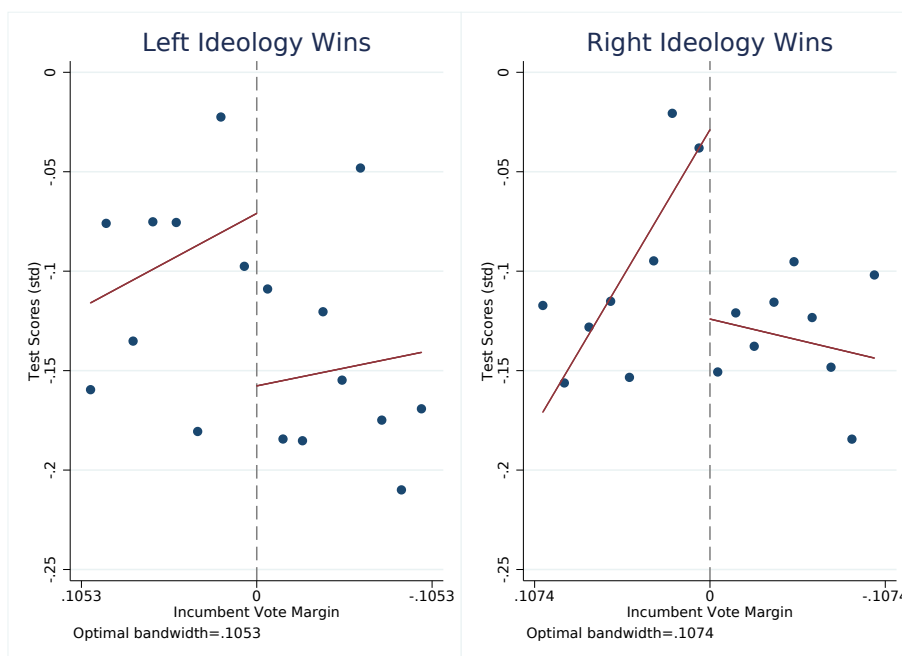
Notes: These graphs show the (lack of a) discontinuity in test scores one year prior to the election as a function of incumbent vote margin during the election for individual-level 4th (Panel A) and 8th (Panel B) grade test scores. Municipalities with $IncumbVoteMargin < 0$ experienced a change in the political party of the mayor. Municipalities with $IncumbVoteMargin > 0$ did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam at baseline (the year before the election) and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. The school-level average test scores for the respective grade prior to the baseline year is included as a control.

Figure A3: Political Turnover and School-level Dropout Rates



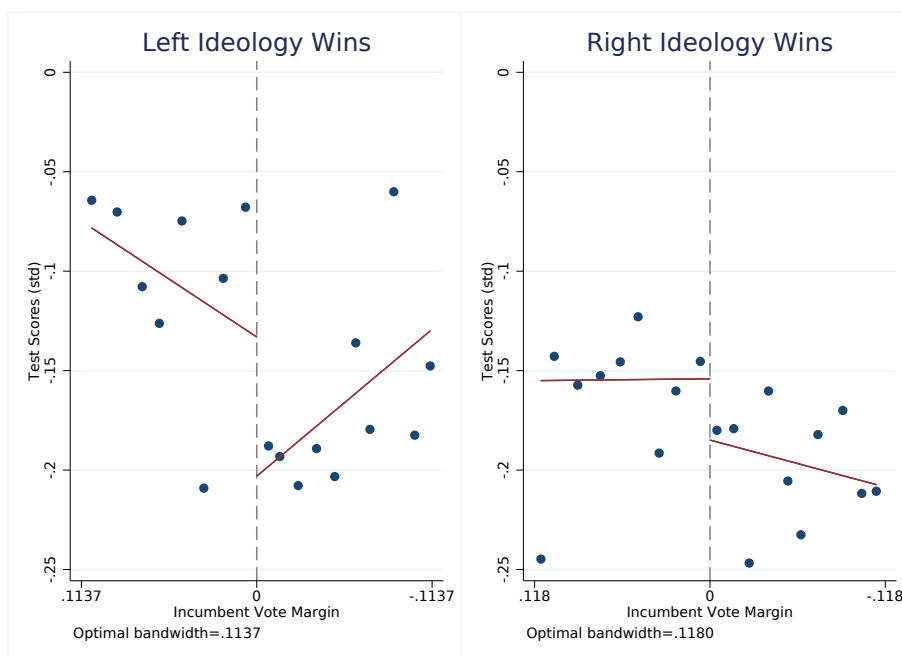
Notes: This figure shows the mean of school-level dropout rates by bins of *IncumbVoteMargin*. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. The school-level dropout rate is measured by the School Census and refers to the dropout rate for all students within a school (in all grade levels). The school-level dropout rate at baseline (the year before the respective election) is included as a control.

Figure A4: Political Turnover and 4th Grade Test Scores in Municipalities where the Winning Party was from the Left vs. the Right



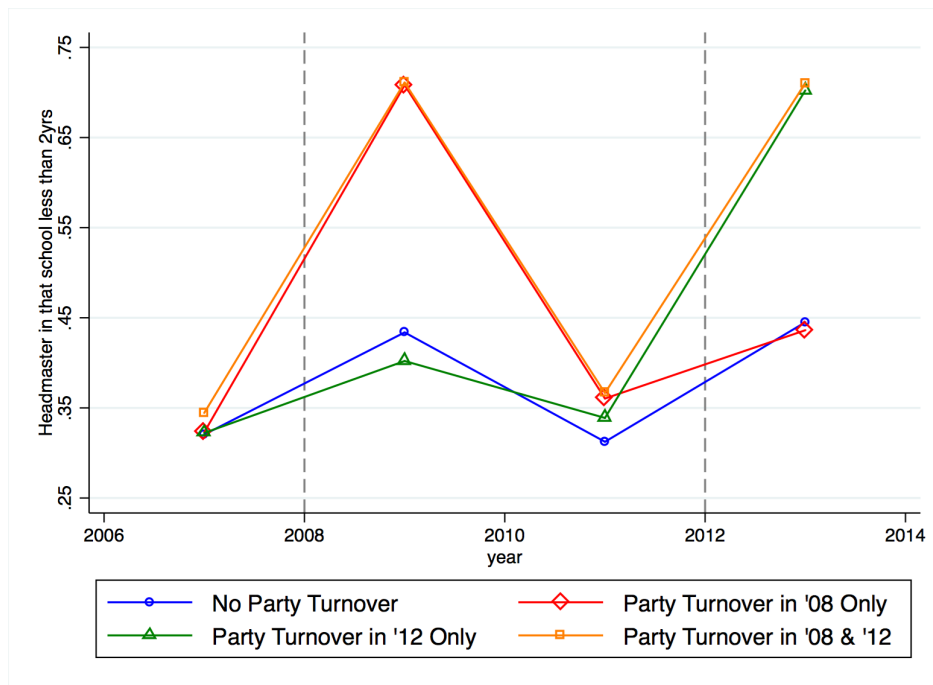
Notes: This figure shows the mean of individual-level 4th grade test scores by bins of *IncumbVoteMargin* separately for municipalities where the winning party was from the left and those where the winning party was from the right. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 4th grade test scores at baseline (the year before the respective election) is included as a control. Party ideology is classified as belonging to the left vs. the right according to *Atlas Político – Mapa do Congresso*.

Figure A5: Political Turnover and 8th Grade Test Scores in Municipalities where the Winning Party was from the Left vs. the Right



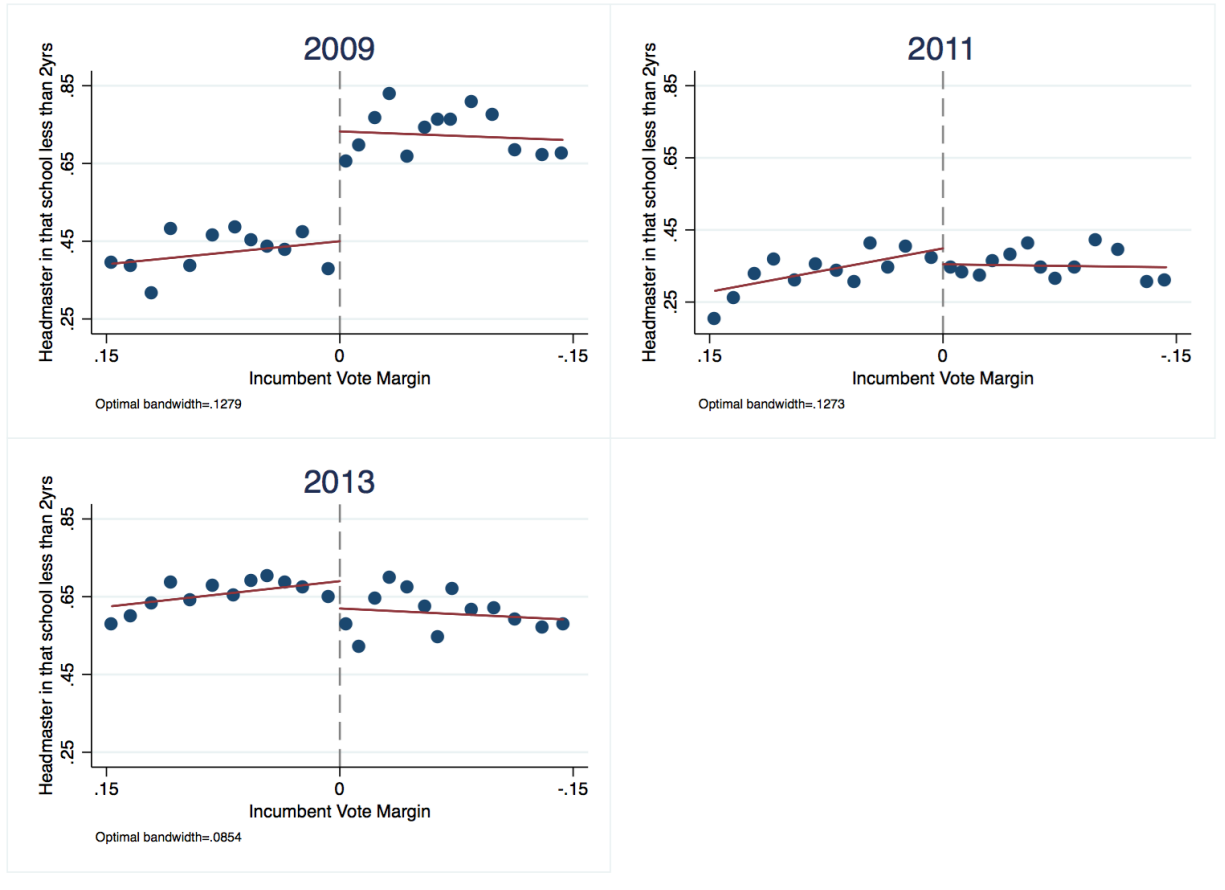
Notes: This figure shows the mean of individual-level 8th grade test scores by bins of *IncumbVoteMargin* separately for municipalities where the winning party was from the left and those where the winning party was from the right. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 8th grade test scores at baseline (the year before the respective election) is included as a control. Party ideology is classified as belonging to the left vs. the right according to *Atlas Político – Mapa do Congresso*.

Figure A6: Political Turnover and Headmaster Replacement - Event Study



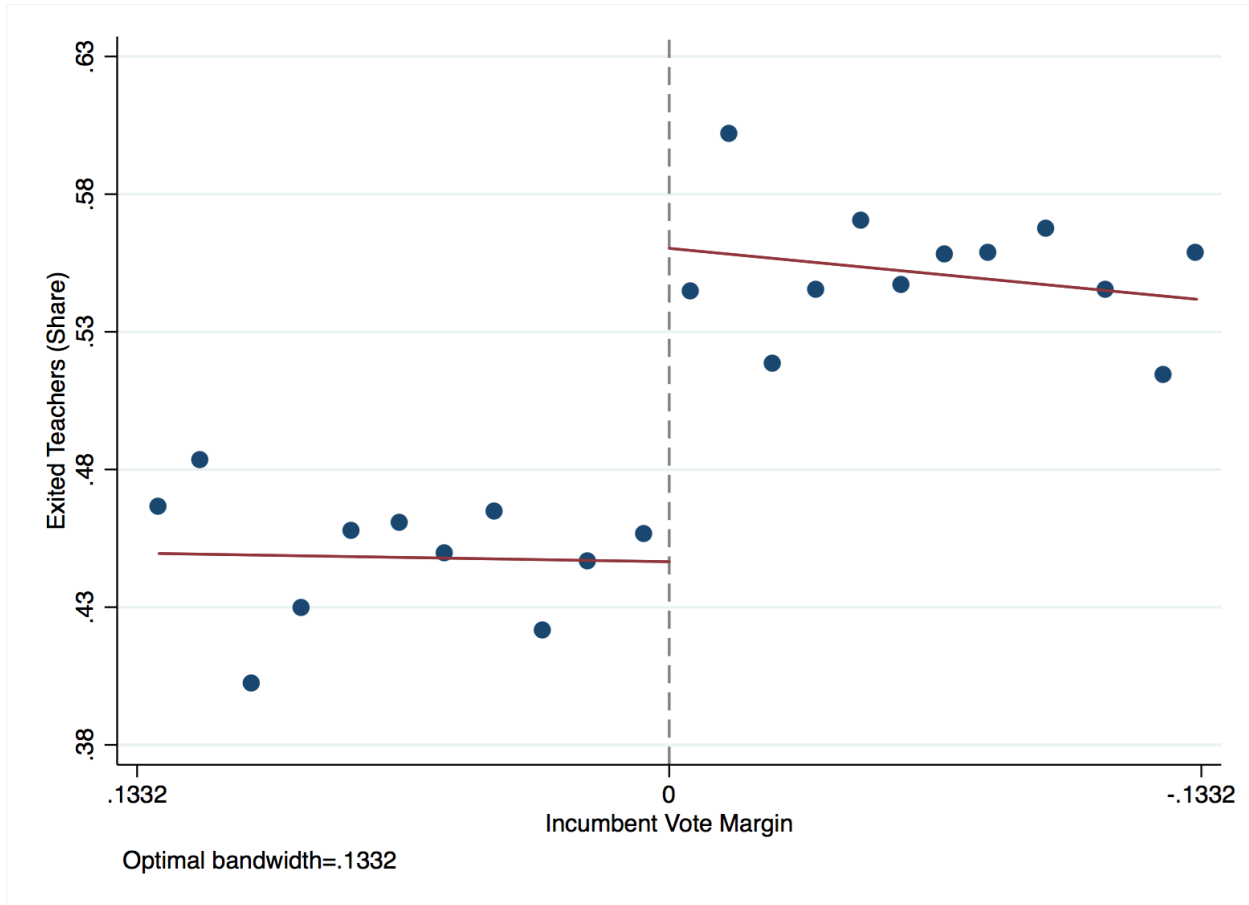
Notes: This figure shows the share of schools with a new headmaster in municipalities that: did not experience party turnover in either election cycle, experienced party turnover only in 2008, experienced party turnover only in 2012, or experienced party turnover in both election cycles. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire.

Figure A7: Political Turnover in 2008 and Headmaster Replacement 1, 3, and 5 Years After the Election



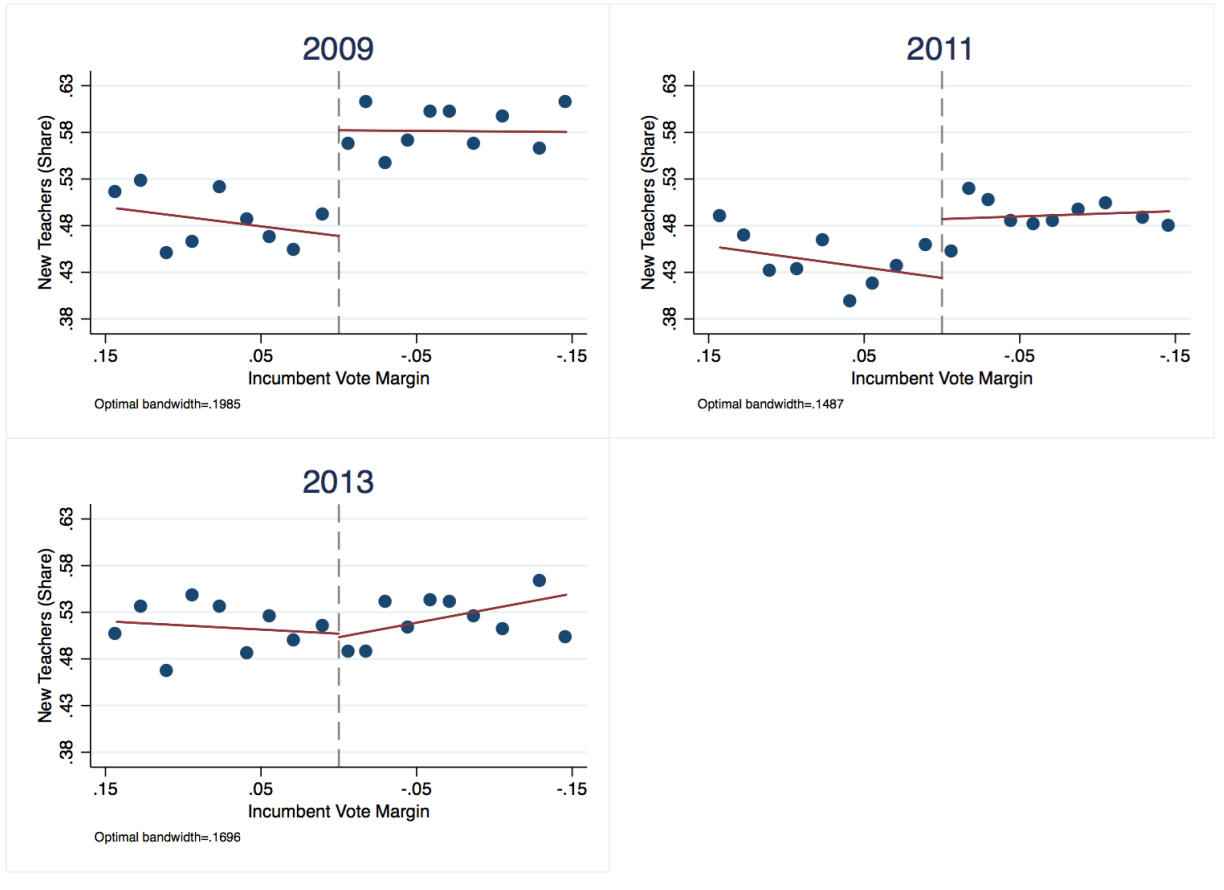
This figure shows the share of schools with a new headmaster by bins of $IncumbVoteMargin_{2008}$ separately for each year t , where t is one year, three years, and five years after the 2008 election. Municipalities with $IncumbVoteMargin_{2008} < 0$ experienced a change in the political party of the mayor. Municipalities with $IncumbVoteMargin_{2008} > 0$ did not experience a change in the political party of the mayor. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire.

Figure A8: Political Turnover and Teachers who have left



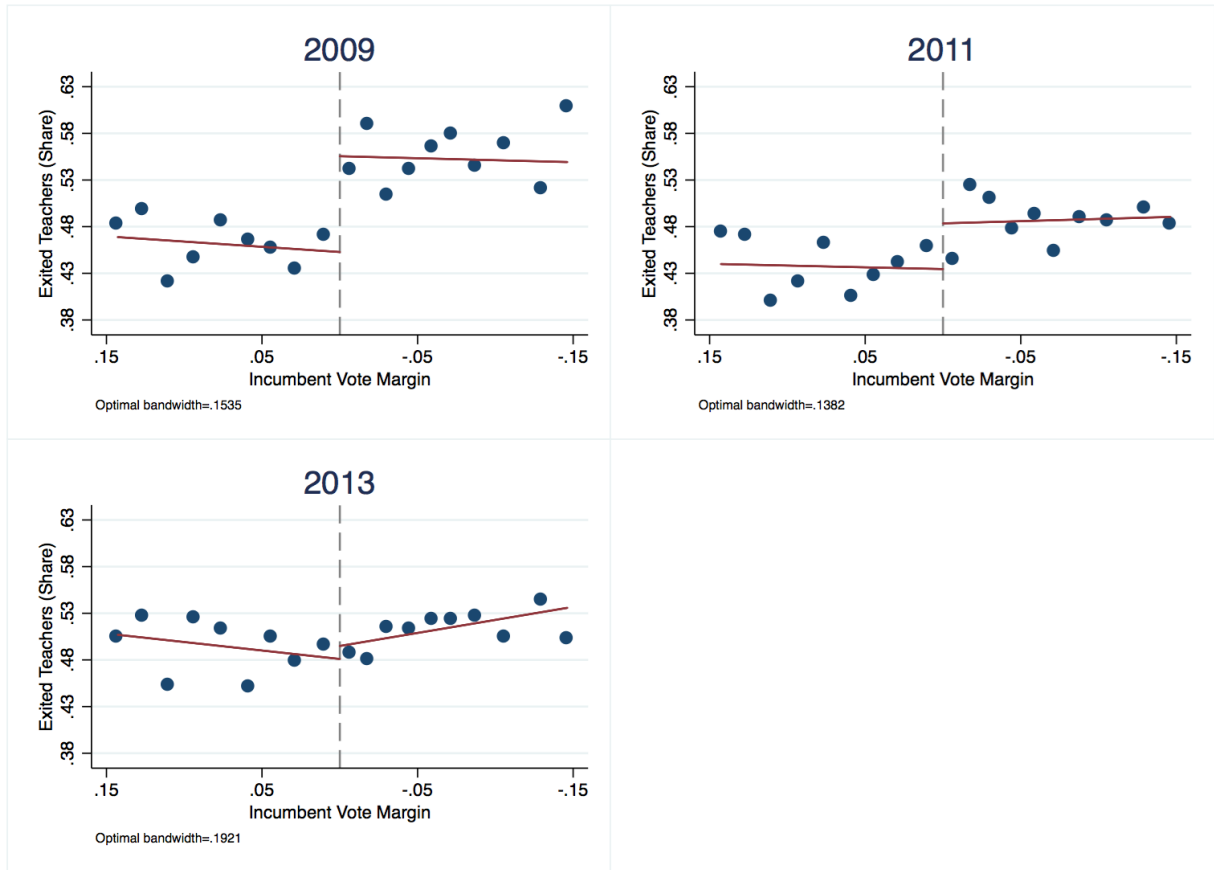
Notes: This figure shows the share of teachers who have left the school by bins of *IncumbVoteMargin*. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. The share of teachers who have left a school is computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ (the year before the respective election) but are no longer in that same school at time t (one year after the respective election).

Figure A9: Political Turnover in 2008 and New Teachers 1, 3, and 5 Years After the Election



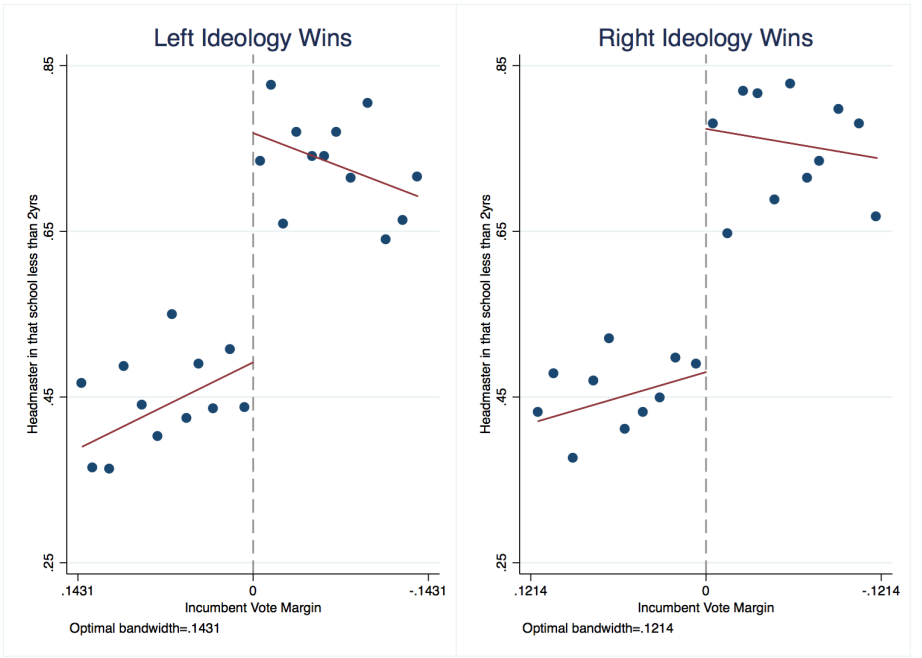
This figure shows the share of teachers that are new to a school by bins of $IncumbVoteMargin_{2008}$ separately for each year t , where t is one year, three years, and five years after the 2008 election. Municipalities with $IncumbVoteMargin_{2008} < 0$ experienced a change in the political party of the mayor. Municipalities with $IncumbVoteMargin_{2008} > 0$ did not experience a change in the political party of the mayor. The share of teachers that are new to a school is computed using the School Census and corresponds to the share of teachers in a school who are in that school at time t but were not in that same school at time $t - 2$.

Figure A10: Political Turnover in 2008 and Teachers that have Left 1, 3, and 5 Years After the Election



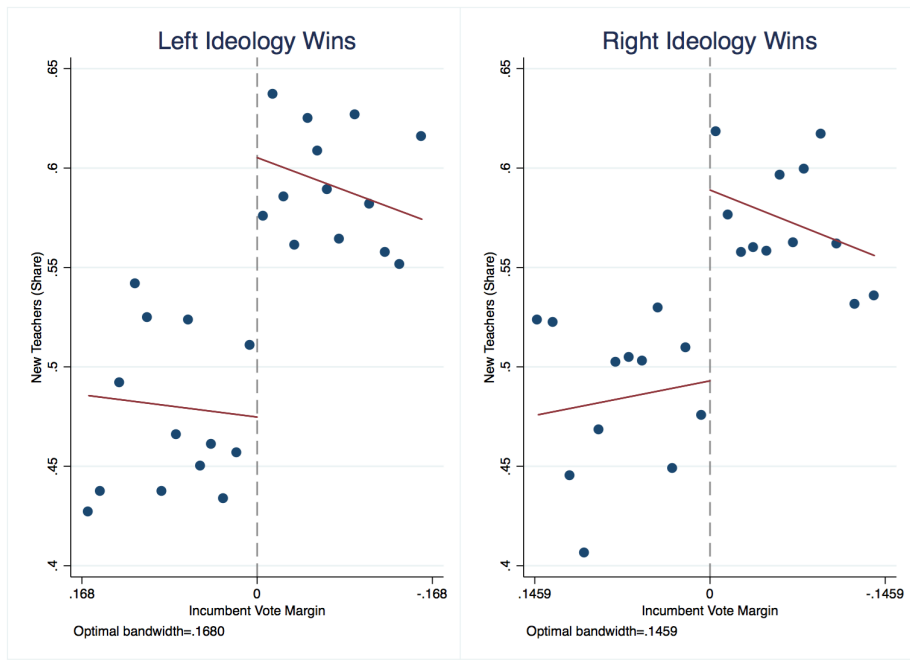
Notes: This figure shows the share of teachers that have left a school by bins of $IncumbVoteMargin_{2008}$ separately for each year t , where t is one year, three years, and five years after the 2008 election. Municipalities with $IncumbVoteMargin_{2008} < 0$ experienced a change in the political party of the mayor in 2008. Municipalities with $IncumbVoteMargin_{2008} > 0$ did not experience a change in the political party of the mayor in 2008. The share of teachers that have left a school is computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ but are no longer in that same school at time t .

Figure A11: Political Turnover and Headmaster Replacement in Municipalities where the Winning Party was from the Left vs. the Right



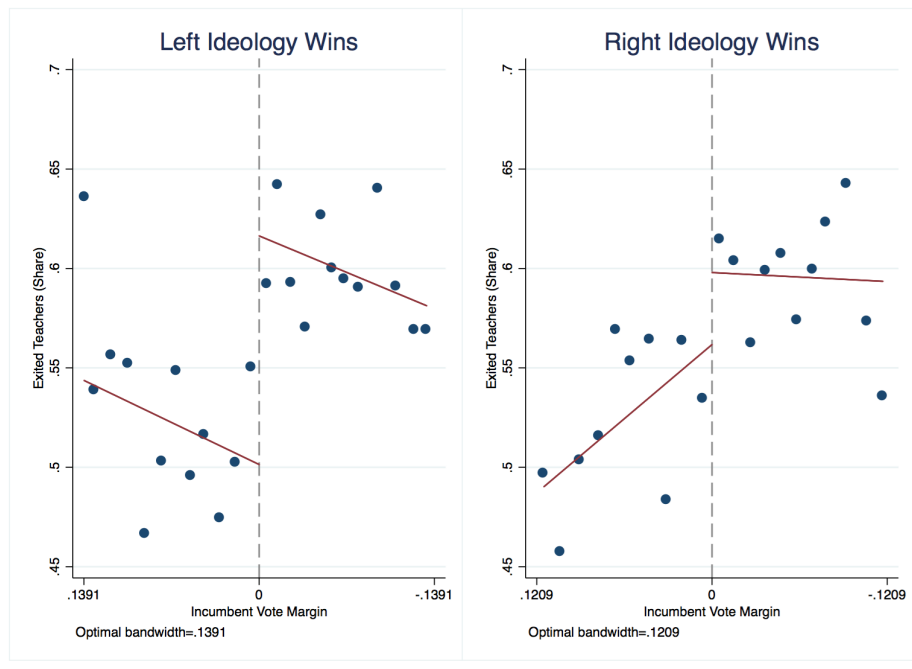
Notes: This figure shows the share of schools with a new headmaster by bins of *IncumbVoteMargin* separately for municipalities where the winning party was from the left and those where the winning party was from the right. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire. Party ideology is classified as belonging to the left vs. the right according to *Atlas Político – Mapa do Congresso*.

Figure A12: Political Turnover and New Teachers in Municipalities where the Winning Party was from the Left vs. the Right



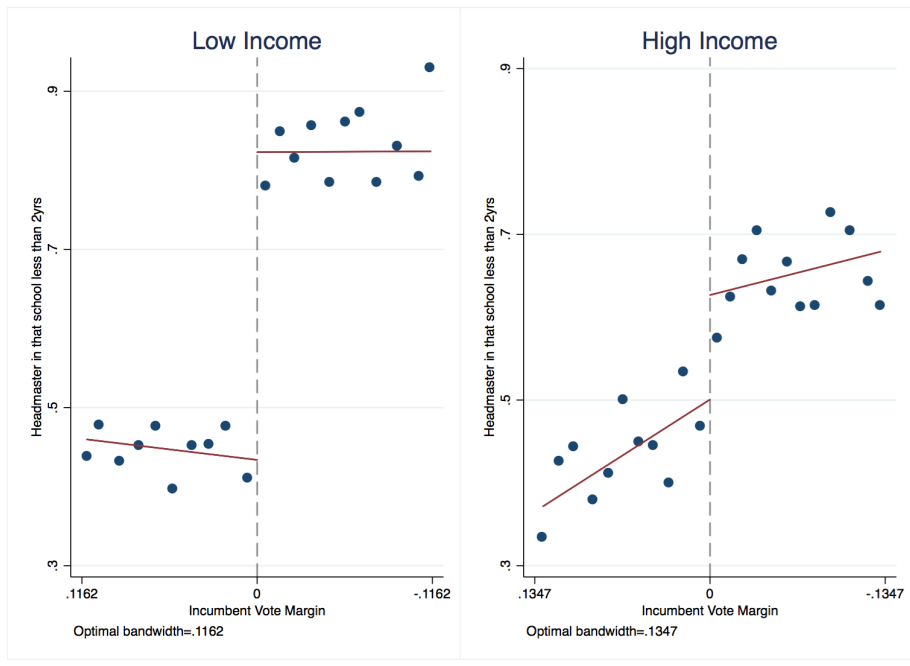
Notes: This figure shows the share of teachers that are new to a school by bins of *IncumbVoteMargin* separately for municipalities where the winning party was from the left and those where the winning party was from the right. Municipalities with *IncumbVoteMargin* < 0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin* > 0 did not experience a change in the political party of the mayor. The share of teachers that are new to a school is computed using the School Census and corresponds to the share of teachers in a school who are in that school at time t (one year after the respective election) but were not in that same school at time $t - 2$ (the year before the respective election). Party ideology is classified as belonging to the left vs. the right according to *Atlas Político – Mapa do Congresso*.

Figure A13: Political Turnover and Teachers that have Left in Municipalities where the Winning Party was from the Left vs. the Right



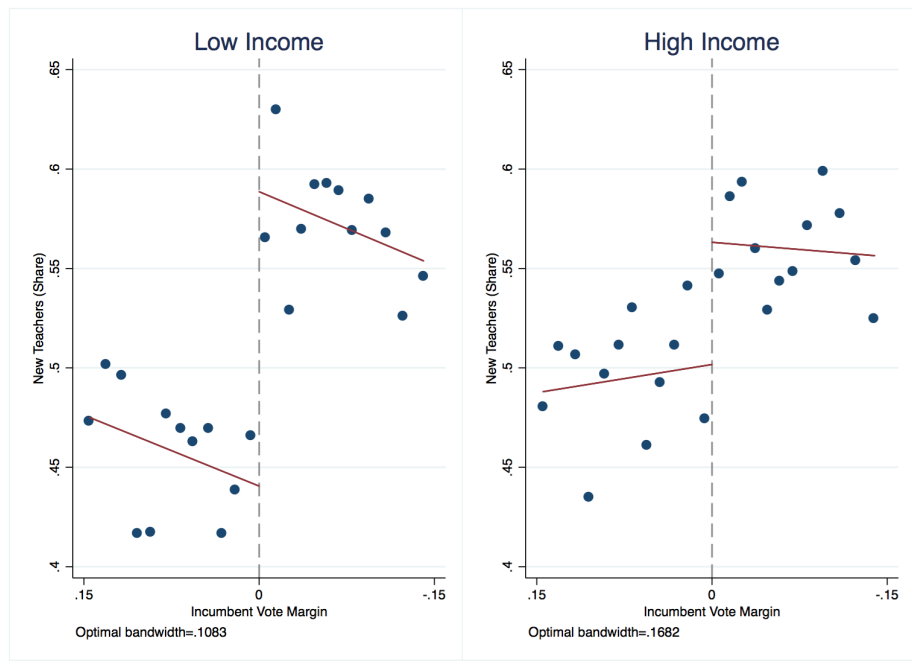
Notes: This figure shows the share of teachers that have left a school by bins of *IncumbVoteMargin* separately for municipalities where the winning party was from the left and those where the winning party was from the right. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. The share of teachers that have left a school is computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ (the year before the respective election) but are no longer in that same school at time t (one year after the respective election). Party ideology is classified as belonging to the left vs. the right according to *Atlas Político – Mapa do Congresso*.

Figure A14: Political Turnover and Headmaster Replacement in Low- and High-income Municipalities



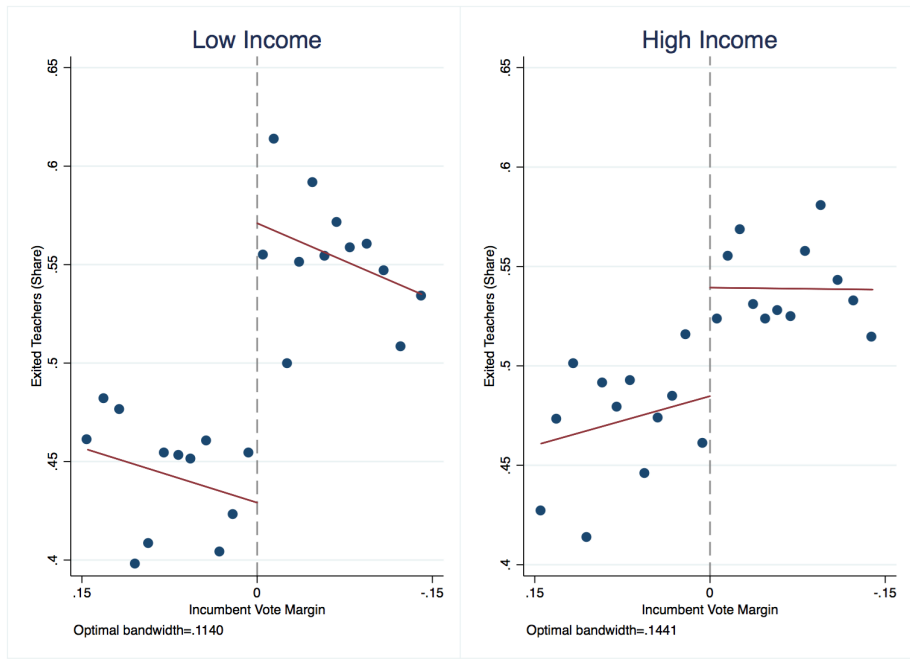
Notes: This figure shows the share of schools with a new headmaster by bins of *IncumbVoteMargin* separately for municipalities with high and low income. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Figure A15: Political Turnover and New Teachers in Low- and High-income Municipalities



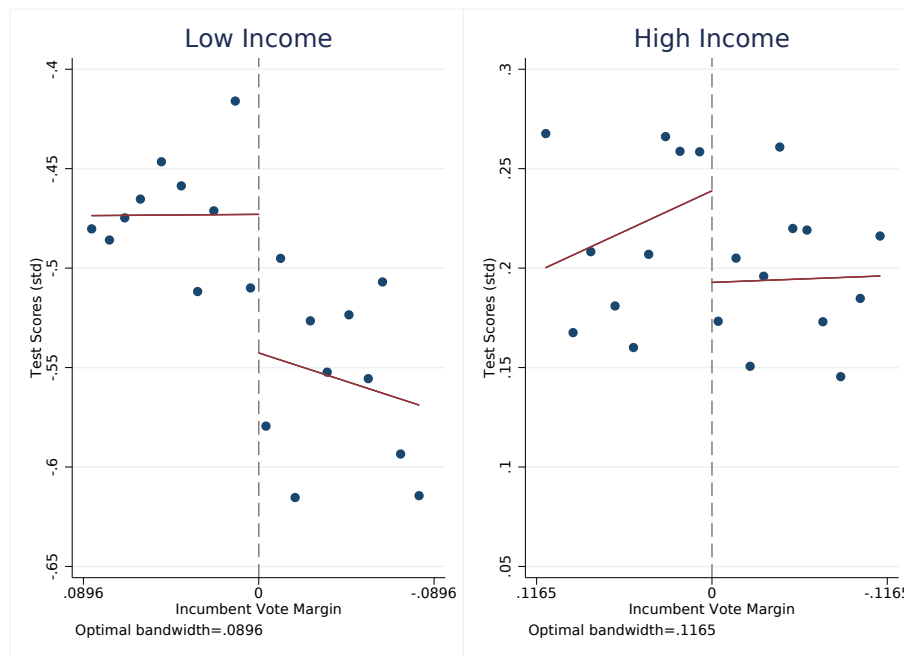
Notes: This figure shows the share of teachers that are new to a school by bins of *IncumbVoteMargin* separately for municipalities with high and low income. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. The share of teachers that are new to a school is computed using the School Census and corresponds to the share of teachers in a school who are in that school at time t (one year after the respective election) but were not in that same school at time $t - 2$ (the year before the respective election). Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Figure A16: Political Turnover and Teachers that have Left in Low- and High-income Municipalities



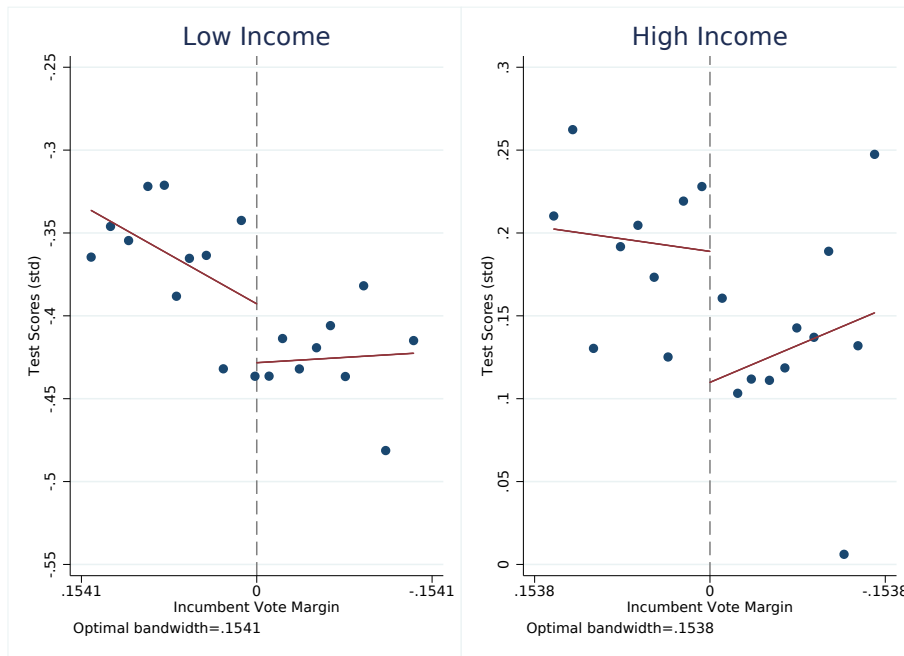
Notes: This figure shows the share of teachers that have left a school by bins of *IncumbVoteMargin* separately for municipalities with high and low income. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. The share of teachers that have left a school is computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ (the year before the respective election) but are no longer in that same school at time t (one year after the respective election). Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Figure A17: Political Turnover and 4th Grade Test Scores in Low- and High-income Municipalities



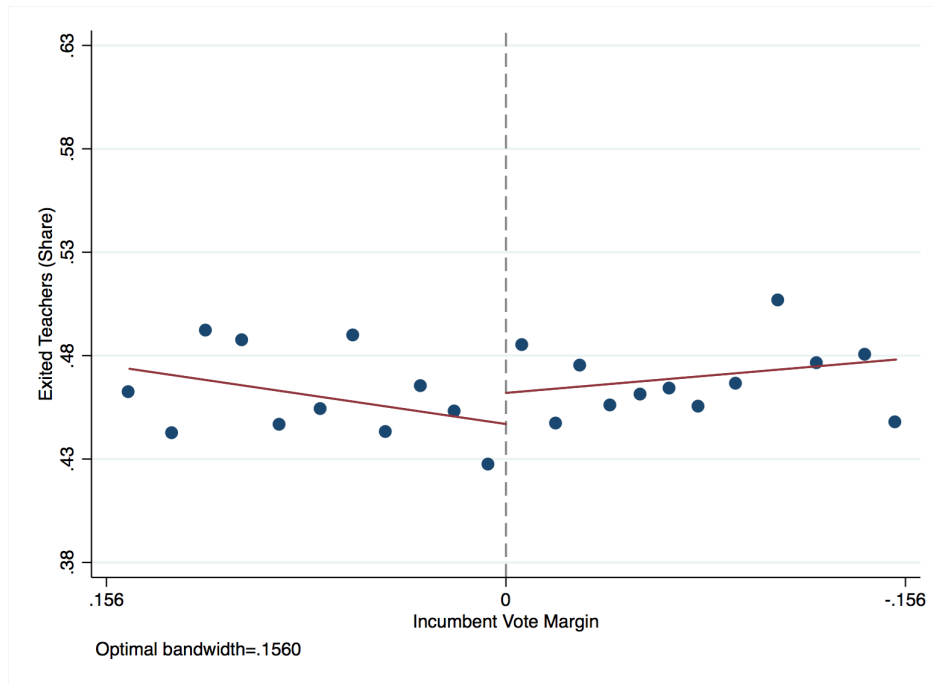
Notes: This figure shows the mean of individual-level 4th grade test scores by bins of *IncumbVoteMargin* separately for municipalities with high and low income. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 4th grade test scores at baseline (the year before the respective election) is included as a control. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Figure A18: Political Turnover and 8th Grade Test Scores in Low- and High-income Municipalities



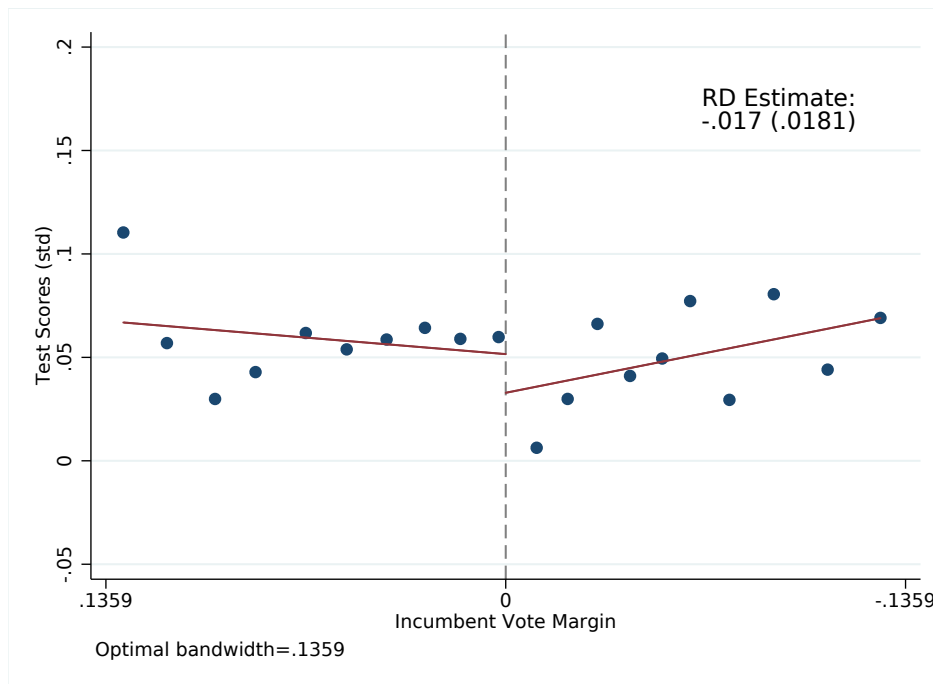
Notes: This figure shows the mean of individual-level 8th grade test scores by bins of *IncumbVoteMargin* separately for municipalities with high and low income. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 8th grade test scores at baseline (the year before the respective election) is included as a control. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Figure A19: Political Turnover and Teachers that have Left in Non-municipal Schools



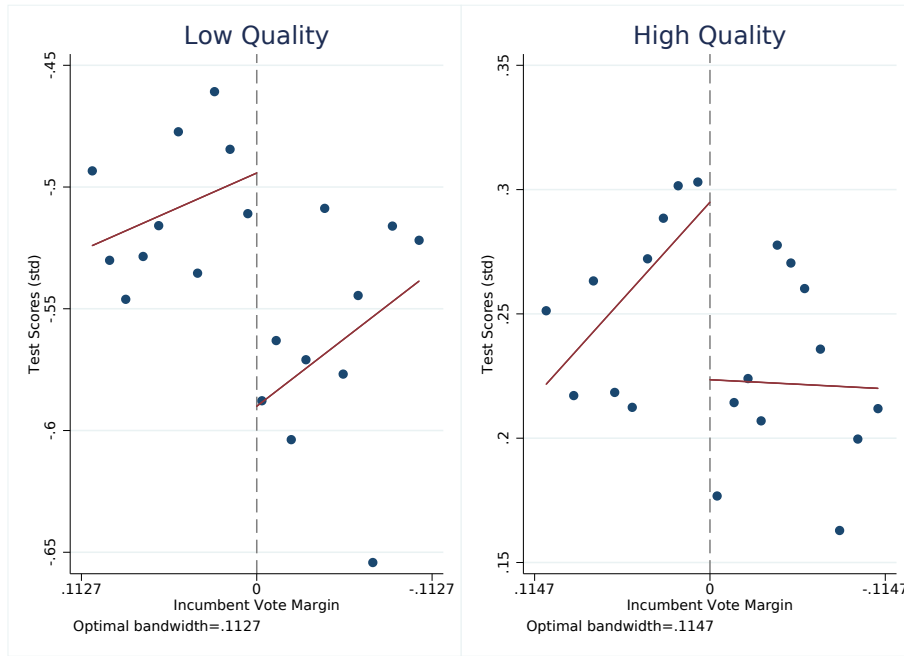
Notes: This figure shows the share of teachers that have left *non-municipal* schools by bins of *IncumbVoteMargin*. Municipalities with $IncumbVoteMargin < 0$ experienced a change in the political party of the mayor. Municipalities with $IncumbVoteMargin > 0$ did not experience a change in the political party of the mayor. The share of teachers that have left a school is computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ (the year before the respective election) but are no longer in that same school at time t (one year after the respective election). The set of *non-municipal* schools for this outcome is comprised of state, federal, and private schools.

Figure A20: Political Turnover and 8th Grade Test Scores in Non-municipal Schools



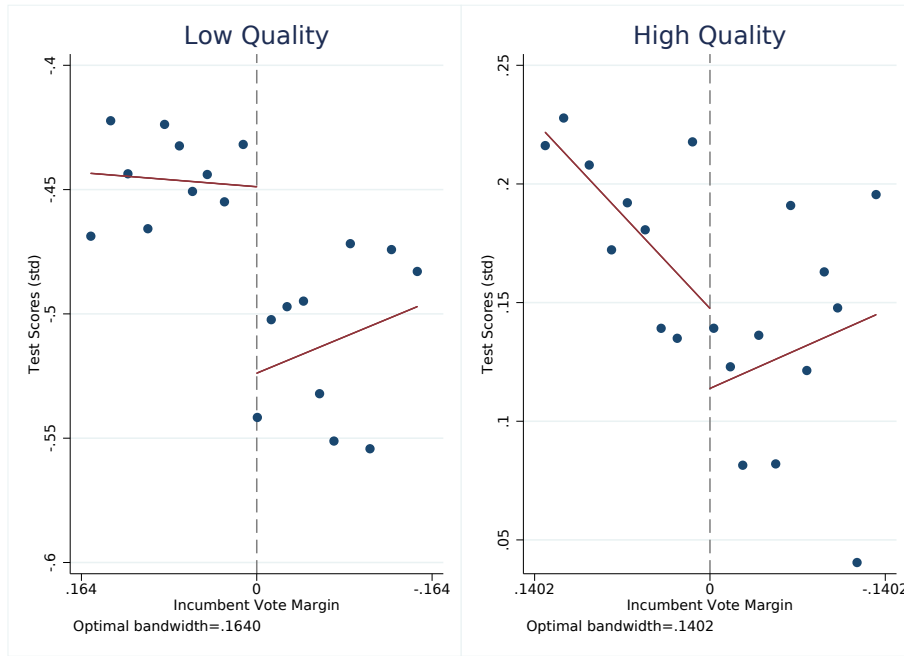
Notes: This figure shows the mean of individual-level 8th grade test scores for students in *non-municipal* schools by bins of *IncumbVoteMargin*. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 8th grade test scores at baseline (the year before the respective election) is included as a control. The set of *non-municipal* schools for this outcome is comprised of state and federal schools, since only public schools participate in the *Prova Brasil* exam.

Figure A21: Political Turnover and 4th Grade Test Scores in Low- and High-quality Schools



Notes: This figure shows the mean of individual-level 4th grade test scores by bins of *IncumbVoteMargin* separately for low- and high-quality *municipal* schools. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 4th grade test scores at baseline (the year before the respective election) is included as a control. Low-quality schools are those below the median in the school-level distribution of test scores at baseline (the year before the respective election). High-quality schools are those above the median in this distribution.

Figure A22: Political Turnover and 8th Grade Test Scores in Low- and High-quality Schools



Notes: This figure shows the mean of individual-level 8th grade test scores by bins of *IncumbVoteMargin* separately for low- and high-quality *municipal* schools. Municipalities with *IncumbVoteMargin*<0 experienced a change in the political party of the mayor. Municipalities with *IncumbVoteMargin*>0 did not experience a change in the political party of the mayor. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. Average, school-level 8th grade test scores at baseline (the year before the respective election) is included as a control. Low-quality schools are those below the median in the school-level distribution of test scores at baseline (the year before the respective election). High-quality schools are those above the median in this distribution.

Table A1: Political Turnover and 4th Grade Test Scores for All Municipalities

| | Outcome: Individual 4 th Grade Test Scores (standardized) | | | | | |
|------------------------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Party Turnover | -0.065** (0.031) | -0.066** (0.029) | -0.070** (0.036) | -0.066** (0.033) | -0.070** (0.031) | -0.070** (0.028) |
| School-level baseline scores | 0.841*** (0.018) | 0.713*** (0.019) | 0.827*** (0.024) | 0.701*** (0.026) | 0.838*** (0.017) | 0.711*** (0.018) |
| N | 582,788 | 582,788 | 405,856 | 405,856 | 601,125 | 601,125 |
| R-squared | 0.199 | 0.235 | 0.189 | 0.225 | 0.197 | 0.233 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 2153 | 2153 | 1606 | 1606 | 2193 | 2193 |
| Using Bandwidth | 0.107 | 0.107 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 | 0.107 |

This table includes the sample of **all** municipalities, including those with irregular elections and those that could potentially go to a second round of elections (population $\geq 200,000$). The endogenous variable, Party Turnover, is instrumented for using the incumbent political party's vote margin from the first round of regular elections. The first-stage coefficients for the instrument range from .80-.81 across bandwidths (not reported). All specifications control for school-level, average test scores for 4th graders at baseline (one year before the respective election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet), individual-level controls (an indicator variable for gender, whether the student is white, and whether the student sees their mother reading), and a 2012 election-cycle indicator.

Table A2: Political Turnover and 8th Grade Test Scores for All Municipalities

| | Outcome: Individual 8 th Grade Test Scores (standardized) | | | | | |
|------------------------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Party Turnover | -0.080*** (0.029) | -0.068** (0.030) | -0.086** (0.038) | -0.087** (0.038) | -0.086** (0.034) | -0.084** (0.034) |
| School-level baseline scores | 0.763*** (0.014) | 0.706*** (0.015) | 0.757*** (0.015) | 0.701*** (0.016) | 0.772*** (0.014) | 0.711*** (0.014) |
| N | 335,824 | 335,824 | 169,556 | 169,556 | 255,509 | 255,509 |
| R-squared | 0.137 | 0.151 | 0.140 | 0.153 | 0.148 | 0.161 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1536 | 1536 | 1010 | 1010 | 1401 | 1401 |
| Using Bandwidth | 0.124 | 0.124 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.124 | 0.124 | 0.124 | 0.124 | 0.124 | 0.124 |

This table includes the sample of **all** municipalities, including those with irregular elections and those that could potentially go to a second round of elections (population $\geq 200,000$). The endogenous variable, Party Turnover, is instrumented for using the incumbent political party's vote margin from the first round of regular elections. The first-stage coefficients for the instrument range from .80-.81 across bandwidths (not reported). All specifications control for school-level, average test scores for 8th graders at baseline (one year before the respective election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet), individual-level controls (an indicator variable for gender, whether the student is white, and whether the student sees their mother reading), and a 2012 election-cycle indicator.

Table A3: Candidate Turnover and 4th Grade and 8th Grade Test Scores

| Panel A | Outcome: Individual 4 th Grade Test Scores (standardized) | | | | | |
|---|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbCandidateVoteMargin < 0\}$ | -0.078*** (0.028) | -0.094*** (0.026) | -0.090*** (0.032) | -0.102*** (0.029) | -0.078*** (0.028) | -0.094*** (0.025) |
| School-level baseline scores | 0.868*** (0.014) | 0.735*** (0.013) | 0.875*** (0.013) | 0.746*** (0.013) | 0.870*** (0.013) | 0.735*** (0.013) |
| Observations | 338,152 | 338,152 | 246,872 | 246,872 | 366,391 | 366,391 |
| Schl Controls | No | Yes | No | Yes | No | Yes |
| Indiv Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1723 | 1723 | 1309 | 1309 | 1867 | 1867 |
| Using Bandwidth | 0.0980 | 0.0980 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.0980 | 0.0980 | 0.0980 | 0.0980 | 0.0980 | 0.0980 |

| Panel B | Outcome: Individual 8 th Grade Test Scores (standardized) | | | | | |
|---|--|----------------------|---------------------|---------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbCandidateVoteMargin < 0\}$ | -0.071*** (0.026) | -0.068*** (0.026) | -0.063* (0.034) | -0.064* (0.033) | -0.079*** (0.028) | -0.076*** (0.028) |
| School-level baseline scores | 0.792*** (0.014) | 0.735*** (0.014) | 0.772*** (0.017) | 0.721*** (0.017) | 0.781*** (0.015) | 0.724*** (0.015) |
| Observations | 181,865 | 181,865 | 106,072 | 106,072 | 161,483 | 161,483 |
| Schl Controls | No | Yes | No | Yes | No | Yes |
| Indiv Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1344 | 1344 | 833 | 833 | 1191 | 1191 |
| Using Bandwidth | 0.129 | 0.129 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.129 | 0.129 | 0.129 | 0.129 | 0.129 | 0.129 |

This table reports the coefficient on candidate turnover from regressing individual-level 4th grade test scores (Panel A) and 8th grade test scores (Panel B) on the running variable of the RDD (*IncumbCandidateVoteMargin*), candidate turnover ($\mathbb{1}\{IncumbCandidateVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbCandidateVoteMargin| < Using\ Bandwidth$. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. All specifications control for school-level, average test scores for the respective grader at baseline (one year before the respective election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet), individual-level controls (an indicator variable for gender, whether the student is white, and whether the student sees their mother reading), and a 2012 election-cycle indicator.

Table A4: Selection of Municipalities and Schools into the Sample

| | (1) All Municipalities | | (2) Sample Municipalities | | (3) Sample Municipalities & School takes PB | |
|--|---------------------------|------------|------------------------------|-----------|---|-----------|
| | Mean | SD | Mean | SD | Mean | SD |
| Municipal Characteristics | | | | | | |
| Municipality population | 33,290.76 | 197,908.57 | 20,201.30 | 27,236.13 | 21,180.96 | 27,771.40 |
| Ruling party from left | 0.26 | 0.44 | 0.26 | 0.44 | 0.26 | 0.44 |
| Winning party from left | 0.30 | 0.46 | 0.28 | 0.45 | 0.28 | 0.45 |
| Ruling party from right | 0.56 | 0.50 | 0.55 | 0.50 | 0.55 | 0.50 |
| Winning party from right | 0.53 | 0.50 | 0.53 | 0.50 | 0.53 | 0.50 |
| School Characteristics | | | | | | |
| Number of schools per municipality | 17.85 | 29.62 | 14.88 | 20.54 | 4.96 | 6.51 |
| Share urban | 0.34 | 0.47 | 0.31 | 0.46 | 0.73 | 0.45 |
| Share connected to grid | 0.85 | 0.36 | 0.86 | 0.35 | 0.99 | 0.11 |
| Share connected to water network | 0.45 | 0.50 | 0.43 | 0.50 | 0.80 | 0.40 |
| Share connected to sewage system | 0.21 | 0.41 | 0.18 | 0.39 | 0.41 | 0.49 |
| Share with regular trash collection | 0.45 | 0.50 | 0.44 | 0.50 | 0.85 | 0.35 |
| Share with Internet | 0.29 | 0.45 | 0.27 | 0.45 | 0.64 | 0.48 |
| Number of teachers per school | 9.67 | 11.42 | 8.79 | 10.17 | 18.83 | 11.27 |
| Teacher age | 37.26 | 6.64 | 37.13 | 6.56 | 38.27 | 3.97 |
| Share of female teachers | 0.81 | 0.28 | 0.82 | 0.27 | 0.85 | 0.15 |
| Share of teachers with B.A. | 0.50 | 0.41 | 0.51 | 0.40 | 0.70 | 0.29 |
| Share of teachers who took <i>Concurso</i> | 0.64 | 0.38 | 0.63 | 0.38 | 0.76 | 0.26 |
| Number of students per school | 190.37 | 252.30 | 163.43 | 214.72 | 378.56 | 245.30 |
| Share of female students | 0.47 | 0.09 | 0.47 | 0.09 | 0.48 | 0.04 |
| Share of student with urban residence | 0.32 | 0.42 | 0.29 | 0.40 | 0.64 | 0.39 |
| Number classrooms per school | 8.42 | 8.92 | 7.66 | 7.96 | 15.69 | 8.44 |
| Students/class per school | 18.51 | 7.38 | 17.72 | 7.15 | 23.41 | 4.91 |
| Number of 4th graders per school | 23.33 | 35.78 | 20.34 | 30.72 | 49.84 | 38.31 |
| Number of 8th graders per school | 10.66 | 30.96 | 8.83 | 26.65 | 24.07 | 41.44 |
| N (municipality-election cycle) | 11,106 | | 5,966 | | 5,608 | |

This table shows descriptive statistics for: all municipalities, municipalities in our sample, and municipalities in our sample with at least one school that participates in the *Prova Brasil* exam. Our sample is selected by dropping: municipalities with irregular elections, municipalities that could potentially go to second-round elections, and municipalities where the incumbent political party did not run for re-election. Furthermore, schools that participate in the *Prova Brasil* exam are schools with at least 20 students enrolled in the relevant grade-level. Hence the sample of schools for which we have *Prova Brasil* data for is also “selected.” The unit of observations is a municipality-election cycle.

Table A5: Descriptive Statistics and Test for Discontinuity in Baseline Characteristics, $|IncumbVoteMargin| < .09$

| | (1) No Party Turnover | (2) Party Turnover | (3) P-value |
|---|--------------------------|-----------------------|----------------|
| Number of Municipalities | 1,233 | 1,195 | . |
| School Characteristics | | | |
| Share connected to grid | 0.83 | 0.84 | 0.30 |
| Share with regular trash collection | 0.37 | 0.40 | 0.70 |
| Share of female students | 0.46 | 0.47 | 0.82 |
| Share of students born in same municipality | 0.62 | 0.63 | 0.72 |
| Share of student with urban residence | 0.25 | 0.27 | 0.64 |

This table shows additional descriptive statistics for school-level characteristics in municipalities that did not have political party turnover and municipalities that did have political party turnover in close elections, $|IncumbVoteMargin| < .09$, in Columns 1-2. Column 3 tests for a discontinuity in baseline characteristics at the $IncumbVoteMargin=0$ threshold: This column reports the p-value corresponding to the coefficient on $\mathbb{1}\{IncumbVoteMargin < 0\}$ in our main specification, Equation 1, with the corresponding variable at baseline used as the dependent variable. The remaining set of characteristics are shown in Table 1.

Table A6: Political Turnover and Student Composition

| Outcome: | Female (1) | White (2) | Asset Index (3) | Mother's Education (4) | Mother Reads (5) | Parental Support Index (6) | Works Outside (7) | Previously Failed (8) | Previously Dropped Out (9) |
|--------------------------------------|-------------------|-------------------|-----------------------|------------------------------|------------------------|----------------------------------|-------------------------|-----------------------------|----------------------------------|
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.007 (0.006) | -0.011 (0.013) | 0.059 (0.215) | 0.085 (0.097) | -0.0002 (0.011) | -0.002 (0.038) | -0.006 (0.004) | -0.005 (0.012) | -0.002 (0.004) |
| N | 933,305 | 933,305 | 933,143 | 933,305 | 933,305 | 933,143 | 933,305 | 691,559 | 700,956 |
| R-squared | 0.001 | 0.015 | 0.055 | 0.010 | 0.008 | 0.003 | 0.002 | 0.016 | 0.005 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Clusters | 2294 | 2294 | 2294 | 2294 | 2294 | 2294 | 2294 | 2287 | 2287 |
| Mean Dep Var | 0.381 | 0.231 | -1.358 | 4.091 | 0.628 | -0.0834 | 0.134 | 0.369 | 0.0818 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.133 | 0.103 | 0.117 | 0.137 | 0.133 | 0.112 | 0.134 | 0.0972 | 0.114 |

This table reports the coefficient on political party turnover from regressing each of the student characteristic variables on the running variable of the RDD ($IncumbVoteMargin$), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < Using\ Bandwidth$. The Asset Index is constructed as follows. We standardize the responses to a series of questions – regarding the number of household items (colored TV, radio, fridge, bathroom), whether or not the student has other items (a VCR/DVD player, a freezer, a vacuum cleaner, a computer, Internet), and how often a domestic worker comes to the student's house – by subtracting the overall mean and dividing by the standard deviation of all student responses for each question. We then add all these standardized question responses to arrive at the "Asset Index." The Parental Involvement Index is constructed as follows. We standardize responses to a series of questions – regarding how often the students' parents attend Parent-Teacher Council meetings, whether parents talk to the student about what happens in school, and whether parents incentivize the student to do homework, read, and attend school – by subtracting the overall mean and dividing by the standard deviation of all student responses for each question. We then add all these standardized question responses to arrive at the "Parental Involvement Index." Student characteristics are from the *Prova Brasil* questionnaire filled out by students. Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table A7: Political Turnover and Dropout Rates

| Outcome: | School-level Dropout Rates | | | | | |
|--------------------------------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.0039 (0.0036) | 0.0033 (0.0033) | 0.0049 (0.0034) | 0.0050 (0.0032) | 0.0031 (0.0033) | 0.0031 (0.0030) |
| Baseline dropout rate | 0.3423*** (0.0248) | 0.3130*** (0.0231) | 0.3399*** (0.0284) | 0.3139*** (0.0263) | 0.3380*** (0.0207) | 0.3060*** (0.0194) |
| N | 31,742 | 31,742 | 26,492 | 26,492 | 39,661 | 39,661 |
| R-squared | 0.1446 | 0.1651 | 0.1502 | 0.1681 | 0.1391 | 0.1614 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 2029 | 2029 | 1783 | 1783 | 2412 | 2412 |
| Mean Dep Var | 0.0337 | 0.0337 | 0.0323 | 0.0323 | 0.0335 | 0.0335 |
| Using Bandwidth | 0.0836 | 0.0836 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.0836 | 0.0836 | 0.0836 | 0.0836 | 0.0836 | 0.0836 |

This table reports the coefficient on political party turnover from regressing school-level dropout rates on the running variable of the RDD (*IncumbVoteMargin*), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < \text{Using Bandwidth}$. The school-level dropout rate is measured by the School Census and refers to the dropout rate for all students within a school (in all grade levels). All specifications control for the school-level, dropout rate at baseline (the year before the respective election). Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table A8: Political Turnover in 2008 and 4th Grade Test Scores 1, 3, and 5 Years After the Election

| Outcome: | Individual 4 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|----------------------|---------------------|---------------------|---------------------|---------------------|
| | 2009 | | 2011 | | 2013 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.113** (0.046) | -0.115*** (0.041) | -0.093 (0.063) | -0.092 (0.056) | -0.080 (0.064) | -0.061 (0.055) |
| School-level scores in 2007 | 0.827*** (0.027) | 0.696*** (0.028) | 0.796*** (0.028) | 0.675*** (0.032) | 0.765*** (0.029) | 0.616*** (0.028) |
| N | 138,089 | 138,089 | 124,158 | 124,158 | 121,986 | 121,986 |
| R-squared | 0.179 | 0.209 | 0.164 | 0.199 | 0.149 | 0.203 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 728 | 728 | 728 | 728 | 728 | 728 |
| Using Bandwidth | 0.0700 | 0.0700 | 0.0700 | 0.0700 | 0.0700 | 0.0700 |
| Optimal Bandwidth | 0.0772 | 0.0772 | 0.104 | 0.104 | 0.102 | 0.102 |

This table reports the coefficient on political party turnover from regressing individual-level 4th grade test scores on the running variable of the RDD ($IncumbVoteMargin_{2008}$), political party turnover ($\mathbb{1}\{IncumbVoteMargin_{2008} < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin_{2008}| < \text{Using Bandwidth}$, separately for each year t , where t is one year, three years, and five years after the 2008 election. Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party. All specifications control for school-level, average test scores for 4th graders at baseline (one year before the 2008 election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and individual-level controls (an indicator variable for gender, whether the student is white, and whether the student sees their mother reading). Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party.

Table A9: Political Turnover in 2008 and 8th Grade Test Scores 1, 3, and 5 Years After the Election

| Outcome: | Individual 8 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| | 2009 | | 2011 | | 2013 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.043 (0.049) | -0.053 (0.050) | -0.053 (0.066) | -0.075 (0.059) | -0.111 (0.075) | -0.131* (0.067) |
| School-level scores in 2007 | 0.791*** (0.027) | 0.732*** (0.027) | 0.819*** (0.033) | 0.736*** (0.034) | 0.648*** (0.037) | 0.570*** (0.037) |
| Observations | 50,338 | 50,338 | 49,142 | 49,142 | 49,229 | 49,229 |
| R-squared | 0.152 | 0.162 | 0.159 | 0.178 | 0.103 | 0.124 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 432 | 432 | 432 | 432 | 432 | 432 |
| Using Bandwidth | 0.0700 | 0.0700 | 0.0700 | 0.0700 | 0.0700 | 0.0700 |
| Optimal Bandwidth | 0.122 | 0.122 | 0.120 | 0.120 | 0.110 | 0.110 |

This table reports the coefficient on political party turnover from regressions of individual-level 8th grade test scores on the running variable of the RDD ($IncumbVoteMargin_{2008}$), political party turnover ($\mathbb{1}\{IncumbVoteMargin_{2008} < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin_{2008}| < Using\ Bandwidth$, separately for each year t , where t is one year, three years, and five years after the 2008 election. All specifications control for school-level, average test scores for 8th graders at baseline (one year before the 2008 election). Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and individual-level controls (an indicator variable for gender, whether the student is white, and whether the student sees their mother reading). Test scores are from the *Prova Brasil* exam and are standardized based on the distribution of individual-level test scores in municipalities with no change in the ruling party.

Table A10: Political Turnover in 2008 and Headmaster Replacement 1, 3, and 5 Years After the Election

| Outcome: | Headmaster is new to the school (as Headmaster) | | | | | |
|--------------------------------------|---|---------------------|-------------------|-------------------|-------------------|-------------------|
| | 2009 | | 2011 | | 2013 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.274*** (0.050) | 0.271*** (0.051) | -0.056 (0.042) | -0.054 (0.042) | -0.056 (0.056) | -0.064 (0.055) |
| N | 4,882 | 4,882 | 3,966 | 3,966 | 3,794 | 3,794 |
| R-squared | 0.090 | 0.091 | 0.002 | 0.005 | 0.005 | 0.014 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1082 | 1082 | 995 | 995 | 969 | 969 |
| Mean Dep Variable | 0.438 | 0.438 | 0.348 | 0.348 | 0.665 | 0.665 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.128 | 0.128 | 0.152 | 0.152 | 0.0785 | 0.0785 |

This table shows the coefficient on political party turnover in 2008 from regressing an indicator variable for whether the school has a new headmaster on the running variable of the RDD ($IncumbVoteMargin_{2008}$), political party turnover ($\mathbb{1}\{IncumbVoteMargin_{2008} < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin_{2008}| < Using\ Bandwidth$, separately for each year t , where t is one year, three years, and five years after the 2008 election. New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire. Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet).

Table A11: Political Turnover and Headmaster Characteristics

| Outcome: | Female | Age | B.A. | Graduate Training | Salary | Hours Worked | Experience in Education | Experience as Headmaster |
|--------------------------------------|-------------------|-------------------|-------------------|---------------------|-------------------|-------------------|-------------------------|--------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.019 (0.018) | -0.230 (0.406) | -0.004 (0.014) | -0.044** (0.022) | 9.107 (76.810) | -0.097 (0.274) | -0.133 (0.222) | -1.756*** (0.257) |
| N | 11,112 | 10,989 | 10,853 | 10,773 | 11,019 | 11,170 | 11,161 | 11,176 |
| R-squared | 0.033 | 0.055 | 0.052 | 0.254 | 0.275 | 0.323 | 0.149 | 0.046 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Clusters | 2142 | 2141 | 2132 | 2130 | 2141 | 2144 | 2136 | 2142 |
| Mean Dep Variable | 0.820 | 41.62 | 0.901 | 0.767 | 2056 | 38.69 | 14.14 | 5.047 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.137 | 0.139 | 0.142 | 0.113 | 0.117 | 0.145 | 0.166 | 0.134 |

This table reports the coefficient on political party turnover from regressing each of the headmaster characteristic variables on the running variable of the RDD ($IncumbVoteMargin$), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < Using\ Bandwidth$. Headmaster characteristics are from the *Prova Brasil* headmaster questionnaire. Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table A12: Political Turnover and Politically Appointed Headmasters

| | (1) Headmaster New & not Political | (2) Headmaster New & Political | (3) Headmaster New & not Political | (4) Headmaster New & Political |
|--------------------------------------|--|--------------------------------------|--|--------------------------------------|
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.418* (0.232) | 1.301*** (0.170) | 0.413* (0.231) | 1.303*** (0.168) |
| N | 10,662 | 10,662 | 10,662 | 10,662 |
| Controls | No | No | Yes | Yes |
| Clusters | 2119 | 2119 | 2119 | 2119 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 |

This table reports the coefficient on political party turnover from a multinomial logistic regression with y_{smt} as the categorical outcome variable and the running variable of the RDD ($IncumbVoteMargin$), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables as the right hand side variables, for the set of municipalities with $|IncumbVoteMargin| < Using\ Bandwidth$. y_{smt} is equal to 0 (the referent category) if the headmaster of a school is not a new headmaster, equal to 1 if the headmaster is a new headmaster *but* not a political appointee ("Headmaster New & not Political"), and equal to 2 if the headmaster is a new headmaster *and* a political appointee ("Headmaster New & Political"). New headmasters are those that report being the headmaster of their current school for less than two years on the *Prova Brasil* headmaster questionnaire. Politically appointed headmasters are those who report being some type of "appointee" on the *Prova Brasil* headmaster questionnaire. Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table A13: Political Turnover in 2008 and Teacher Replacements 1, 3, and 5 Years After the Election

| Outcome: | Share of Teachers New to the School | | | | | Share of Teachers that have Left the School | | | | | | |
|--------------------------------------|-------------------------------------|---------------------|------------------|------------------|------------------|---|---------------------|---------------------|------------------|------------------|------------------|------------------|
| | 2009 | 2011 | 2013 | 2009 | 2011 | 2013 | 2009 | 2011 | 2013 | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.098*** (0.033) | 0.097*** (0.032) | 0.042 (0.038) | 0.040 (0.038) | 0.006 (0.039) | 0.005 (0.039) | 0.093*** (0.034) | 0.092*** (0.034) | 0.036 (0.038) | 0.035 (0.038) | 0.016 (0.035) | 0.015 (0.035) |
| N | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 | 12,637 |
| R-squared | 0.019 | 0.023 | 0.005 | 0.014 | 0.001 | 0.007 | 0.017 | 0.021 | 0.004 | 0.010 | 0.001 | 0.006 |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Clusters | 944 | 944 | 944 | 944 | 944 | 944 | 944 | 944 | 944 | 944 | 944 | 944 |
| Mean Dep Variable | 0.489 | 0.489 | 0.446 | 0.446 | 0.526 | 0.526 | 0.465 | 0.465 | 0.445 | 0.445 | 0.499 | 0.499 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.163 | 0.163 | 0.145 | 0.145 | 0.153 | 0.153 | 0.152 | 0.152 | 0.145 | 0.145 | 0.145 | 0.145 |

This table shows the coefficient on political party turnover in 2008 from regressing the share of teachers that are new to the school or the share of teachers that have left a school on the running variable of the RDD ($IncumbVoteMargin_{2008}$), political party turnover ($\mathbb{1}\{IncumbVoteMargin_{2008} < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin_{2008}| < UsingBandwidth$, separately for each year t , where t is one year, three years, and five years after the 2008 election. The share of teachers that are new to a school is computed using the School Census and corresponds to the share of teachers in a school who are in that school at time t but were not in that same school at time $t - 2$. The share of teachers that have left a school is also computed using the School Census and corresponds to the share of teachers in a school who were in that school at time $t - 2$ but are no longer in that same school at time t . Controls include school-level controls (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet).

Table A14: Political Turnover and Teacher Characteristics

| Outcome: | N Teachers (1) | Age (2) | Female (3) | B.A. (4) | Graduate Training (5) | Temporary Contract (6) | Contract Type Missing (7) |
|--------------------------------------|----------------------|-------------------|-------------------|----------------------|-----------------------------|------------------------------|---------------------------------|
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.196 (0.279) | -0.400 (0.364) | -0.015 (0.014) | -0.073*** (0.023) | -0.023* (0.014) | 0.042 (0.034) | 0.010* (0.006) |
| N | 39,642 | 39,642 | 39,642 | 39,642 | 39,642 | 20,945 | 20,945 |
| R-squared | 0.507 | 0.060 | 0.068 | 0.295 | 0.200 | 0.121 | 0.024 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Clusters | 2304 | 2304 | 2304 | 2304 | 2304 | 1523 | 1523 |
| Mean Dep Var | 7.859 | 37.31 | 0.815 | 0.485 | 0.155 | 0.344 | 0.0184 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.0922 | 0.144 | 0.0995 | 0.0917 | 0.0884 | 0.0915 | 0.169 |

This table reports the coefficient on political party turnover from regressing each of the teacher characteristic variables on the running variable of the RDD (*IncumbVoteMargin*), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < \text{Using Bandwidth}$. The teacher characteristics are from the School Census and are averaged at the school-level. Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table A15: Political Turnover and Headmaster Replacement in Low- and High-income Municipalities

| Outcome: | Headmaster is new to the school (as Headmaster) | | | | | |
|--------------------------------------|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Panel A | Low Income Municipalities (Below Median Income) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.389*** (0.038) | 0.389*** (0.037) | 0.371*** (0.047) | 0.371*** (0.045) | 0.379*** (0.039) | 0.378*** (0.038) |
| N | 6,703 | 6,703 | 4,294 | 4,294 | 6,447 | 6,447 |
| R-squared | 0.151 | 0.154 | 0.160 | 0.168 | 0.156 | 0.159 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1073 | 1073 | 754 | 754 | 1030 | 1030 |
| Mean Dep Variable | 0.447 | 0.447 | 0.447 | 0.447 | 0.445 | 0.445 |
| Using Bandwidth | 0.116 | 0.116 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.116 | 0.116 | 0.116 | 0.116 | 0.116 | 0.116 |
| Panel B | High Income Municipalities (Above Median Income) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.126*** (0.043) | 0.127*** (0.043) | 0.131** (0.064) | 0.134** (0.063) | 0.115** (0.048) | 0.122** (0.048) |
| N | 5,870 | 5,870 | 3,223 | 3,223 | 4,749 | 4,749 |
| R-squared | 0.052 | 0.053 | 0.032 | 0.036 | 0.046 | 0.048 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1272 | 1272 | 808 | 808 | 1109 | 1109 |
| Mean Dep Variable | 0.433 | 0.433 | 0.464 | 0.464 | 0.449 | 0.449 |
| Using Bandwidth | 0.135 | 0.135 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 |

This table shows the same analysis as in Table 3 separately for low-income (Panel A) and high-income (Panel B) municipalities. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Table A16: Political Turnover and Teacher Replacements in Low- and High-income Municipalities

| Outcome: | Share of Teachers New to the School | | | | Share of Teachers that have Left the School | | | | | | | |
|--------------------------------------|-------------------------------------|---------------------|---------------------|---------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Panel A | | | | | | | | | | | | |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.113*** (0.024) | 0.113*** (0.024) | 0.130*** (0.028) | 0.130*** (0.028) | 0.117*** (0.024) | 0.117*** (0.024) | 0.115*** (0.024) | 0.115*** (0.024) | 0.127*** (0.028) | 0.127*** (0.028) | 0.114*** (0.025) | 0.113*** (0.024) |
| N | 24,003 | 24,003 | 16,008 | 16,008 | 24,337 | 24,337 | 25,052 | 25,052 | 16,008 | 16,008 | 24,337 | 24,337 |
| R-squared | 0.036 | 0.041 | 0.032 | 0.036 | 0.035 | 0.040 | 0.032 | 0.037 | 0.029 | 0.033 | 0.032 | 0.037 |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Clusters | 965 | 965 | 707 | 707 | 975 | 975 | 1001 | 1001 | 707 | 707 | 975 | 975 |
| Mean Dep Variable | 0.447 | 0.447 | 0.453 | 0.453 | 0.447 | 0.447 | 0.434 | 0.434 | 0.439 | 0.439 | 0.433 | 0.433 |
| Using Bandwidth | 0.108 | 0.108 | 0.0700 | 0.0700 | 0.110 | 0.110 | 0.114 | 0.114 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.108 | 0.108 | 0.108 | 0.108 | 0.108 | 0.108 | 0.114 | 0.114 | 0.114 | 0.114 | 0.114 | 0.114 |
| Panel B | | | | | | | | | | | | |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | 0.058*** (0.022) | 0.064*** (0.021) | 0.063* (0.033) | 0.064** (0.032) | 0.057** (0.026) | 0.064** (0.026) | 0.058*** (0.022) | 0.063*** (0.022) | 0.049 (0.031) | 0.050 (0.030) | 0.055** (0.025) | 0.061** (0.024) |
| N | 12,321 | 12,321 | 5,877 | 5,877 | 8,546 | 8,546 | 11,148 | 11,148 | 5,877 | 5,877 | 8,546 | 8,546 |
| R-squared | 0.015 | 0.026 | 0.014 | 0.027 | 0.013 | 0.024 | 0.014 | 0.023 | 0.014 | 0.027 | 0.013 | 0.024 |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Clusters | 1380 | 1380 | 802 | 802 | 1081 | 1081 | 1277 | 1277 | 802 | 802 | 1081 | 1081 |
| Mean Dep Variable | 0.495 | 0.495 | 0.497 | 0.497 | 0.498 | 0.498 | 0.475 | 0.475 | 0.476 | 0.476 | 0.478 | 0.478 |
| Using Bandwidth | 0.168 | 0.168 | 0.0700 | 0.0700 | 0.110 | 0.110 | 0.144 | 0.144 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.168 | 0.168 | 0.168 | 0.168 | 0.168 | 0.168 | 0.144 | 0.144 | 0.144 | 0.144 | 0.144 | 0.144 |

This table shows the same analysis as in Table 4 separately for low-income (Panel A) and high-income (Panel B) municipalities. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Table A17: Political Turnover and 4th Grade Test Scores in Low- and High-income Municipalities

| Outcome: | Individual 4 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| Panel A | Low Income Municipalities (Below Median Income) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.060 (0.037) | -0.038 (0.035) | -0.069* (0.039) | -0.053 (0.037) | -0.061* (0.032) | -0.047 (0.031) |
| School-level baseline scores | 0.737*** (0.025) | 0.667*** (0.024) | 0.738*** (0.024) | 0.669*** (0.023) | 0.726*** (0.022) | 0.654*** (0.022) |
| N | 148,635 | 148,635 | 127,443 | 127,443 | 188,065 | 188,065 |
| R-squared | 0.111 | 0.152 | 0.112 | 0.152 | 0.109 | 0.151 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 802 | 802 | 718 | 718 | 987 | 987 |
| Using Bandwidth | 0.0812 | 0.0812 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.0812 | 0.0812 | 0.0812 | 0.0812 | 0.0812 | 0.0812 |
| Panel B | High Income Municipalities (Above Median Income) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.038 (0.034) | -0.031 (0.032) | -0.101** (0.042) | -0.089** (0.037) | -0.067* (0.035) | -0.060* (0.031) |
| School-level baseline scores | 0.733*** (0.020) | 0.642*** (0.018) | 0.732*** (0.026) | 0.637*** (0.025) | 0.744*** (0.020) | 0.653*** (0.019) |
| N | 266,709 | 266,709 | 167,727 | 167,727 | 241,914 | 241,914 |
| R-squared | 0.108 | 0.143 | 0.102 | 0.138 | 0.112 | 0.147 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1180 | 1180 | 820 | 820 | 1114 | 1114 |
| Using Bandwidth | 0.120 | 0.120 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 |

This table shows the same analysis as in Table 2 (Panel A) separately for low-income (Panel A) and high-income (Panel B) municipalities. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Table A18: Political Turnover and 8th Grade Test Scores in Low- and High-income Municipalities

| Outcome: | Individual 8 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|---------------------|---------------------|---------------------|----------------------|---------------------|
| Panel A | Low Income Municipalities (Below Median Income) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.032 (0.028) | -0.027 (0.028) | -0.034 (0.037) | -0.027 (0.037) | -0.015 (0.031) | -0.007 (0.031) |
| School-level baseline scores | 0.687*** (0.020) | 0.659*** (0.021) | 0.663*** (0.032) | 0.633*** (0.031) | 0.687*** (0.024) | 0.655*** (0.024) |
| N | 143,725 | 143,725 | 74,190 | 74,190 | 113,464 | 113,464 |
| R-squared | 0.081 | 0.092 | 0.072 | 0.084 | 0.082 | 0.093 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 936 | 936 | 549 | 549 | 770 | 770 |
| Using Bandwidth | 0.154 | 0.154 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.154 | 0.154 | 0.154 | 0.154 | 0.154 | 0.154 |
| Panel B | High Income Municipalities (Above Median Income) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.072* (0.038) | -0.050 (0.035) | -0.079 (0.050) | -0.072 (0.050) | -0.122*** (0.043) | -0.099** (0.041) |
| School-level baseline scores | 0.775*** (0.027) | 0.725*** (0.025) | 0.767*** (0.030) | 0.718*** (0.030) | 0.763*** (0.029) | 0.710*** (0.027) |
| N | 103,705 | 103,705 | 52,665 | 52,665 | 77,705 | 77,705 |
| R-squared | 0.108 | 0.128 | 0.100 | 0.120 | 0.103 | 0.123 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 677 | 677 | 416 | 416 | 565 | 565 |
| Using Bandwidth | 0.151 | 0.151 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.151 | 0.151 | 0.151 | 0.151 | 0.151 | 0.151 |

This table shows the analysis in Table 2 separately for low-income (Panel A) and high-income (Panel B) municipalities. Low-income municipalities are those below the median in the municipal-level distribution of median monthly household income as measured in the 2000 Census. High income municipalities are those above the median in this distribution.

Table A19: Political Turnover and 8th Grade Test Scores in Non-municipal Schools

| Outcome: | Individual 8 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.017 (0.018) | -0.011 (0.018) | -0.030 (0.026) | -0.013 (0.025) | -0.031 (0.021) | -0.023 (0.020) |
| Baseline Scores | 0.760*** (0.010) | 0.697*** (0.010) | 0.753*** (0.013) | 0.688*** (0.013) | 0.762*** (0.011) | 0.699*** (0.011) |
| N | 381,972 | 381,972 | 222,724 | 222,724 | 316,167 | 316,167 |
| R-squared | 0.106 | 0.125 | 0.106 | 0.125 | 0.107 | 0.126 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 2155 | 2155 | 1409 | 1409 | 1888 | 1888 |
| Using Bandwidth | 0.136 | 0.136 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.136 | 0.136 | 0.136 | 0.136 | 0.136 | 0.136 |

This table shows a similar analysis to that of Table 2 with the key difference that the estimation sample for this table is *non-municipal* schools. The set of *non-municipal* schools for this outcome is comprised of state and federal schools, since only public schools participate in the *Prova Brasil* exam.

Table A20: Political Turnover and 4th Grade Test Scores in Low- and High-quality Municipal Schools

| Outcome: | Individual 4 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|---------------------|----------------------|----------------------|---------------------|---------------------|
| Panel A | Low Quality Schools (Below Median Baseline Test Scores) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.082** (0.033) | -0.059* (0.031) | -0.078** (0.039) | -0.051 (0.037) | -0.075** (0.033) | -0.052* (0.031) |
| School-level baseline scores | 0.867*** (0.026) | 0.725*** (0.025) | 0.860*** (0.032) | 0.715*** (0.029) | 0.860*** (0.026) | 0.716*** (0.025) |
| N | 187,409 | 187,409 | 122,528 | 122,528 | 181,445 | 181,445 |
| R-squared | 0.074 | 0.122 | 0.074 | 0.121 | 0.074 | 0.122 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1186 | 1186 | 818 | 818 | 1150 | 1150 |
| Using Bandwidth | 0.113 | 0.113 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 |
| Panel B | High Quality Schools (Above Median Baseline Test Scores) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.056* (0.034) | -0.053 (0.033) | -0.112*** (0.039) | -0.106*** (0.035) | -0.068** (0.032) | -0.069** (0.029) |
| School-level baseline scores | 0.775*** (0.024) | 0.674*** (0.024) | 0.775*** (0.031) | 0.672*** (0.031) | 0.784*** (0.025) | 0.683*** (0.024) |
| N | 234,508 | 234,508 | 162,053 | 162,053 | 229,476 | 229,476 |
| R-squared | 0.081 | 0.119 | 0.079 | 0.118 | 0.082 | 0.121 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 1338 | 1338 | 969 | 969 | 1319 | 1319 |
| Using Bandwidth | 0.113 | 0.113 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 |

This table shows the same analysis as in Table 2 separately for low-quality (Panel A) and high-quality (Panel B) *municipal* schools. Low-quality schools are those below the median in the school-level distribution of test scores at baseline (the year before the respective election). High-quality schools are those above the median in this distribution.

Table A21: Political Turnover and 8th Grade Test Scores in Low- and High-quality Municipal Schools

| Outcome: | Individual 8 th Grade Test Scores (standardized) | | | | | |
|--------------------------------------|---|---------------------|---------------------|---------------------|---------------------|---------------------|
| Panel A | Low Quality Schools (Below Median Baseline Test Scores) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.054* (0.032) | -0.048 (0.032) | -0.033 (0.039) | -0.025 (0.039) | -0.047 (0.034) | -0.038 (0.035) |
| School-level baseline scores | 0.674*** (0.033) | 0.626*** (0.034) | 0.653*** (0.041) | 0.603*** (0.041) | 0.669*** (0.035) | 0.622*** (0.035) |
| N | 99,103 | 99,103 | 59,639 | 59,639 | 91,279 | 91,279 |
| R-squared | 0.040 | 0.054 | 0.036 | 0.050 | 0.040 | 0.054 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 811 | 811 | 533 | 533 | 744 | 744 |
| Using Bandwidth | 0.122 | 0.122 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.122 | 0.122 | 0.122 | 0.122 | 0.122 | 0.122 |
| Panel B | High Quality Schools (Above Median Baseline Test Scores) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.038 (0.035) | -0.018 (0.035) | -0.080* (0.043) | -0.071* (0.042) | -0.082** (0.036) | -0.064* (0.035) |
| School-level baseline scores | 0.861*** (0.028) | 0.788*** (0.029) | 0.853*** (0.037) | 0.779*** (0.038) | 0.839*** (0.030) | 0.762*** (0.031) |
| N | 105,075 | 105,075 | 62,711 | 62,711 | 90,880 | 90,880 |
| R-squared | 0.086 | 0.103 | 0.085 | 0.102 | 0.078 | 0.095 |
| Controls | No | Yes | No | Yes | No | Yes |
| Clusters | 841 | 841 | 548 | 548 | 762 | 762 |
| Using Bandwidth | 0.128 | 0.128 | 0.0700 | 0.0700 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 | 0.128 |

This table shows the same analysis as in Table 2 separately for low-quality (Panel A) and high-quality (Panel B) *municipal* schools. Low-quality schools are those below the median in the school-level distribution of test scores at baseline (the year before the respective election). High-quality schools are those above the median in this distribution.

Table A22: Political Turnover and School Problems (as Reported by Headmaster)

| Outcome: | Teacher Council Meetings (1) | Coordinated Curriculum (2) | Curriculum Together (3) | Textbooks On-time (4) | Textbooks Correct (5) | Program for Dropouts (6) | Program for Tutoring (7) | Program for Failing Students (8) | Teacher Training Held (9) | Teacher Training Participation (10) |
|--------------------------------------|------------------------------|----------------------------|-------------------------|-----------------------|-----------------------|--------------------------|--------------------------|----------------------------------|---------------------------|-------------------------------------|
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.130** (0.066) | -0.027** (0.011) | -0.047** (0.021) | -0.090*** (0.026) | -0.059** (0.025) | -0.052* (0.027) | -0.076*** (0.025) | -0.035* (0.019) | -0.150*** (0.031) | -0.026** (0.013) |
| N | 7,058 | 7,058 | 7,058 | 7,058 | 7,058 | 7,058 | 7,058 | 7,058 | 7,058 | 4,228 |
| R-squared | 0.035 | 0.036 | 0.155 | 0.029 | 0.023 | 0.086 | 0.055 | 0.123 | 0.024 | 0.488 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Clusters | 1819 | 1819 | 1819 | 1819 | 1819 | 1819 | 1819 | 1819 | 1819 | 1521 |
| Mean Dep Var | 2.557 | 0.963 | 0.776 | 0.776 | 0.794 | 0.621 | 0.835 | 0.845 | 0.607 | 0.639 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.160 | 0.119 | 0.142 | 0.115 | 0.138 | 0.113 | 0.132 | 0.139 | 0.120 | 0.117 |

This table reports the coefficient on political party turnover from regressing each of the outcome variables (survey responses) on the running variable of the RDD ($IncumbVoteMargin$), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $IncumbVoteMargin$ Using Bandwidth. The survey responses are from the *Prova Brasil* headmaster questionnaire. Teacher Council Meetings refers to the number of teacher council meetings that have been held in the school this year (ranges from 0-3). Coordinated Curriculum refers to whether the school has a teaching plan (*Projeto Pedagógico*). Curriculum Together refers to whether the headmasters and teachers developed the teaching plan together. Textbooks On-time refers to whether the school received its textbooks at the beginning of the school-year and Textbooks Correct refers to whether the appropriate textbooks were (eventually) received. Each of the Program variables refers to whether the school offers that particular program for students. Teacher Training Held refers to whether the school held any teacher training sessions. Finally, Teacher Training Participation refers to the share of teachers who participated in the teacher training sessions (conditional on the school holding at least one such session). Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.

Table A23: Political Turnover and School Problems (as Reported by the Proctoring Teacher)

| Outcome: | Teacher Council Meetings (1) | Coordinated Curriculum (2) | Curriculum Together (3) | Relationship w/ Headmaster (Index) (4) | Relationship w/ Teachers (Index) (5) | Collaborative Environment (6) |
|--------------------------------------|---------------------------------|-------------------------------|----------------------------|---|---|----------------------------------|
| $\mathbb{1}\{IncumbVoteMargin < 0\}$ | -0.042 (0.064) | -0.014** (0.007) | -0.037** (0.017) | -0.235 (0.311) | -0.059 (0.157) | -0.028 (0.031) |
| N | 23,409 | 23,409 | 23,409 | 23,409 | 23,409 | 23,409 |
| R-squared | 0.025 | 0.021 | 0.055 | 0.007 | 0.022 | 0.327 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Clusters | 2087 | 2087 | 2087 | 2087 | 2087 | 2087 |
| Mean Dep Var | 2.337 | 0.969 | 0.800 | 0.705 | 0.387 | 3.677 |
| Using Bandwidth | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 | 0.110 |
| Optimal Bandwidth | 0.146 | 0.135 | 0.144 | 0.190 | 0.130 | 0.121 |

This table reports the coefficient on political party turnover from regressing each of the outcome variables (survey responses) on the running variable of the RDD (*IncumbVoteMargin*), political party turnover ($\mathbb{1}\{IncumbVoteMargin < 0\}$), and the interaction of these two variables for the set of municipalities with $|IncumbVoteMargin| < Using\ Bandwidth$. The survey responses are from the *Prova Brasil* teacher questionnaire, which is administered to teachers who proctor the exam. Teacher Council Meetings refers to the number of teacher council meetings that have been held in the school this year (ranges from 0-3). Coordinated Curriculum refers to whether the school has a teaching plan (*Projeto Pedagogico*). Curriculum Together refers to whether the headmasters and teachers developed the teaching plan together. The Relationship with Headmaster Index is constructed as follows. We standardize the responses to a series of questions – regarding whether the teacher trusts the headmaster, whether the teacher believes the headmaster motivates her, is committed to the school, innovates, cares about the students, cares about the school personnel, and cares about the school as a whole, and whether the teacher respects the headmaster/feels respected by the headmaster – by subtracting the overall mean and dividing by the standard deviation of all teacher responses for each question. We then add all these standardized responses to arrive at the "Relationship w/ Headmaster Index." The Relationship with Teacher Index is constructed as follows. We standardize the responses to a series of questions – regarding whether the teachers share ideas and whether the teachers work together – by subtracting the overall mean and dividing by the standard deviation of all teacher responses for each question. We then add all these standardized responses to arrive at the "Relationship w/ Teacher Index." Finally, Collaborative Environment refers to how collaborative the teacher feels the school is (on a scale of 1-5, where 5 is very collaborative). Controls include school-level controls taken from the School Census (whether: the school is located in an urban or rural area, the school is connected to the electric grid, the school is connected to the water network, the school is connected to the sewage system, the school's trash is regularly collected, and the school has Internet) and a 2012 election-cycle indicator.