# Female political leadership and the quality of local bureaucracy

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**ABSTRACT**

This study explores the influence of female political leadership on bureaucratic practices, focusing on school management under a regression discontinuity design in mayoral competitive elections. Our analysis shows that the election of a woman as mayor positively affects the quality of management practices in Brazilian municipal public schools. On the other hand, we found no significant effects in non-municipal schools not under the mayor's jurisdiction. Furthermore, the election of female mayors impacts the age and level of education of bureaucrats in all sectors, suggesting wider implications beyond the education sector. These effects are particularly larger in smaller municipalities and when female mayors are politically aligned with state governors. In addition, our results indicate that mayors improve student performance in 9th-grade language and math assessments. In turn, the women's election increases non-monetary incentives for principals and changes the focus of principals planning activities to educational outcomes.

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# 1 Introduction

Women are under-represented in many political positions in many countries[1]. However, recent political initiatives have increased the participation of women in leadership positions in the public sector. In the last two decades, over a hundred countries have introduced quotas for women in parliament or party lists (Besley et al., 2017; Baskaran et al., 2023)[2]. The impact of increasing women's participation in political leadership positions varies among developed and developing countries[3]. In developing countries, the recent literature shows that female leadership improves public policies, especially in education and health[4]. Chattopadhyay and Duflo (2004) argues that women have different preferences than men towards public policy and this can explain its effectiveness. In turn, Brollo and Troiano (2016); Afridi et al. (2017) argues that women's efficiency can be explained by their lesser involvement in inefficient public management practices, such as corruption, clientelism, and patronage. This article argues that female political leadership improves the effectiveness of public workers by changing bureaucratic practices. By promoting "good" management practices, female political leadership affects the quality of the bureaucracy and, consequently, the implementation, direction, and outcomes of local public policies.

Recent evidence highlights the importance of the quality of the public administration on public outcomes (Fenizia, 2022; Dahis et al., 2023; Bertrand et al., 2020; Xu et al., 2023; Besley et al., 2022). Nevertheless, there is scant evidence of a relationship between bureaucratic quality and local political elections. In the Brazilian educational public sector, the focus of this paper, two recent studies find that the turnover of political parties in mayoral elections affects the selection of school managers and the quality of school management (Leaver et al., 2022; Akhtari et al., 2022), both important dimensions of bureaucracy effectiveness. In our case, we are interested in understanding if the election of a female mayor also impacts the quality of the practices adopted by local bureaucracy.

[1]Data from 141 countries indicates that over 3 million women, comprising 35.5 percent, hold elected positions in local governments. Only three nations have achieved a 50 percent representation, while 22 other countries have over 40 percent female participation in local government, See UN Women (https://localgov.unwomen.org/).

[2]The increase in female participation in the bureaucracy through quota policies is an international phenomenon. In the case of Brazil, it occurred through Law No. 9,504/1997, becoming mandatory only in 2009; while in India, reservations were allocated for women in 1993 (see Baskaran et al. (2023)), and for other countries see Dahlerup (2013).

[3]Bagues and Campa (2021); Gago and Carozzi (2021); Casarico et al. (2022), and Ferreira and Gyourko (2014) show that female leadership has no impact on outcomes in Spain, Italy, and in the United States.

[4]Many studies find a positive effect on public outcomes as a result of women's increased political participation, see: Afridi et al. (2017); Chattopadhyay and Duflo (2004); Clots-Figueras (2011, 2012); Bhalotra and Clots-Figueras (2014); Baskaran et al. (2023); Bruce et al. (2022); Hessami and da Fonseca (2020), and Baskaran and Hessami (2018).

Identifying the effect of female political leadership on the quality of the local bureaucracy is challenging due to context-specific factors that can be related to both female leadership and outcomes, and because the effectiveness of the public administration is difficult to measure across different contexts. To address the first challenge, we implement a Regression Discontinuity (RD) design focusing on mixed-gender races. We used the 2012 and 2016 municipal elections carried out in Brazil, totaling 10.905 electoral races. This method allows us to identify the effect of electing a female mayor on public administration outcomes by comparing municipalities where a female candidate won against a male one by a narrow margin with those where the opposite occurred.

To address the second challenge, we focused our analysis on the educational sector, which offers representative nationwide surveys on different aspects related to the quality of primary school management. In Brazil, primary education is mostly provided by municipalities[5]. In particular, we focused on surveys of principals and teachers extracted from the SAEB assessment[6], which is applied bi-annually in state and municipal primary schools in Brazil. Nearly 80% of public schools in Brazil participated in the SAEB assessment.

Our main outcome variable is the School Management Quality Index (SMQI) developed by Leaver et al. (2022) based on the benchmark proposed by the World Management Survey (WMS), a leading approach dedicated to measuring establishments' adoption of structured management practices. Bloom et al. (2015) adapted the WMS framework for the educational sector and Leaver et al. (2022) extended this framework for Brazilian public data. The SMQI measures five WMS topics: standardization of instructional processes, personalization of instruction and learning, data-driven planning and student transitions, adoption of best educational practices, and performance analysis. Using 29 questions from the SAEB, 19 from the school principal questionnaire, and 10 from the teacher questionnaire, Leaver et al. (2022) developed this school management index at the school level for the years 2013 to 2017[7]. Our outcome variable is measured one year after the municipal election, which provides us with consistent estimates of the electoral effect of women on school management practices.

[5]In 2017, according to data from the Ministry of Education, almost 22.7 million students were attending public elementary school in Brazil, and of these, 0.09% were studying in federal schools, 31.5% in state schools, and 68% in municipal schools.

[6]*Sistema Nacional de Avaliação da Educação Básica*, SAEB, is a standardized educational assessment that has been carried out every two years since 2007 on a census basis for primary education. Accompanying this assessment is a questionnaire for teachers and principals on various aspects of school management.

[7]In fact, Leaver et al. (2022) estimated the SMQI for the years 2007 to 2017. However, in this paper, we have focused only on 2013 to 2017 for two reasons. First, the SAEB 2013, 2015, and 2017 editions have the same questionnaire for both principals and teachers. This allows us to obtain consistent measures over time of the quality of school management. Second, between 2007 and 2011, there was a significant reduction in the number of schools participating in SAEB.

In close races, municipalities that elect a female mayor have a positive and significant impact on the School Management Quality Index. This finding is robust to modifications in the main specification, including the mayor's control variables, specifications with different bandwidths, and quadratic RD polynomial order. In addition, we perform a placebo test by estimating the RD in non-municipal schools. Municipal governments do not administer (have any jurisdiction over) all of Brazil's public schools, therefore, non-municipal schools should not be affected by the mayor's election. We find that for public schools in the same municipality not controlled by the municipal government (non-municipal schools), a woman's win in municipal elections compared to a narrow loss for a man does not impact the School Management Quality Index, suggesting that the changes in the SMQI in municipal schools are directly related to women's election.

We also analyze the heterogeneous effect of these findings. First, we verify that female political leadership impacts significantly in municipalities with a population size below 30.000 inhabitants. Those municipalities are, in general, poorer, largely dependent on intergovernmental transfers, and have strong political power concentrated in political families. Population size is also considered a proxy to local political accountability (Barbosa and Ferreira, 2023). In municipalities larger than 30.000 inhabitants, the election of a woman does not impact school management quality. Another factor that may moderate the effectiveness of women's leadership is the political alignment of the women's party coalition with the state governors. We also tested the heterogeneous effect of women's election effectiveness by the political alignment. We found that being elected in the same political coalition as the state governor has a positive and significant effect on the impact of female leadership on the quality of school management. Finally, we also estimate if the school's socioeconomic status contributes to female mayor effectiveness on school management quality. Our results suggest that female elections only have a positive and significant impact on schools with a higher socio-economic status, i.e. a school with a socio-economic index above the median of its state.

To understand the findings in more detail, we apply the same RD empirical strategy to specific school management practices. We focus on three dimensions of school management that may be affected by female political leadership. Firstly, women's elections affect the recruitment of school managers. In municipalities where women win barely to men, the recruitment of principals becomes more focused on meritocratic (through a formal civil service examination) than politicians' discretionary nomination. A discretionary political appointment is often used as a tool for patronage, leads to the selection of less competent individuals, and is

not related to the quality of public management (Colonnelli et al., 2020; Muñoz and Prem, 2023; Brollo and Troiano, 2016). Our results confirm that women mayors reduce political discretion by adopting selection criteria for public servants based on meritocracy.

In addition, we estimated the impact of women's elections on the age and education of civil servants in all public sectors using employer-employee data from RAIS [8]. We found that when a woman wins a close election against a man, there is a significant increase in hiring younger and more educated lower bureaucrats for all public sectors. This finding suggests that women's elections impact the recruitment of all public servants, not just restricted to the educational sector. Furthermore, it's important to highlight that choosing a different database from SAEB, such as RAIS, reduces bias related to teacher and principal answers in a self-reported questionnaire, providing us with a more robust estimate of the impact of women's elections on local bureaucracy.

Second, we investigate whether the gender of the policymaker is linked to monetary and non-monetary incentives to teachers and principals. The results indicate that, in close races, municipalities with a female mayor present a reduction in reported principal workload and, at least one year after the election, no impact on principal wage. In addition, the teachers reported that under women's municipal administration, the principals stimulated innovative activities and motivated the teachers to do work activities. Both results suggest that the election of a female mayor yields non-monetary incentives for the lower-level bureaucracy and front-liners.

Thirdly, we verify the teachers' perceptions of the principal's attitude toward planning actions for the school. Teachers reported that principals increase the frequency of learning planning activities when a woman wins a close election against a man. Furthermore, teachers observe a small positive effect in the frequency of planning related to administrative norms and on the attention of principals to the aspects associated with school maintenance. These findings suggest that female mayors influence principals' focus on dimensions related to learning. Teachers report that this emphasis on learning aspects is observed in various facets associated with the improvement of school management, such as the definition of educational targets, the promotion of teachers' professional development, accountability for education quality, the sharing of teaching materials, and the promotion of closer integration between teachers.

Finally, given that the election of female mayors impacts school management practices, we check whether this could translate into better educational outcomes. We therefore re-estimated the regression in

[8] Annual Registry of Social Information (*Relação Anual de Informações Sociais*, RAIS)

discontinuity (RD), however, on the performance in math and language of students in the 5th and 9th grades of the primary schools. The findings indicate that the election of a female mayor in close races against a male has a positive and significant impact on student's performance in language and math in the 9th grade and no impact on the 5th grade. These results are robust to variations in the RD specification and a placebo "exercise". One possible explanation for why women's effectiveness is concentrated in the 9th grade is related to the potential effect of women's election on the management of the school that offers 9th grades. Primary schools in the early years (grades 1 to 5, called in Brazil as *Anos Iniciais*) have only one teacher, making them potentially easier to manage. On the other hand, schools between 6th and 9th (*Anos Finais*) have more than one teacher in each class and are possibly more difficult to manage. We present evidence about this hypothesis.

Our paper contributes to three strands of the literature. First, this paper contributes to the literature on personnel economics and bureaucracy performance (Ashraf and Bandiera, 2018; Dal Bó et al., 2013; Finan et al., 2015; Fenizia, 2022; Xu et al., 2023). In particular, we relate to the literature investigating the linkages between politicians and the quality of bureaucracy. Mayors in Brazil have great discretionary power and use it to nominate personnel to obtain payback for past campaign favors, both from elite donors and street-level supporters, and also to extract electoral advantages in the next elections (Colonnelli et al., 2020; Brollo et al., 2020; Gulzar and Pasquale, 2017). Particularly related to our paper is Akhtari et al. (2022), which shows that political turnover affects staff replacements and educational outcomes in Brazil. Leaver et al. (2022) extends the results of the Akhtari et al. (2022) and concludes that political turnover also affects the quality of school management. Our results suggest that political characteristics, such as gender, also impact the quality of bureaucracy.

Second, we contribute to investigating the role of women's political participation in public outcomes. Evidence from developing countries suggests that women's political leadership improves public policy and increases economic outcomes (Afridi et al., 2017; Chattopadhyay and Duflo, 2004; Clots-Figueras, 2011, 2012; Bhalotra and Clots-Figueras, 2014; Baskaran et al., 2023; Bruce et al., 2022; Hessami and da Fonseca, 2020), and (Baskaran and Hessami, 2018). Two theories help explain this evidence. First, following Chattopadhyay and Duflo (2004), women have different preferences for public policies than men, and this impacts the public goods relevant to women, such as health (Bhalotra and Clots-Figueras, 2014; Bhalotra et al., 2019), education (Beaman, 2007; Clots-Figueras, 2012)[9], and domestic violence(Delaporte and Pino, 2022). Secondly, female

[9]In Brazil, Barbosa (2017) found that women's elections do not affect educational outcomes.

mayors are less corrupt and less involved in patronage than male mayors (Afridi et al., 2017; Brollo and Troiano, 2016). Habyarimana et al. (2018) found correlational evidence that higher integrity among locally elected politicians is associated with substantively better delivery of public health services by district bureaucracies. To the best of our knowledge, we are the first to show that female mayors can affect the quality of bureaucrats' practices. This may also help to explain why women mayors have better public performance than men mayors.

Third, our paper contributes to a large and recent literature that investigates the effect of improvements in the quality of school management in developing countries (Bruns et al., 2018; De Hoyos et al., 2017; Fryer et al., 2017; Romero et al., 2020; Lemos et al., 2021; Romero et al., 2022; Muralidharan and Singh, 2020). A recent meta-analysis focused on school management programs in low and middle-income countries found that improving school management quality affects learning (Anand et al., 2023). Similar evidence is found in Brazil (Leaver et al., 2022; Bruns et al., 2018). Our paper shows that women's political leadership also affects school management practices.

This paper is divided into six more sections in addition to this introduction. The next section presents the context of Brazilian municipal elections and local bureaucracy. Section three discusses the data and the empirical strategy. Section four presents the main results on SMQI and the analysis of heterogeneous effects. In turn, section five analyzes in more detail the possible mechanisms by which elected female mayors may affect local bureaucracy. Section six presents the results on student learning in the 5th and 9th grades. Finally, the last section presents the concluding remarks.

# 2 Context

## 2.1 Brazilian municipal elections

Brazil holds municipal elections every four years in 5,570 municipalities. Each municipal election elects, by the rule of plurality, a mayor and a council of legislators (*Câmara de Vereadores*) for a four-year term. Mayors are term-limited and can remain in office for a maximum of two consecutive terms. Each voter can give two votes in a municipal election: one for a mayoral candidate and one for an individual council candidate (or a generic ballot for a party). In municipalities with more than 200,000 registered voters, a second round can be held if no candidate receives a majority in the first round.

We focused our analysis on two elections held in 2012 and 2016, for municipalities with fewer than 200,000 registered voters, comprising 10,905 elections, representing 97,8% of total polls in both years. This restriction is applied to prevent strategic political activities, stimulated by the possibility of a second round, from affecting the results.

## 2.2 Brazilian local bureaucracy

Municipalities are decentralized, autonomous, and responsible for public services like education, health, and sanitation. Most of the funding for these activities depends mainly on transfers from the higher levels of government (state and federal). Municipal public servants are a large part of public sector employment, representing nearly 62% of Brazilian public workers in 2013 (RAIS, 2013). There are two main ways of selecting public employees. Most public servants are hired using objective selection criteria: candidates present academic and professional qualifications and pass a formal civil service exam (*Concurso Público*), which is specific to the position and consists of a combination of written and oral tests. Public sector workers hired through this procedure acquire stability after three full years of service, after which they can only be dismissed for reasons of misconduct and after a court decision.

Public sector workers can also be hired without a civil service exam in three special exempt categories: commissioned positions, functions of trust, and temporary jobs. Hiring in the first two categories allows politicians to have discretion in selecting individuals for managerial or administrative assistant positions. The difference between positions of trust and commissioned positions is that the former requires the individual to already be employed as a civil servant.

In particular, in the education sector, both teachers and principals can be hired with or without a civil service exam. Almost 65% of principals are hired without a civil service exam by direct appointment, 31% of principals are recruited with a civil service exam and 4% are contracted by election by the school community. Hiring principals and teachers without a civil service exam allows mayors to exert political influence over school governance and is associated with lower educational outcomes (Akhtari et al., 2022; Pereda et al., 2019). This influence extends to public managers who can politicize the administration of public programs and resources. Moreover, public employees at various hierarchical levels and across sectors may be utilized as rewards for supporters and street donors who have previously contributed to political campaigns (Akhtari et al.,

2022; Colonnelli et al., 2020).

# 3 Data and Econometric Strategy

## 3.1 Data

**Electoral Data:** The electoral data comes from the Superior Electoral Court (*Tribunal Superior Eleitoral*, TSE), which monitors all municipal, state, and federal elections in Brazil. We used electoral data from 2012 and 2016. This data provides the number of votes each mayoral candidate received in the election and the candidate's gender. In this way, we can determine the share of votes each candidate got in these elections and define the margin of votes that women received over men.

**Educational data:** We used data from the National Basic Education Assessment System (*Sistema Nacional de Avaliação da Educação Básica*, SAEB) provided by the Anísio Teixeira National Institute for Educational Studies and Research (*Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira*, INEP). The SAEB is a national assessment applied to public school students in the 5th and 9th grades of primary school with at least 10 students enrolled in that specific grade. It is applied every two years. Particularly important for us is the questionnaire answered by teachers and principals in conjunction with the SAEB assessment. The questionnaire asks teachers and principals about many aspects of school management, school conditions, teachers' perceptions about student future performance, and others. We use these items to compute the School Management Quality Index (SMQI) and to measure additional aspects, divided into three categories: recruitment (selection) of public servants, incentives (monetary and non-monetary), and planning actions. We use the answers to those items as our main policy outcomes. A detailed list of dependent variables is presented in Table A7 and Table A8. There are two advantages to using the SAEB questionnaire for teachers and principals. Firstly, there is the possibility of confronting two different perspectives on school management, the perception of teachers and principals. Secondly, the responses from teachers and principals are anonymous and low-risk. This gives confidence that the answers reflect the perception of these school agents about the quality of school management. Finally, we use proficiency in math and language skills, also measured by SAEB assessments, to estimate the impact of gender elections on learning. These outcomes may be affected as a result of an improvement in school management.

**Baseline characteristics:** We extracted data on the municipalities from various sources. We extracted data from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*, IBGE) and IPEADATA on the economic and social characteristics of the municipalities for the years 2012, and 2016. We used the Educational Census, by INEP, to check whether educational variables related to the baseline characteristics of schools are affected by the gender of mayors. In addition, we used data from the Brazilian National Educational Census (*Censo Escolar*).

**RAIS:** Finally, RAIS is an administrative matched employer-employee dataset managed by the Ministry of Labor (*Ministério do Trabalho e Emprego*, MTE) and made available by the Special Secretary of Labor and Retirement (*Secretaria Especial da Previdência e Trabalho*, SEPRT) which provides information on the universe of workers in both the public and formal private sector. We extracted three variables from RAIS data: age, education (if the employee has a college degree), and information about the specific occupation of public servants. The information about the particular occupation of workers is classified according to the Official Brazilian Labor Market Classification (*Classificação Brasileira de Ocupações 2002*, CBO). We use this data to understand if the potential impact of gender affects other sectors of municipal governments. Similarly to Colonnelli et al. (2020), we divided the group of public servants into two groups: bureaucrat-manager (e.g., manager of a public sector agency at the municipal or state level, school headmaster, administrative director, health services manager) and bureaucrat-lower level (e.g., school principals, administrative assistants, administrative supervisors, receptionists).

### 3.1.1 Measuring school management practices

Measuring the quality of public management is challenging because many factors can affect management efficiency and management quality is a latent unobservable factor. One approach is to measure the presence of a set of selected practices where there has been a high level of *ex-ante* consensus (among consultants and sector experts) that these management practices have a causal influence on the entity's performance (Hwa and Leaver, 2021). This approach has been adopted by the World Management Survey (WMS), a leading and popular initiative designed to measure the quality of management in different settings. According to this procedure, more of those selected practices imply higher management quality[10].

[10]This approach has advantages and disadvantages. As an advantage, practices are easy to measure and observe. It is possible to estimate how these practices are implemented, which allows understanding beyond the simple presence (or not) of those practices.

Although this approach is a reliable and consistent measure of management quality, it requires a costly procedure that is difficult to apply when there are many units to be analyzed, as is the case with public schools in Brazil. Some attempts to adopt procedures similar to the WMS have been made in Brazil (Borges et al., 2024; Hoogerbrugge, 2019); however, these initiatives are restricted to a small number of schools in a given municipality.

Leaver et al. (2022) developed a School Management Quality Index (SMQI) adapted to Brazilian public data available in the SAEB assessment. They consider the World Management Survey (WMS) for schools developed by Bloom et al. (2015) as a benchmark and identify the set of questions in the public SAEB's survey (teacher and principal) that elicit information on the management practices that are also measured in the WMS. After that, they code answers in line with the WMS scoring methodology — that is, more structured practices are assigned higher scores — and build a set of indices from these individual question scores. They average the scores within each topic using Anderson (2008) estimator and yield the school management quality indicator (SMQI) for nearly 75000 schools in Brazil for the years 2013 and 2017. Leaver et al. (2022) validated this measure by comparing it with the WMS index computed in 2013 for 273 Brazilian schools. We use this measure as our main outcome variable for the quality of school management. In the appendix, Table A7, we detailed the variables used by Leaver et al. (2022).

## 3.2 Econometric strategy

We use the econometric strategy of regression discontinuity (RD) to identify the causal effect of electing a female candidate on school management variables. The RD compares municipalities that elected female mayors barely to other municipalities that elect male mayors. The econometric specification is defined by:

$$y_{ms,t+1} = \alpha + \beta Women_{mst} + f(WomenMargin_{mst}) + \varepsilon_{mst} \tag{1}$$

Where: $y_{ms,t+1}$ is the school management variable in municipality $m$, state $s$, and $t+1$ represents that outcome variables are measured one year after the women's election. In addition, $WomenMargin_{mst}$ is a continuous variable representing the margin of victory of the women candidate against mayor candidates.

The disadvantage is that carrying out those practices does not necessarily imply management quality. For example, carrying out school performance assessments is considered a "good" practice in the school context. However, if the assessment's results are not used to develop actions to promote learning, then the presence or absence of evaluation may be innocuous.

Positive values of $WomenMargin_{mst}$ indicate that the female candidate was elected in municipality $m$ in election year $t$. Negative values of $WomenMargin_{mst}$ suggest that the male candidates were elected in municipality $m$ in election year $t$. The parameter of interest is $\beta$ which indicates the effect of electing a female mayor on the quality of school management one year after the election. In turn, $Women_{mst}$ is a binary variable that takes the value 1 if $Women_{mst} > 0$ and the value zero otherwise.

The Equation 1 is estimated using a polynomial functional form on both sides of the cutoff. The polynomial order varies between one and two and the optimal bandwidth is chosen using the non-parametric (Calonico et al., 2014) procedure. We also report the results with half the optimum bandwidth and two times the optimum bandwidth, to understand the sensitivity of the estimates to the choice of optimum bandwidth following the approach of (Calonico et al., 2014). Changing the optimum bandwidth helps to interpret the external validity of results, given that doubling the optimum bandwidth increases the number of municipalities. In some specifications, covariates are included as characteristics of the elected mayors, such as age, education, self-declaration of race, and if the incumbent is running for reelection. In addition, we estimate the standard errors by clustering at the municipal level.

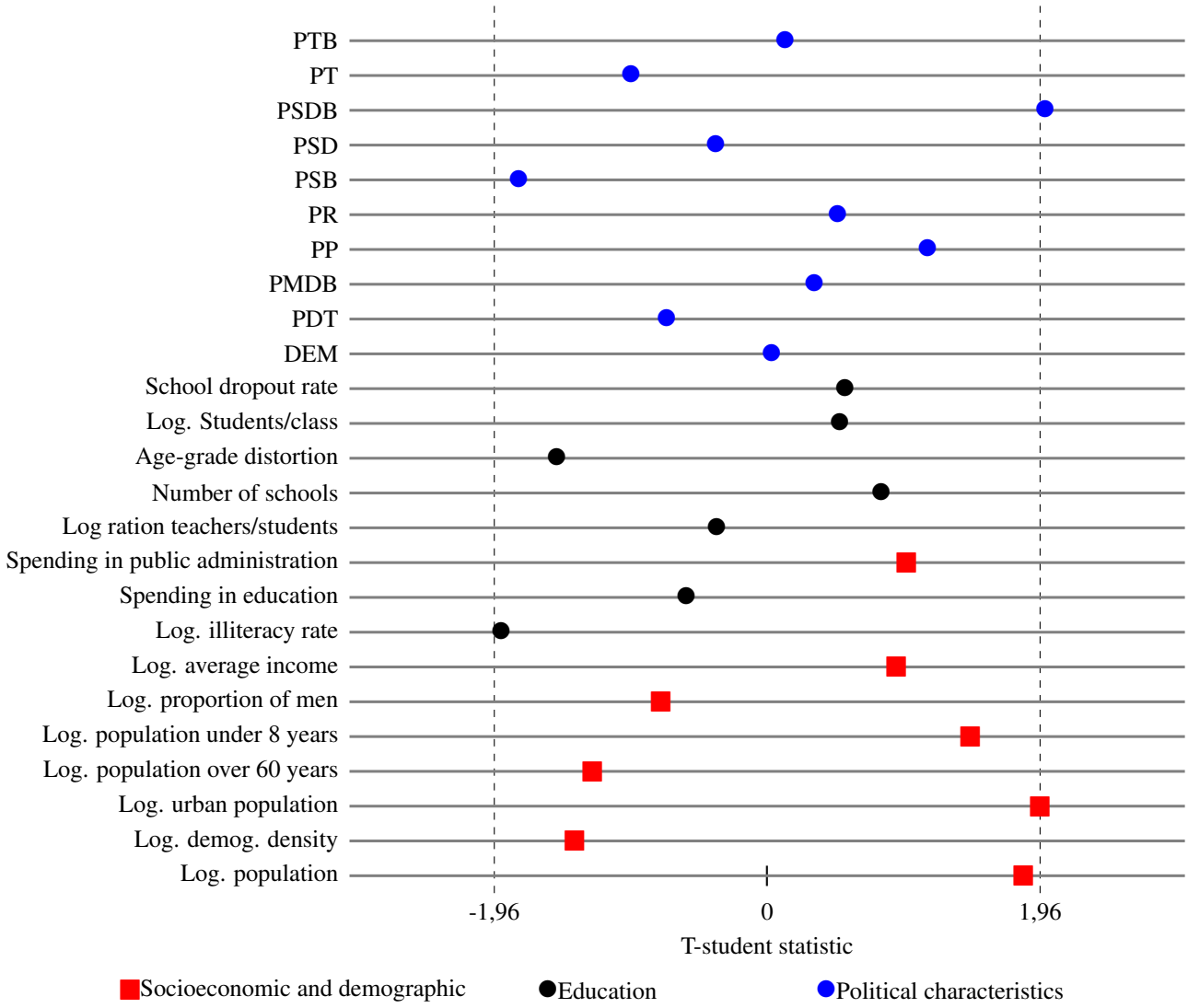
### 3.2.1 Validity of Econometric strategy

Two conditions must be satisfied for the regression discontinuity method to be valid. First, the continuity hypothesis states that in the absence of treatment, the treated group would show similar results to the control group. In our context, this means that school management in municipalities that elected a female mayor would be identical if they had elected a male mayor. The continuity hypothesis is not directly tested, however, we assume its validity if other variables that characterize municipalities do note present discontinuity when a woman candidate barely wins an election concerning a male candidate. If they are discontinuous, the treatment effect can be confounded with the impact of these variables on school management outcomes. Thus, we regressed the RD against a set of predetermined variables related to educational and economic municipal conditions and elected political parties. We present the estimates in Figure 1 using our baseline covariates as dependent variables in Equation 1. We find that all our baseline characteristics are balanced. In the Table A1, we reported the detailed estimations.

The second condition to validate the RD estimation is the absence of manipulation of the treated indi-

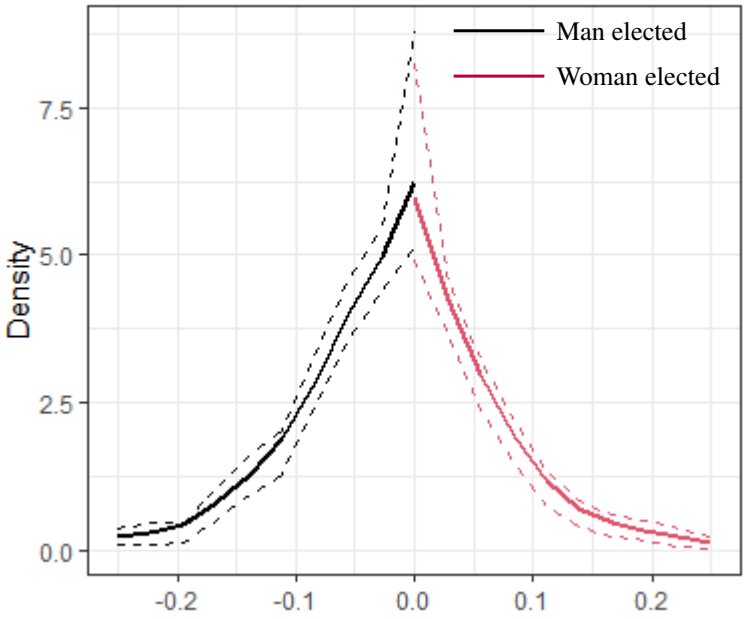
viduals in the treatment group. We employ McCrary's test whether $WomenMargin_{mst}$ density is around zero (McCrary, 2008). We report the McCrary's density test in Figure 2. The results indicated that the female margin of victory is continuous around zero, which suggests the absence of manipulation of the threshold. We replicate McCrary's test for each year separately and do not observe any indication of manipulation in any election. See Figure A10.

Figure 1: Test for Discontinuity in Baseline Characteristics




**Note:** This figure displays the robust-bias corrected t-statistics and standardized coefficients from our baseline covariates' balance RD estimates. For each variable, we run a RD with linear polynomial, uniform kernel specification, and optimal bandwidths following Calonico et al. (2014). In the graph, we indicate the 5% significance level thresholds in gray.

Figure 2: McCrary Density Test




**Note:** This figure displays the McCrary density test for the running variable around the cutoff considering both the 2012 and 2016 elections. Dashed lines show the confidence intervals.

# 4 Female mayor election and school management quality

## 4.1 Women's elections and school management index

Table 1 presents the estimates of the regression discontinuity on the School Management Quality Index (SMQI) one year after the election of mayors. Given the availability of the SMQI, we analyzed the election in 2012 and 2016 with the outcome variables measured in 2013 and 2017. Table 1 displays the results in five columns for two panels. Panel A presents the RD estimates of women's election in municipal schools, and Panel B shows the estimates for non-municipal (state) schools located in the same municipalities. Mayors do not have jurisdiction over non-municipal schools, therefore, we do not expect that the mayor's elections affect the school management practices in non-municipal schools, similar to a placebo "exercise". Column (1) shows the impact of electing a woman mayor without introducing controls for the characteristics of the mayors in the specification. For columns (2)–(5), we include controls for the characteristics of the mayors, such as age,

education, self-declaration of race, and if the incumbent is running for reelection.

In all the specifications, we assume a linear trajectory on both sides around the cutoff, except for column (5), which considers quadratic non-linearity. Finally, the Calonico et al. (2014) method is used to choose the optimal bandwidth, but in columns (3) and (4), we vary this optimal choice of bandwidth to check the sensitivity of the estimates to this method. In column (3), we extended the bandwidth to double the optimal value. In column (4), we tighten the bandwidth to half the optimal value. In addition to the discontinuity regression estimates, Table 1 reports the standard errors, the robust confidence interval, and the p-value (row 4), obtained from the procedure developed by Calonico et al. (2014).

The SMQI is measured in terms of standard deviation; therefore, the estimates presented in Table 1 suggest that the election of a woman mayor increases by $0.015 s.d.$ according to the specification in column (2). This result is not due to the inclusion of controls for the mayors' characteristics, as the estimates presented in columns (1) and (2) are quite similar. Additionally, this result is robust to tightening or widening the optimal bandwidth and considering quadratic polynomial order, suggesting that the findings are robust. All estimates were significant at 5%, except for columns (3) and (4), which widened and tightened, respectively, the optimal bandwidth. In this case, of column (3) the $p - value$ reported was 0.058. However, in the tightened optimal bandwidth specification, the estimate is non-significant.

In Panel B, we observe that the election of women barely to men does not impact non-municipal schools. These estimates suggest that in schools where we do not expect women's elections to impact school management practices, this does not occur. All the estimates were non-significant, indicating that the election of female mayors has no impact on schools that are not administered by the municipality.

Figure A9 shows graphically the effects described above. We present the RD plot for the impact of the female mayor on the SMQI for municipal schools, displaying a larger discontinuity around the cutoff. Note that the values to the right of zero are smaller (men's election) than the values to the left (women's election).

According to Chattopadhyay and Duflo (2004), women in political positions have preferences for some specific kind of public policy. Our estimates suggest that women may also have preferences for how policies are implemented and about bureaucratic practices. This means that women mayors change how public workers act, making it possible for them to be more effective. In turn, Brollo and Troiano (2016) and Afridi et al. (2017) state that women mayors are less involved in patronage and clientelism and, therefore, are more efficient

Table 1: Impact of Female Political Leadership on School Management Quality Index (SMQI)

| **Panel A: Municipal schools** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | 0.014** | 0.015** | 0.010* | 0.015 | 0.017** |
| Robust Std. Errors | 0.007 | 0.007 | 0.006 | 0.009 | 0.008 |
| Robust Conf. Int. | [0.001 , 0.032] | [0.002 , 0.034] | [-0.000 , 0.028] | [-0.011 , 0.028] | [0.002 , 0.036] |
| Robust p-value | 0.032 | 0.023 | 0.058 | 0.407 | 0.028 |
| Eff.Number Obs. | 1,568 | 1,519 | 2,135 | 957 | 1,965 |
| **Panel B: Non-municipal schools** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | 0.005 | 0.006 | 0.004 | 0.009 | 0.007 |
| Robust Std. Errors | 0.011 | 0.011 | 0.008 | 0.013 | 0.012 |
| Robust Conf. Int. | [-0.020 , 0.031] | [-0.018 , 0.031] | [-0.017 , 0.027] | [-0.022 , 0.039] | [-0.019 , 0.035] |
| Robust p-value | 0.682 | 0.611 | 0.635 | 0.592 | 0.568 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |
| Eff.Number Obs. | 616 | 627 | 941 | 406 | 765 |

**Note:** Table 1 reports source RD estimates of the effect of female mayors on the School Management Quality Index (SMQI) considering 2012 and 2016 Brazilian elections. Panel A shows results for municipal schools and Panel B for non-municipal schools. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

in implementing public policies. Our results suggest that women's effectiveness can also be explained by changing the practices adopted by public schools.

## 4.2 Heterogeneous Effects

In this section, we investigate the presence of a heterogeneous effect of the municipal election of women on the School Management Quality Index (SMQI). We consider three main variables that can moderate the impact of women's political power on bureaucratic practices: population size, political alignment, and the School's Socioeconomic Index (SSEI). Population size is a proxy variable for local political accountability (Barbosa and Ferreira, 2023). Municipalities with small population sizes in Brazil are generally poorer, have greater dependence on the public sector, and have strong political power concentrated in political families. We re-estimated the Equation 1 in two sub-samples: municipalities with less than 30,000 inhabitants and municipalities with more than 30,000 inhabitants. We utilize the optimum bandwidth from Calonico et al. (2015), incorporate mayor's controls in all estimates, and assume the linear polynomial order of RD.

In turn, the political alignment of the mayor with other levels of government may facilitate the implementation of local policies through more political support or by facilitating access to resources aimed at favoring mayors who are members of a specific political coalition (Arulampalam et al., 2009; Alberti et al., 2023). Thus, we re-estimated Equation 1 in two sub-samples. The first is the sample in which the mayor's political coalition is the same as the political coalition of the governor of the state to which that municipality belongs (political alignment)[11]. The second is those whose mayor's political party coalition differs from the political coalition that elected the state governor.

Finally, schools whose students have a higher socio-economic status can impact the introduction of new school management policies. In general, these schools are preferred by permanent and more experienced teachers, and parents are more involved in school decisions. We re-estimate the Equation 1 in two sub-samples: above and below the median of the School Socioeconomic Index (SSEI) in each Brazilian state[12].

The results are presented in Table 2. Panel A reports the estimates of the heterogeneous effect by population size. Women mayors are more effective in changing school management practices in small mu-

[11]Elections for state governors also take place every four years, although always two years after the mayoral elections. Thus, when the election for mayor occurs, the governors and the party coalitions that elected them have already been defined.

[12]The School Socioeconomic Index (SSEI) was obtained by average out the student socioeconomic index estimated by Soares and Alves (2023).

Table 2: Heterogeneous effect of women's election

| **Panel A: Population Size** | (1)<br>Below 30,000 | (2)<br>Above 30,000 |
|---|---|---|
| RD Estimator | 0.018** | -0.005 |
| Robust Std. Errors | 0.008 | 0.012 |
| Robust Conf. Int. | [0.003 , 0.038] | [-0.033 , 0.019] |
| Robust p-value | 0.021 | 0.592 |
| Eff.Number Obs. | 1,078 | 549 |
| **Panel B: Political alignment** | (1)<br>No Political alignment | (2)<br>Political alignment |
| RD Estimator | -0.002 | 0.025*** |
| Robust Std. Errors | 0.006 | 0.005 |
| Robust Conf. Int. | [-0.014 , 0.015] | [0.016 , 0.037] |
| Robust p-value | 0.933 | 0.000 |
| Eff.Number Obs. | 3,172 | 2,665 |
| **Panel C: School Socioeconomic Index (SSEI)** | (1)<br>Below SSEI median | (2)<br>Above SSEI Median |
| RD Estimator | 0.018* | 0.020** |
| Robust Std. Errors | 0.01 | 0.009 |
| Robust Conf. Int. | [-0.002 , 0.042] | [0.003 , 0.045] |
| Robust p-value | 0.074 | 0.025 |
| Eff.Number Obs. | 1,246 | 1,267 |
| Mayor controls | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal |
| Polynomial order | Linear | Linear |

**Note:** Table 2 reports source RD estimates of the heterogeneous effect of female mayors on the School Management Quality Index (SMQI) considering 2012 and 2016 Brazilian elections. Panel A shows results considering municipal population size, above or below 30,000 inhabitants. Panel B shows estimates varying the political alignment of the female mayor. Panel C reports the RD estimates separating for above or below school socioeconomic index. In both cases, we estimate a first-degree polynomial. Optimal bandwidths following Calonico et al. (2014) and we include mayors' control variables in all specifications. We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

nicipalities, those with fewer than 30,000 inhabitants. The significant impact occurs in the first year after the election and increases throughout the term of office. These findings may be associated with female mayors being more effective in municipalities with lower political accountability. Another potential explanation for this finding is that less socially advantaged municipalities, such as municipalities with small population sizes in Brazil, may benefit more from effective political leaders because they may have more room for improvement. A third potential explanation is the possibility that in small municipalities, it is less difficult to verify if a mayor police is executed at lower bureaucracy levels.

In Panel B, we show the estimates of the mayor's political alignment with the state governor. Being politically aligned with the state governor contributes to the impact of women mayors on the bureaucratic practices of schools. The state governor's potential support is important for female mayors' effectiveness.

Finally, we examined whether the socio-economic status of municipal students contributes to the effectiveness of the mayor in changing school management practices. Female mayors are more effective in municipalities with higher socioeconomic status. However, the impact of women's elections almost doubled from the beginning to the end of their term in the least socioeconomically disadvantaged schools, while it remained the same in schools with lower socioeconomic status. Possibly, the presence of a more engaged school community and more experienced teachers can contribute to the introduction of school management practices. Leaver et al. (2022) develop a theoretical framework to explain why improvements in school management practices affect student learning. They assume that teacher selection and community involvement are the possible drivers of school management practices for student learning. In our case, we suggest that good school management practices can be more easily implemented in schools that potentially already have higher parental engagement and that have selected better teachers (more experienced and not temporary).

# 5 Understanding the effect of women's election on school management practices

This section explores some potential channels through which the election of a female mayor can change the management practices of public school principals. We argue that female mayors can affect management practices through three channels: public servant recruitment; monetary and non-monetary incentives; and tar-

geting the public policy agenda. There may be other mechanisms through which female political leadership may affect the practices of lower-level bureaucrats. However, the availability of data prevents us from investigating such additional causal channels.

Table 3 presents the RD estimation on the variables: Recruitment without formal exam, principal's wage, and principals' reported workload hours. The Table A8 in the appendix shows the definition of each variable in detail. Recruitment without a formal civil exam is a binary variable that indicates 1 if the principal reports that she was hired without taking a formal exam and 0 if she has passed a formal civil exam. In turn, the variable workload hours refers to the weekly workload of a school principal. This variable is divided into five categories, and the higher the value, the more hours the principal works at the school. Finally, the school principal's wage refers to the gross salary received for acting as the school principal and ranges between 11 categories, with the higher the category, the higher the gross salary.

We use the same specification as Equation 1. In all the specifications, we assume a linear trajectory on both sides around the cutoff, except for column (5), which considers quadratic non-linearity. Finally, the Calonico et al. (2014) method is used to choose the optimal bandwidth. In column (3), we extended the bandwidth to double the optimal value. In column (4), we tighten the bandwidth to half the optimal value. Column (1) shows the impact of electing a woman mayor without introducing controls for the characteristics of the mayors in the specification. For columns (2)–(5), we include controls for the characteristics of the mayors, such as age, education, self-declaration of race, and if the incumbent is running for reelection.

The estimates presented in Table 3 show a significant reduction in the hiring of school principals without a formal admission exam. In other words, the election of a woman mayor reduces the recruitment of public servants by appointment and increases recruitment through meritocracy. A discretionary political appointment is often used as a tool for patronage, leads to the selection of less competent individuals, and is not related to the quality of public management (Colonnelli et al., 2020; Muñoz and Prem, 2023; Brollo and Troiano, 2016).

The findings are related to the education sector, however, the election of women may potentially affect other sectors as well. To test this, we used the same RD specification on the educational level and age of bureaucrats in the municipality. We utilized the RAIS database, an administrative record detailing employers and formal employees. From this dataset, we extracted three variables: age, education (indicating whether the employee holds a college degree), and occupation details specific to civil servants. Age can be seen as a

proxy variable for the experience of the public worker. Age and education represent important characteristics of civil servants(Alesina et al., 2019; Besley and Reynal-Querol, 2011; Dal Bó et al., 2017) and whether female election affects those variables may suggest that the effect of women's political leadership is not restricted to the educational sector. Following the approach of Colonnelli et al. (2020), we categorized civil servants into two groups: Bureaucrats managers (such as managers of public sector bodies at the municipal or state level, school directors, administrative directors, and health services managers) and Bureaucrats lower-level (including school principals, administrative assistants, administrative supervisors, and receptionists). We regress the RD estimation to each group and both variables.

The results are presented in Table A3 and Table A2. For bureaucratic managers, women's elections significantly increase the age of managers, suggesting that women choose more experienced civil servants for the top bureaucracy. The results are not robust concerning education because the signs vary according to changes in the specifications. In turn, for lower-level bureaucrats, such as school principals, the effect of the female election is positive and significant for education, indicating that women recruit bureaucrats at lower levels with higher education more than men, however, it is negative and significant for age, implying that women prefer less experienced bureaucrats lower level. Both estimates show that, possibly, the effect of electing women is not restricted to the education sector, rather it affects other sectors as well.

Panel B and C of the Table 3 show the effect on the wage and workload of the principals. Both variables can be directly influenced by the discretionary action of the mayor. The results show that the election of a female mayor has an impact positively on the gross salary and negatively on the workload of school managers, indicating a reduction of the workload. These findings refer to column (2), which includes linear polynomial order and control variables at the level of the mayor. Concerning wages, other specifications were not significant, although the positive effect size. In the case of workload reduction, the estimates in all specifications are significant. In summary, the estimates suggest an increase in the monetary and non-monetary incentive for school managers to work.

Another aspect that could be directly affected by the election of female mayors refers to the focus of the principals' planning actions. Figure 3 shows teachers' perceptions of the school planning practices conducted by principals. All the questions on this topic are asked of teachers and refer to the frequency with which principals implement such planning actions. The answer options are 0: If never; 1: If sometimes; 2: If often;

Table 3: Women's election and school management

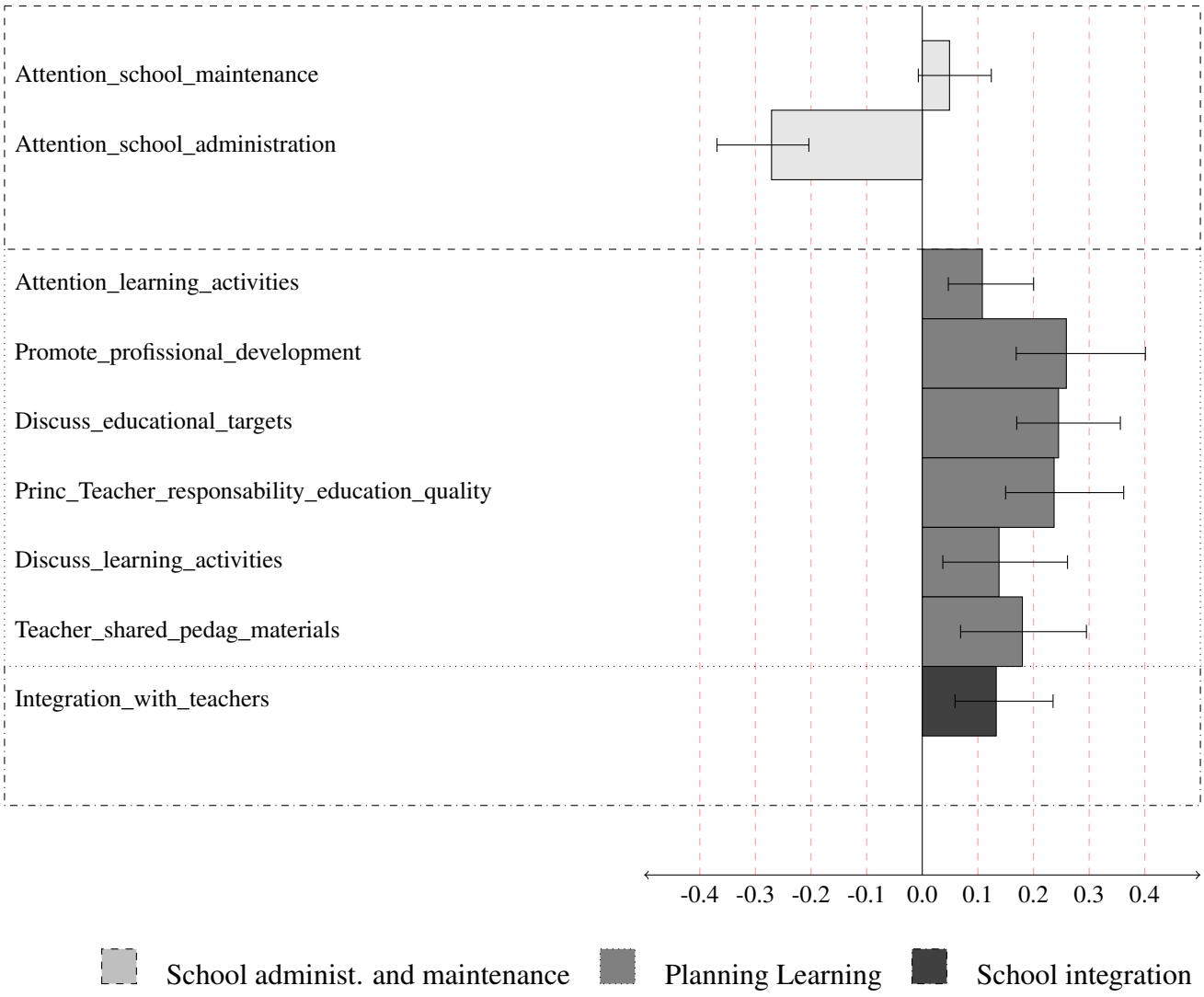
| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Panel A: Recruitment without formal civil exam** | | | | | |
| RD Estimator | -0.176*** | -0.171*** | -0.167*** | -0.183*** | -0.170*** |
| Robust Std. Errors | 0.028 | 0.029 | 0.024 | 0.034 | 0.033 |
| Robust Conf. Int. | [-0.245 , -0.121] | [-0.243 , -0.112] | [-0.235 , -0.115] | [-0.285 , -0.145] | [-0.247 , -0.109] |
| Robust p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff.Number Obs. | 1,686 | 1,523 | 2,162 | 988 | 1,893 |
| | (1) | (2) | (3) | (4) | (5) |
| **Panel B: Principal's Wage** | | | | | |
| RD Estimator | 0.353 | 0.606** | 0.594** | 0.265 | 0.321 |
| Robust Std. Errors | 0.254 | 0.215 | 0.175 | 0.272 | 0.279 |
| Robust Conf. Int. | [-0.302 , 0.791] | [0.040 , 1.035] | [0.125 , 1.026] | [-0.218 , 1.025] | [-0.401 , 0.789] |
| Robust p-value | 0.381 | 0.034 | 0.012 | 0.203 | 0.522 |
| Eff.Number Obs. | 933 | 1,130 | 1,387 | 721 | 1,101 |
| | (1) | (2) | (3) | (4) | (5) |
| **Panel C: Workload hours** | | | | | |
| RD Estimator | -0.070* | -0.066* | -0.063** | -0.072* | -0.076** |
| Robust Std. Errors | 0.030 | 0.031 | 0.025 | 0.040 | 0.034 |
| Robust Conf. Int. | [-0.137 , 0.001] | [-0.136 , 0.009] | [-0.140 , -0.011] | [-0.173 , 0.009] | [-0.151 , -0.001] |
| Robust p-value | 0.055 | 0.086 | 0.022 | 0.078 | 0.047 |
| Eff.Number Obs. | 2,698 | 2,416 | 3,211 | 1,561 | 3,137 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table 3 reports source RD estimates of the effect of female mayors on three specific variables related to school management considering the 2012 and 2016 Brazilian elections. Panel A shows results for a binary variable indicating 1 to principal's recruitment based on direct nomination and 0 to the contrary. Panel B presents the estimates for the principal's wage. Panel C shows the estimates for the principal's workload hours. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

3: If always or almost always.

In addition, we observed a reduction in the frequency of the principal concerning planning actions not related to learning, such as Attention to School Administration or Maintenance. These results indicate that female leadership affects the focus of bureaucratic practices on aspects associated with the results of public policies, for instance, the promotion of student learning.

Figure 3: Teachers' perceptions about principals' planning activities




**Note:** This figure displays the RD estimates of the effect of female mayors on the teachers' report of planning activities about principals, considering the 2012 and 2016 Brazilian elections. We estimate a first-degree polynomial, optimal bandwidths following Calonico et al. (2014), and we include mayors' control variables for all estimations. We report 95% CI. The definition of the variables is shown in Table A8.

# 6 Women's elections and educational outcomes

In this section, we analyze whether the election of female mayors has an impact on the educational outcomes of municipalities. To do this, we use the same econometric strategy as Equation 1, although we replace the outcome variable with the performance of students in the 5th and 9th grades of elementary school. The equation to be estimated is as follows:

$$y_{ijms,t+1} = \alpha + \beta Women_{mst} + f(WomenMargin_{mst}) + \varepsilon_{ijmst} \tag{2}$$

Where: $y_{ijms,t+1}$ is the performance in mathematics or language of the student $i$, at the grade $j = \{5\text{th}, 9\text{th}\}$, in the municipality $m$, in the state $s$, and $t+1$ is the number of years after the election in year $t$. The student's performance is measured by SAEB assessment in the years 2013 and 2017. This is a low-stakes assessment administered by the federal government to assess the progress of students' cognitive abilities across the country. It uses Item Response Theory (ITR), which allows comparability of test scores over time. It has no direct implications for student progress in school, student grades, teacher promotion, or removal. Students are not informed about their performance on this assessment. To facilitate the interpretation of the estimates, we use the standardized student scores[13].

Table 4 and Table 5 show the estimates. The results indicate that the election of a female mayor in close races to a male mayor impacts, positively and significantly student performance in language and math only for the 9th grade. Student's performance in math in 5th grade is not affected by the election of a female mayor. For language, it was marginally significant at 10% only in some specifications in language. According to the preferred specification shown in column (2), the effect size of electing a woman one year after the municipal election is approximately $0.175 s.d.$ in math and $0.183 s.d.$ in language for the 9th grade. These estimates are robust to the addition of mayoral-level controls, variations in optimal bandwidths, and the polynomial order of the quadratic RD.

In addition, we conducted a placebo exercise by estimating the Equation 2 for non-municipal schools, i.e., those schools that are not administrated by mayors. The estimates are presented in the Table A5 and Table A6, for the 5th and 9th grades, respectively. The estimations suggest no significant effect on the perfor-

[13]This standardized score is already provided in the SAEB microdata and considers the individual distribution of test scores for students in all Brazilian municipalities.

mance of students in non-municipal schools, except for performance in language for the 5th grade. However, even in this case, in most of the specifications, the null hypothesis of a significant impact at a 5% significance level is rejected.

Table 4: Impact of female mayor election on performance 5th grade in municipal schools

| **Panel A: Mathematics** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | 0.115 | 0.113 | 0.129 | 0.131 | 0.104 |
| Robust Std. Errors | 0.079 | 0.081 | 0.060 | 0.103 | 0.093 |
| Robust Conf. Int. | [-0.078 , 0.322] | [-0.082 , 0.333] | [-0.032 , 0.292] | [-0.129 , 0.375] | [-0.091 , 0.349] |
| Robust p-value | 0.233 | 0.236 | 0.117 | 0.339 | 0.251 |
| Eff.Number Obs. | 95,821 | 91,642 | 118,653 | 61,849 | 109,402 |
| **Panel B: Language** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | 0.153* | 0.154* | 0.160** | 0.173 | 0.155* |
| Robust Std. Errors | 0.074 | 0.077 | 0.057 | 0.097 | 0.093 |
| Robust Conf. Int. | [-0.024 , 0.349] | [-0.021 , 0.364] | [0.019 , 0.324] | [-0.077 , 0.390] | [-0.030 , 0.402] |
| Robust p-value | 0.087 | 0.081 | 0.028 | 0.189 | 0.091 |
| Eff.Number Obs. | 94,125 | 90,806 | 118,177 | 61,540 | 102,584 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table 4 reports RD estimates of the effect of female mayors on the student's performance in 5th grade in municipal schools, considering the 2012 and 2016 Brazilian elections. Panel A shows results for math performance and Panel B for language. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

One potential explanation for why only 9th-grade student performance was impacted stems from the increased complexity of managing 9th-grade schools. In Brazil, some schools offer education only for the initial stage of primary education (1st to 5th grades, called *Anos Iniciais*), schools that offer education only for the final stage (6th to 9th grades, called *Anos Finais*) and schools that offer both the initial and final stages. In the *Anos Iniciais*, classes are staffed by just one teacher. In the *Final Years*, classes are staffed by more teachers specializing in certain subjects, such as language, mathematics, history, etc. The rise in the number of teachers, subjects, and students increases the complexity of school management.

The Ministry of Education in Brazil (MEC) has created a school Management Complexity Indicator

Table 5: Impact of female mayor election on performance 9th grade in municipal schools

| **Panel A: Mathematics** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | 0.188** | 0.175** | 0.130*** | 0.221** | 0.204** |
| Robust Std. Errors | 0.072 | 0.067 | 0.054 | 0.087 | 0.087 |
| Robust Conf. Int. | [0.036 , 0.393] | [0.033 , 0.370] | [0.061 , 0.343] | [0.000 , 0.409] | [0.043 , 0.429] |
| Robust p-value | 0.019 | 0.019 | 0.005 | 0.05 | 0.016 |
| Eff.Number Obs. | 55,027 | 54,826 | 67,067 | 36,441 | 56,330 |
| **Panel B: Language** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | 0.193*** | 0.183*** | 0.14*** | 0.231** | 0.212*** |
| Robust Std. Errors | 0.067 | 0.063 | 0.051 | 0.082 | 0.081 |
| Robust Conf. Int. | [0.054 , 0.383] | [0.052 , 0.365] | [0.077 , 0.340] | [0.001 , 0.387] | [0.059 , 0.421] |
| Robust p-value | 0.009 | 0.009 | 0.002 | 0.049 | 0.009 |
| Eff.Number Obs. | 54,734 | 54,734 | 67,067 | 35,922 | 56,517 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table 5 reports RD estimates of the effect of female mayors on the student's performance in 9th grade in municipal schools, considering the 2012 and 2016 Brazilian elections. Panel A shows results for math performance and Panel B for language. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

(*Índice de Complexidade de Gestão*, ICG) based on the number of teachers, students, and grades per school. The indicator ranges from 1 to 6 and the higher the value, the more difficult the school is to manage, according to the MEC. For 2017, considering only municipal schools, the average ICG value for schools offering only *Anos Inicial* is 2.49. On the other hand, for schools offering only *Anos Finais*, the ICG is 3.57. For schools offering both stages of education, the ICG is 3.81. We hypothesize that the election of female mayors improves the quality of municipal public school management, with a greater effect on schools with more complex management. Therefore, improving school management practices only affects performance in the 9th grade.

Our results differ from the conclusions of Barbosa (2017), who estimated a similar RD specification for Brazil and found no effect on language and math performance as a consequence of the election of a female mayor. However, the results cannot be directly compared for two reasons. First, she measured the effect of the election of a woman mayor in the medium and long term, i.e. 3, 5, and 7 years after the election. Our estimate is short-term, as we measured the students' performances one year after the election. Second, Barbosa (2017) considered the average performance in language and math in the 5th and 9th grades. We, in turn, analyzed the impact separately according to grades. The reason for considering the estimates by grades is that schools in the 9th grade have greater challenges to be managed due to the larger number of teachers.

# 7 Concluding Remarks

This paper studied the effect of female political leadership on the management practices of school principals in Brazil, using an RD strategy applied to 10,905 municipal elections in the years 2012 and 2016. The main outcome variable is a School Management Quality Index (SMQI) developed by Leaver et al. (2022) which uses the same framework as the World Management Survey adapted for schools. The results indicated that the election of female mayors in close elections concerning male candidates has a positive and significant impact on the SMQI. The estimates were robust to variations in the optimal bandwidth, the addition of control variables at the mayoral level, and changes in the polynomial order. In addition, through a placebo "exercise", it was observed that schools that were not administered by mayors were not affected by the female election.

We also analyzed heterogeneous effects. The estimates suggest that the election of female mayors is more effective on the SMQI in small municipalities, with less than 30,000 inhabitants, and when the mayor is politically aligned with the political party of the state governor. To understand in more detail how the women

mayors affect the management practices of school principals, we adopted the same empirical strategy as the RD on some specific aspects of school management. We found that female mayors increase the recruitment of principals through formal civil examinations. The results indicate that there was an increase in the hiring of lower-level bureaucrats with a high level of education and a reduction in the age of bureaucrats, suggesting that the election of women mayors has an impact on other sectors, not restricted to the education sector.

The estimations also suggest that the election of women mayors has an impact on the non-monetary incentives of school managers by reducing their workload. In addition, we found evidence that women mayors in close elections change the planning activities of school managers, directing them towards planning activities focused on promoting students learning.

Finally, it was estimated whether the election of female mayors impacts student performance in standardized tests. We find that the election of female mayors in close elections has a positive and significant impact on student performance in 9th grade in both, mathematics and language. One potential explanation for this effect only in 9th grade stems from the greater difficulty in managing schools that offer this stage of education in Brazil.

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# Appendix

## 7.1 Additional tables

Table A1: Detailed discontinuity estimations on predetermined characteristics

| | Estimated coefficient | Standard Deviation | P-Value | CI | Bandwidth | Observations |
|---|---|---|---|---|---|---|
| Log. Population | 0.2308 | 0.1254 | 0.0656 | [-0.0034; 0.5553] | 0.0662 | 947 |
| Log. Demographic density | -0.2544 | 0.1839 | 0.1665 | [-0.7287; 0.0793] | 0.0586 | 950 |
| Log. Urban Population ratio | 0.144 | 0.0735 | 0.0503 | [0.0028; 0.3378] | 0.0610 | 950 |
| Log. 60 years old (or more) ratio | -0.0432 | 0.0344 | 0.2083 | [-0.1291; 0.0207] | 0.0511 | 950 |
| Log. 8 years old (or less) ratio | 0.0467 | 0.0320 | 0.1447 | [-0.0168; 0.1270] | 0.0516 | 950 |
| Log. Male population ratio | -0.0026 | 0.0034 | 0.4578 | [-0.0113; 0.0045] | 0.0629 | 950 |
| Log. Average income | 0.07 | 0.0755 | 0.3539 | [-0.1086; 0.2380] | 0.0785 | 949 |
| Log. Illiteracy ratio | -0.1754 | 0.0918 | 0.0561 | [-0.3789; 0.0357] | 0.0775 | 949 |
| Log. Per capita public spending on education | -0.0419 | 0.0719 | 0.5599 | [-0.2183; 0.1028] | 0.0622 | 343 |
| Log. Per capita public spending on administration | 1e-04 | 0.0001 | 0.3503 | [-0.0001; 0.0003] | 0.0618 | 343 |
| Log. Teachers by students | -0.0165 | 0.0454 | 0.7167 | [-0.1293; 0.0744] | 0.0718 | 951 |
| Log. Municipal schools | 0.1211 | 0.1478 | 0.4128 | [-0.1736; 0.4873] | 0.0683 | 951 |
| Age-grade difference | -0.0266 | 0.0176 | 0.1308 | [-0.0682; 0.0103] | 0.0712 | 943 |
| Log. Students by classroom ratio | 0.0182 | 0.0350 | 0.6025 | [-0.0529; 0.0996] | 0.0653 | 946 |
| School dropout rate | 0.0058 | 0.0104 | 0.5795 | [-0.0155; 0.0321] | 0.0769 | 600 |
| DEM | -8e-04 | 0.0250 | 0.9744 | [-0.0571; 0.0465] | 0.0687 | 957 |
| PDT | -0.0268 | 0.0371 | 0.4704 | [-0.1168; 0.0494] | 0.0766 | 957 |
| PMDB | 0.0201 | 0.0595 | 0.7355 | [-0.1228; 0.1552] | 0.0769 | 957 |
| PP | 0.0451 | 0.0392 | 0.2505 | [-0.0339; 0.1434] | 0.0673 | 957 |
| PR | 0.0131 | 0.0259 | 0.6123 | [-0.0440; 0.0682] | 0.0863 | 957 |
| PSB | -0.0746 | 0.0418 | 0.0744 | [-0.1846; 0.0043] | 0.0750 | 957 |
| PSD | -0.0134 | 0.0362 | 0.7102 | [-0.1018; 0.0599] | 0.0810 | 957 |
| PSDB | 0.089600* | 0.0449 | 0.0460 | [0.0060; 0.2042] | 0.0668 | 957 |
| PT | -0.0443 | 0.0453 | 0.3278 | [-0.1538; 0.0602] | 0.1043 | 957 |
| PTB | 0.0053 | 0.0414 | 0.8976 | [-0.0910; 0.1018] | 0.0711 | 957 |

**Note:** Table A1 the robust-bias corrected t-statistics and standardized coefficients from our baseline covariates' balance RD estimates. We run a RD with linear polynomial, uniform kernel specification, and optimal bandwidths following Calonico et al. (2014) for each variable.

Table A2: Impact of female mayor election on the average age of municipal public servants

| **Panel A: Bureaucrat Managers** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | 0.848*** | 0.788** | 0.677** | 1,139*** | 0.929*** |
| Robust Std. Errors | 0.287 | 0.284 | 0.212 | 0.378 | 0.336 |
| Robust Conf. Int. | [0.284 , 1.599] | [0.194 , 1.502] | [0.106 , 1.284] | [0.478 , 2.231] | [0.324 , 1.753] |
| Robust p-value | 0.005 | 0.011 | 0.021 | 0.002 | 0.004 |
| Eff.Number Obs. | 26,086 | 26,273 | 37,149 | 16,798 | 33,358 |
| **Panel B: Bureaucrats Lower-Level** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | -0.602*** | -0.548*** | -0.215*** | -0.666*** | -0.654*** |
| Robust Std. Errors | 0.193 | 0.185 | 0.151 | 0.236 | 0.209 |
| Robust Conf. Int. | [-1.097 , -0.287] | [-1.029 , -0.240] | [-0.950 , -0.171] | [-1.743 , -0.698] | [-1.178 , -0.299] |
| Robust p-value | 0.001 | 0.002 | 0.005 | 0.000 | 0.001 |
| Eff.Number Obs. | 49,215 | 52,235 | 71,631 | 28,615 | 66,077 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table A2 reports RD estimates of the effect of female mayors on the age of municipal public servants, considering the 2012 and 2016 Brazilian elections. Panel A shows results for Bureaucrat Managers and Panel B for Bureaucrats Lower-Level. We classified these public servants using the information about the particular occupation extracted from RAIS, considering the Official Brazilian Labor Market Classification (*Classificação Brasileira de Ocupações 2002*). We follow the Colonnelli et al. (2020) for defining both groups. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

Table A3: Impact of female mayor election on the education of municipal public servants

| **Panel A: Bureaucrat Managers** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | -0.025*** | -0.035*** | -0.006** | 0.006 | 0.024** |
| Robust Std. Errors | 0.009 | 0.010 | 0.007 | 0.012 | 0.015 |
| Robust Conf. Int. | [-0.048 , -0.011] | [-0.058 , -0.011] | [-0.038 , -0.002] | [-0.012 , 0.047] | [-0.000 , 0.058] |
| Robust p-value | 0.002 | 0.004 | 0.027 | 0.249 | 0.053 |
| Eff.Number Obs. | 34,492 | 28,880 | 43,301 | 23,067 | 24,392 |
| **Panel B: Bureaucrats Lower-Level** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | 0.098*** | 0.094*** | 0.071*** | 0.084*** | 0.096*** |
| Robust Std. Errors | 0.007 | 0.008 | 0.006 | 0.008 | 0.008 |
| Robust Conf. Int. | [0.086 , 0.116] | [0.082 , 0.113] | [0.088 , 0.117] | [0.051 , 0.086] | [0.084 , 0.115] |
| Robust p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Eff.Number Obs. | 30,437 | 25,219 | 50,353 | 16,523 | 43,293 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table A3 reports RD estimates of the effect of female mayors on education (binary variable indicating if the public servant holds a college degree), considering the 2012 and 2016 Brazilian elections. Panel A shows results for Bureaucrat Managers and Panel B for Bureaucrats Lower-Level. We classified these public servants using the information about the particular occupation extracted from RAIS, considering the Official Brazilian Labor Market Classification (*Classificação Brasileira de Ocupações 2002* (CBO)). We follow the Colonnelli et al. (2020) for defining both groups. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

Table A5: Impact of female mayor election on performance 5th grade in non-municipal schools

| **Panel A: Math** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | 0.155 | 0.155 | 0.181 | 0.164 | 0.142 |
| Robust Std. Errors | 0.100 | 0.101 | 0.070 | 0.137 | 0.117 |
| Robust Conf. Int. | [-0.095 , 0.412] | [-0.099 , 0.403] | [-0.053 , 0.346] | [-0.103 , 0.539] | [-0.111 , 0.476] |
| Robust p-value | 0.220 | 0.236 | 0.150 | 0.183 | 0.223 |
| Eff.Number Obs. | 15,055 | 14,606 | 21,285 | 9,862 | 18,748 |
| **Panel B: Language** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | 0.230* | 0.231* | 0.242** | 0.236* | 0.226* |
| Robust Std. Errors | 0.102 | 0.102 | 0.073 | 0.138 | 0.115 |
| Robust Conf. Int. | [-0.020 , 0.497] | [-0.022 , 0.492] | [0.019 , 0.431] | [-0.019 , 0.628] | [-0.045 , 0.526] |
| Robust p-value | 0.070 | 0.073 | 0.032 | 0.065 | 0.098 |
| Eff.Number Obs. | 15,172 | 15,172 | 21,354 | 10,013 | 19,423 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table A5 reports RD estimates of the effect of female mayors on the student's performance in 5th grade in non-municipal schools, considering the 2012 and 2016 Brazilian elections. Panel A shows results for math performance and Panel B for language. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

Table A6: Impact of female mayor election on performance 9th grade in non-municipal schools

| **Panel A: Mathematics** | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| RD Estimator | 0.097 | 0.097 | 0.061* | 0.13 | 0.107 |
| Robust Std. Errors | 0.059 | 0.059 | 0.04 | 0.09 | 0.082 |
| Robust Conf. Int. | [-0.022 , 0.492] | [-0.049 , 0.260] | [-0.007 , 0.238] | [-0.065 , 0.399] | [-0.074 , 0.340] |
| Robust p-value | 0.182 | 0.182 | 0.065 | 0.157 | 0.207 |
| Eff.Number Obs. | 43,629 | 43,629 | 56,199 | 28,663 | 47,665 |
| **Panel B: Language** | (1) | (2) | (3) | (4) | (5) |
| RD Estimator | 0.118* | 0.119* | 0.086** | 0.151** | 0.128* |
| Robust Std. Errors | 0.053 | 0.052 | 0.037 | 0.079 | 0.078 |
| Robust Conf. Int. | [-0.049 , 0.260] | [-0.008 , 0.262] | [0.025 , 0.246] | [-0.008 , 0.390] | [-0.020 , 0.336] |
| Robust p-value | 0.088 | 0.066 | 0.016 | 0.06 | 0.081 |
| Eff.Number Obs. | 43,190 | 44,266 | 55,895 | 28,270 | 44,419 |
| Mayor controls | No | Yes | Yes | Yes | Yes |
| CCT-Optimal BW | Optimal | Optimal | 2 x Optimal | 0.5 x Optimal | Optimal |
| Polynomial order | Linear | Linear | Linear | Linear | Quadratic |

**Note:** Table A6 reports RD estimates of the effect of female mayors on the student's performance in 9th grade in non-municipal schools, considering the 2012 and 2016 Brazilian elections. Panel A shows results for math performance and Panel B for language. In both cases, we estimate a first-degree polynomial, in columns (1) - (4), and a second-degree polynomial in column (5). Optimal bandwidths following Calonico et al. (2014), except for columns (3) and (4), that we double and half the optimal bandwidths. We include mayors' control variables in columns (2) to (5). We report robust-bias corrected p-values and 95% CI. Coefficients significantly different from zero at 99%(***), 95%(**) and 90%(*) confidence level.

Table A7: Variables from SAEB used to estimate the SMQI

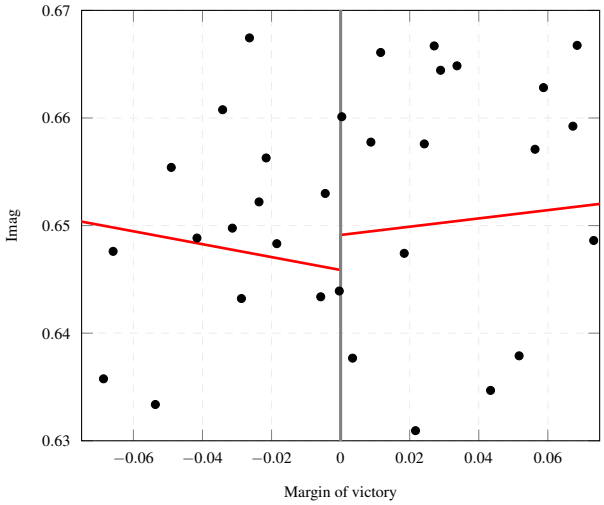
| Var Name(Base 2013) | Question | Years | Principal/Teacher |
|---|---|---|---|
| **Standardisation of Instructional Processes** | | | |
| TX_RESP_Q044 | We'd like to know what resources you use for teaching purposes in this class: Newspapers and magazines. | 2013-2017 | Teacher |
| TX_RESP_Q045 | We would like to know what resources you use for teaching purposes in this class: Literature books in general. | 2013-2017 | Teacher |
| X_RESP_Q048 | e would like to know what resources you use for teaching purposes in thisclass: Copying machine (xerox). | 2013-2017 | eacher |
| TX_RESP_Q099 | Do the students in this class have textbooks? | 2013-2017 | Principal |
| TX_RESP_Q048 | Indicate how often the following activities are carried out to minimize student absences this year and in this school: Parents/guardians are called to the school to talk about the subject individually. | 2013-2017 | Teacher |
| TX_RESP_Q106 | How much of the planned content were you able to develop with the students in this class this year? | 2013-2017 | Teacher |
| TX_RESP_Q073 | In your perception, the possible learning problems of the students in thegrade(s) or year(s) being assessed in this school are due to the following: Failure to comply with curricular content throughout the student's school career. | 2013-2017 | Teacher |
| **Personalization of Instruction and Learning** | | | |
| TX_RESP_Q086 | How was the textbook chosen this year? | 2013-2017 | Principal |
| TX_RESP_Q047 | Indicate how often the following activities are carried out to minimize student absences this year and at this school: Parents/guardians are called to the school to discuss the issue at a parents' meeting. | 2013-2017 | Principal |
| TX_RESP_Q049 | Indicate how often the following activities are carried out to minimize student absences this year and at this school: The school sends someone to the student's home. | 2013-2017 | Principal |
| TX_RESP_Q045 | Indicate how often the following activities are carried out to minimize student absences this year and at this school: Teachers talk to students to try to solve the problem. | 2013-2017 | Principal |
| TX_RESP_Q046 | Indicate how often the following activities are carried out to minimize student absences this year and at this school: Parents/guardians are notified by communication from the school. | 2013-2017 | Principal |
| TX_RESP_Q072 | In your perception, the possible learning problems of the students in the grade(s) or year(s) being assessed at this school are due to: Curriculum content that is inadequate for the students' needs. | 2013-2017 | Teacher |
| **Data-Driven Planning and Student Transitions** | | | |
| TX_RESP_Q040 | This year, what was the main criterion for assigning classes to teachers? | 2007-2017 | Principal |
| **Adopting Educational Best Practices** | | | |
| TX_RESP_Q061 | In this school and this year, indicate how often: The principal pays special attention to aspects related to student learning. | 2013-2017 | Teacher |
| TX_RESP_Q065 | In this school and this year, indicate how often: The principal encourages innovative activities. | 2013-2017 | Teacher |
| TX_RESP_Q061 | In this school and this year, indicate how often: The principal pays special attention to aspects related to student learning. | 2013-2017 | Teacher |
| TX_RESP_Q027 | How many teachers at this school have taken part in the continuing education activities you have organized in the last two years? | 2013-2017 | Principal |
| TX_RESP_Q075 | In the last two years, have you organized any continuing education activities (refresher courses, training, etc.) at this school? | 2013-2017 | Principal |
| TX_RESP_Q027 | In your perception, the possible learning problems of the students in the grade(s) or year(s) being assessed in this school are due to: Teacher dissatisfaction and discouragement with the teaching career. | 2013-2017 | Teacher |
| **Performance Review** | | | |
| TX_RESP_Q031 | The Class Council is a body made up of all the teachers who teach each class/grade. How many times has the Class Council met this year and in this school? | 2013-2017 | Principal |
| TX_RESP_Q052 | The Class Council is a body made up of all the teachers who teach each class/grade. This year and in this school, how many times has the Class Council met? | 2013-2017 | Teacher |

Table A8: Additional aspects of school management practices

| Variable | Question | Code in SAEB |
|---|---|---|
| Principal's wage | As a principal, approximately what is your gross salary (with bonuses, if any)?<br>Description: Principal's gross salary<br>Option/Value label: 1: If less than or equal to a minimum wage; 2: If between 1 and 1.5 minimum wage; 3: If between 1.5 and 2 minimum wage; 4: If between 2 and 2.5 minimum wage; 5: If between 2.5 and 3 minimum wage; 6: If between 3 and 3.5 minimum wage; 7: If between 3.5 and 4 minimum wage; 8: If between 5 and 5 minimum wage; 9: If between 5 and 7 minimum wage; 10: If between 7 and 10 minimum wage; 11: If higher than 10 minimum wages | TX_RESP_Q010 |
| Recruitment without formal civil exam | You took over the management of this school through:<br>Description: Means by which you took over the school<br>Option/Value label: 1: Indication; 0 Otherwise | TX_RESP_Q014 |
| If the principal encourages innovative activities | In this school and this year, indicate how often: The principal encourages innovative activities.<br>Description: If the director encourages innovative activities<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q065 |
| If the principal encourages and motivates the teacher to work | In this school and this year, indicate how often: The principal encourages and motivates me to work.<br>Description: If the principal encourages and motivates the teacher to work<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q064 |
| Attention_school_maintenance | In this school and this year, indicate how often: The principal pays special attention to aspects related to the maintenance of the school.<br>Description: If the principal gives special attention to aspects related to the maintenance of the school<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q063 |
| Attention_school_administration | In this school and this year, indicate how often: The principal pays special attention to aspects related to administrative rules.<br>Description: If the principal pays special attention to aspects related to administrative rules.<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q062 |
| Attention_learning_activities | In this school and this year, indicate how often: The principal pays special attention to aspects related to student learning.<br>Description: If the principal pays special attention to aspects related to student learning.<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q061 |
| Promote_profissional_development | In this school and this year, indicate how often: The principal informs teachers about the possibilities for professional development.<br>Description: Frequency with which the principal informs teachers about professional development opportunities<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q060 |
| Discuss_educational_targets | In this school and this year, indicate how often: The principal discusses educational goals with teachers at meetings.<br>Description: The principal discusses educational goals with teachers at meetings.<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q058 |
| Princ_Teacher_responsability_education_quality | In this school and this year, indicate how often: The principal and teachers aim to ensure that teaching quality issues are a collective responsibility.<br>Description: The principal and teachers aim to ensure that teaching quality issues are a collective responsibility.<br>Option/Value label: 0: If never; 1: If sometimes; 2: If often; 3: If always or almost always. | TX_RESP_Q059 |
| Discuss_learning_activities | In this school, how often did you do the following: Participated in discussions about the learning development of particular students.<br>Description: Frequency with which you participated in discussions about the learning development of certain students.<br>Option/Value label: 0: Never; 1: Once a year; 2: 3 to 4 times a year; 3: Monthly; 4: Weekly. | TX_RESP_Q056 |
| Teacher_shared_pedag_materials | In this school, how often did you do the following? Exchanged teaching materials with your colleagues.<br>Description: Frequency with which you exchanged teaching materials with colleagues<br>Option/Value label: 0: Never; 1: Once a year; 2: 3 to 4 times a year; 3: Monthly; 4: Weekly. | TX_RESP_Q054 |
| Integration_with_teachers | In this school, how often did you do the following? Engaged in joint activities with different teachers (e.g. interdisciplinary projects).<br>Description: Frequency of involvement in joint activities with different teachers<br>Option/Value label: 0: Never; 1: Once a year; 2: 3 to 4 times a year; 3: Monthly; 4: Weekly. | TX_RESP_Q057 |

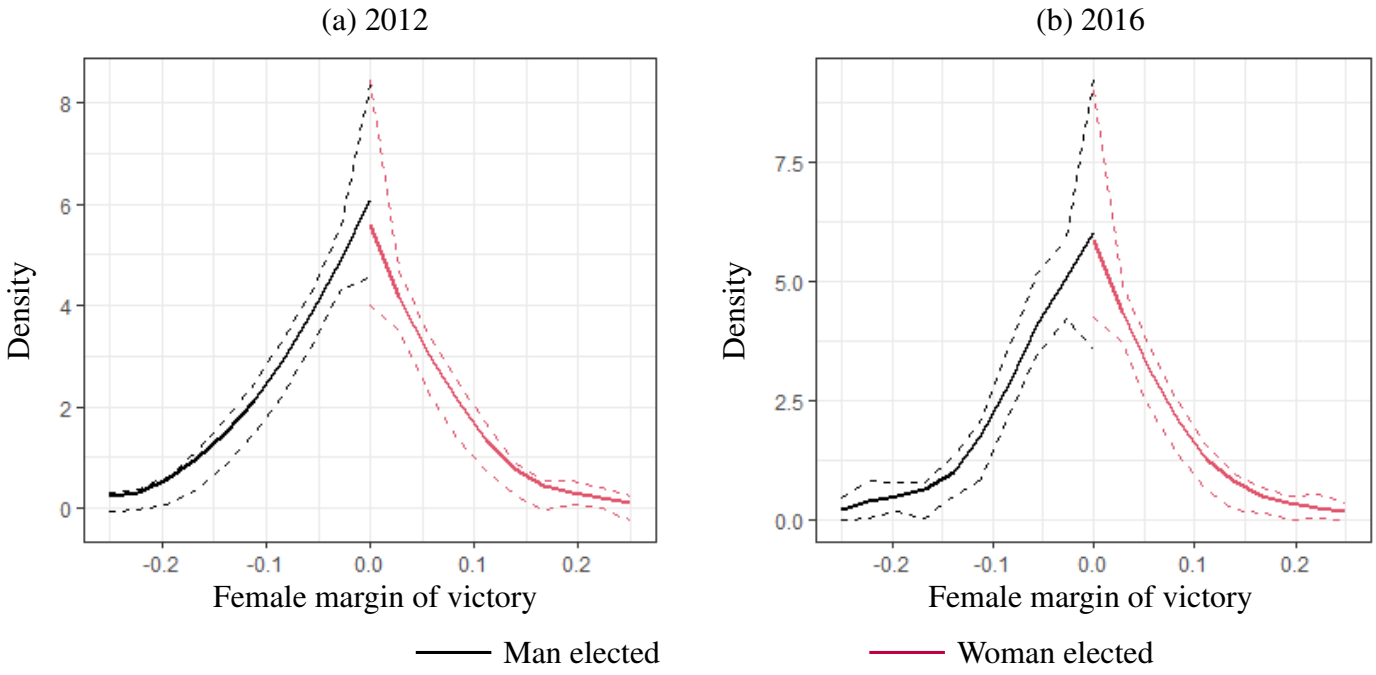
## 7.2 Additional figures

Figure A9: Impact of Female Leadership on School Management Quality Index




**Note:** Figure A9 displays graphically the effect of female mayors on the SMQI, considering the Brazilian municipalities elections in 2012 and 2016. The graphs were drawn according to Calonico et al. (2015). We used a linear specification and a uniform kernel. Optimal bandwidths were then chosen to minimize the mean square error of the local polynomial RD point estimator following Calonico et al. (2014).

Figure A10: McCrary density test per election year




**Note:** This figure displays the McCrary density test for the running variable around the cutoff considering the 2012 and 2016 elections. Dashed lines show the confidence intervals.