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OLD AND YOUNG POLITICIANS

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ABSTRACT

We evaluate the effect of a politician's age on political governance, reelection rates,and policies using data on Italian local governments. Our results suggest that younger politicians are more likely to behave strategically in response to election incentives: they increase spending and obtain more transfers from higher levels of government in preelection years. We argue that is a sign of stronger career concerns incentives. The results are robust to adopting three different identification strategies: fixed-effects regression, standard regression discontinuity design, and an augmented regression discontinuity design that controls for residual heterogeneity.

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1 Introduction

Do younger politicians act differently than older ones? We provide some answers to this question using data on mayors of Italian cities. Older mayors are supported by an older city council and select older executive committee members. Younger mayors are more likely to be reelected to office. Younger and older mayors choose a similar level of expenditures and revenues on average during their term. However, younger mayors are more likely to strategically increase expenditures and attract more transfers from the higher levels of government right before the election. Thus younger mayors tend to be more strategic. They are also successful in doing so since we show that the presence of these fiscal cycles is positively correlated with reelection of the mayor.

Younger politicians may differ from older ones for three reasons. One is that they have a potentially longer political career in front of them and therefore have more career concerns. The second is simply that as younger citizens they have a longer horizon and therefore a lower discount rate, causing them to adopt more long-term policies.[1] The third and more mundane reason is that younger politicians are more energetic and more productive at work. Our results seem most consistent with the first explanation. In fact if young politicians were simply more energetic than older ones, they would plausibly attract more transfers from higher levels of governments in every year of their term, not only in preelection periods. As for the second explanation, it is unclear why longer-horizon policies such as increasing investments would be adopted only in preelection years and not independently of the timing of elections.

Evaluating empirically the causal effect of age on choices is tricky. Comparing the choices of mayors of different ages would not allow us to identify our effect of interest, because many other variables, not only observable but also not observable, are correlated with the age of the mayor. In order to avoid this problem we adopt three different identification strategies. First, we rely on fixed effects estimates, in order to control for all of the time invariant confounding factors. Second, in order to account for any kind of municipality-specific confounding factors, we employ a regression discontinuity design. Close elections amongst candidates of different age generate exogenous variation in the age of the winning candidate for mayor. However even in a regression discontinuity design, it is possible that

[1] See Bisin, Lizzeri, and Yariv (2015) and Prato (2015) for theoretical models on the effects of discount rates on policies.

older mayors may differ from younger mayors in other individual-level characteristics. In fact older mayors have less education and more political experience on average in our data set. Even in settings where individual-level covariates are balanced, the econometrician cannot rule out the possibility that individual unobservable characteristics are unbalanced. In order to alleviate these concerns, we augment the standard regression discontinuity framework to account for some residual unobserved heterogeneity. We then show, in the spirit of Altonji, Elder, and Taber (2005), that our results are robust if the residual individual heterogeneity at the threshold is no larger than the individual heterogeneity that we can identify by using our rich dataset on individual characteristics and a regression discontinuity design. To the best of our knowledge our application is the first that combines the intuition of Altonji et al. (2005) with a standard regression discontinuity design. This strategy can be applied in other settings to address the concerns of the applied econometrician when she is concerned that some individual-level covariates may not be balanced at the threshold when analyzing close elections.

This paper is related to three branches of the literature. The first is the literature on how certain characteristics of politicians affect their choices. While the standard Downsian framework predicts that only the median voter determine policies, a rapidly growing set of studies, both theoretical and empirical, shows that the characteristics of political leaders matters do matter for policies and outcomes (Alesina 1988; Washington 2008; Besley, Montalvo, and Reynal-Querol 2011; Gagliarducci and Paserman 2012; Brollo and Troiano 2014). The great majority of the papers belonging to this strand of literature has focused on gender. An exception is Besley et al. (2011), which focuses on the role of the education of politicians. In the context of studying the political responses to an anti-tax evasion program, Casaburi and Troiano (2014) show a negative correlation between the age of the politicians and tax enforcement following the program.

The second is a literature which has provided quasi-experimental evidence about the political economy of local governments around the world. Thanks to the recent availability of administrative microeconomic data, this literature has been rapidly growing, and many recent papers deal with how Italian local governments function (for instance, among many others, Gagliarducci and Nannicini (2013), Casaburi and Troiano (2014), Alesina and Paradisi (2014), and Grembi, Nannicini, and Troiano (2014)).

Finally, by showing that younger politicians are more likely to increase investments and attract more transfers before the elections, our contribution naturally fits in the political business cycles literature. See, for example, Ben-Porath (1975), Rogoff and Sibert (1988), Rogoff (1990), Alesina, Cohen, and Roubini (1997), Persson and Tabellini (2002), Drazen and Eslava (2003), Akhmedov and Zhuravskaya (2004), Brender and Drazen (2005), Shi and Svensson (2006), Brender and Drazen (2008).

This paper is organized as follows. Section 2 describes our data and the institutional settings of Italian local governments. Section 3 describes our methodology. Section 4 presents our results, and the final section concludes.

2 Data and Institutional Framework

2.1 Institutional information

The Italian municipal government (*Comune*) is composed of a mayor (*Sindaco*), an executive committee (*Giunta*) appointed by the mayor, and an elected city council (*Consiglio Comunale*) responsible, among other things, for authorizing the annual budget proposed by the mayor. The mayor and the executive committee propose changes in policies, such as reductions in the tax rates or expenditures. Subsequently, the city council votes on the proposed modifications. Municipalities manage about 10 percent of total public expenditure in Italy and are in charge of many public services, such as preschools, waste management, municipal roads, and municipal public housing.

The local expenditures are divided into two types: capital expenditures, which are all of those expenditures related to "multi-year production factors, where amortization does take place", and current expenditures, which are those expenditures that relate only to the current fiscal year. The electoral regulations of local governments were significantly reformed in 1993, when a new law changed the mayoral electoral rule from party to individual ballot and introduced a two-term limit. In 2000 the duration of the mayoral term was extended from four to five years. Municipalities with more than 15,000 inhabitants adopt a runoff system to elect mayors, while a single-round system is in place in cities with a population below this threshold.[2] The number of city councilors depends on the size of the municipality.[3]

[2] Bordignon, Nannicini, and Tabellini (2013) study the effect of the electoral rules on policies, finding that under runoff elections, the number of political candidates is larger, but the influence of extremist voters on equilibrium policy is smaller.

[3] The electoral rule for the city councilors also depends on the size of the municipality: in cities with fewer than 15,000 inhabitants, two thirds of the seats are assigned to councilors in the mayoral coalition, while the

Each observation in our dataset represents a mayoral term.

2.2 Data and Descriptive Statistics

The main database for the analysis includes administrative data on municipal elections and politicians from 1993 to 2010, provided by the Italian Department of the Interior (*Ministero degli Interni*). We complement this dataset with socio-economic and demographic information about Italian municipalities from the National Statistical Office and data on financial reports from the Italian Municipal Association. Table 1 presents summary statistics for the entire sample: mayor-level characteristics, municipality-level characteristics, political governance, re-election rates, and public finance outcomes.

We include in the sample all observations with non-missing data on the electoral vote count and the mayor's age. This creates a sample of over 20,000 observations for each municipality-term pair.[4] Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes. The average age of the city councilors belonging to the mayor's coalition is 42.6 years, and the average age of the executive committee is about 44 years. On average, Italian mayors in our sample are about 48 years old.

In Table 2 and Table 3 we split our sample in two parts: municipalities where the older candidate won the election, and ones where the younger candidate won the election. We then summarize mayor and municipality characteristics (Table 2) and outcomes (Table 3) in each of these two subsamples. The average age of the older winning candidate (52) is 8.5 years older than the average age of the younger winning candidate (43.5). The age difference is slightly smaller than the standard deviation of the mayor's age, which is 9.7. Older winning candidates tend to have one year more of prior political experience and one half year less of education. In addition, older winning candidates are about 2 percentage points less likely to be female (baseline: 7 percent) and 9 percentage points more likely to be born in the city in which they were elected (baseline: 54 percent). We are interested in studying whether the age of the mayor affects the age of the other municipal administrators, the reelection

rest of the seats are assigned proportionally to the vote shares. In cities with more than 15,000 inhabitants, every seat of the city council is assigned according to the proportional rule.

[4] We were able to obtain data on Italian financial reports only from 1993 to 2007, and the dataset contains some missing observations: this implies that our sample for the public finance outcomes is smaller. To limit the potential impact of outliers, we winsorize the public finance variables at the 99 percent level. The results are very similar without winsorizing those variables.

rates, and the implemented policies. Older winning candidates tend to have a slightly older coalition and executive committee, and they tend to increase taxes and spending by a smaller amount than younger winning candidates. Older winning candidates are also less likely to run for reelection or to be reelected, conditional on the term limit not binding.

3 Empirical Strategy

Comparing the outcomes of municipalities governed by mayors of diverse ages would not allow us to identify our effect of interest, because many other variables, not only observable but also unobservable, are correlated with the age of the mayor. In Table 4 we correlate the age of the mayor with many predetermined covariates, both mayor-specific and municipality-specific. The age of the mayor is correlated with most of the individual- and municipality-specific covariates we consider. For instance, older mayors are more likely to be conservative and are more likely to govern cities characterized by an older demographic structure or with higher income per capita. Those results suggest that relying only on cross-sectional variation in the age of the politician would likely not yield our treatment effect of interest. Therefore, we rely on three different identification strategies to alleviate the aforementioned concerns: fixed-effects regression, conventional regression discontinuity design, and an augmented regression discontinuity design. We describe those methods in the next three subsections.

3.1 Fixed-Effects Model

We begin our analysis by using a fixed-effects (FE) model of the form

$$Y_{jt} = \beta A_{jt} + \boldsymbol{\delta}' \boldsymbol{Z}_{jt} + \eta_j + \gamma_t + \varepsilon_{jt},$$

where Y is an outcome, A is the age of the mayor, and $\boldsymbol{Z}$ is a vector of mayor characteristics. The letter j indexes municipalities and t indexes election years. The parameters η_j and γ_t represent municipality fixed effects and election-year effects. The outcome Y_{jt} is typically measured over the term in office of the winner in municipality j and election year t. For example, Y_{jt} could be the change in total revenue from the beginning to the end of the term.

The effect of age is identified using within-municipality variation in the mayor's age across mayoral terms. Our identifying assumption is that the mayor's age is strictly exogenous with respect to the time-varying municipality and mayor unobservables, ε_{jt}. This assumption will hold if $\boldsymbol{Z}_{jt}$ contains all outcome-relevant mayor characteristics correlated with age, and the municipality and election-year fixed effects absorb all unobserved municipality and temporal heterogeneity that is correlated with both outcomes and the age of the mayor. If the identification assumptions are satisfied, then β represents the expected change in Y from increasing the mayor's age by one year, holding the controls constant.

3.2 Conventional Regression Discontinuity Design

A major concern with the fixed-effects model is that time-varying unobservables may be correlated with both the outcomes and the mayor's age. For example, a change in voter preferences may drive changes in outcomes and in the age of the winning mayoral candidate. Alternatively, the age distribution of the mayoral candidate pool may change as a result of changes in policy outcomes, if the candidate's decision to run for office as a function of current policy differs by age.

In order to address these concerns, we adopt a regression discontinuity (RD) design and focus on close elections between mayoral candidates of different ages. The running variable, X, is defined as the older candidate's margin of victory, measured in percentage points. The main intuition is that, for each close election involving two candidates of different ages, whether the older candidate wins is as good as randomly assigned. Let D equal unity if the older candidate wins, and zero otherwise. Adopting the potential outcomes framework, let Y_j denote the policy outcome in the event that the winning politician is j years old, where $j \in \{1, 2, \ldots, J\}$. In addition, let $A_D \in \{1, 2, \ldots, J\}$ be the age of the winning politician when the election outcome is D. The usual monotonicity condition is satisfied, because by construction $A_1 > A_0$ for all elections.[5] We adopt the standard notation for the left and right limits of a conditional expectation at the cutoff: $V^+ = \lim_{x \to 0^+} \mathbb{E}[V|X = x]$ and $V^- = \lim_{x \to 0^-} \mathbb{E}[V|X = x]$.

In contrast to most RD designs, our setting involves variable treatment intensity, because

[5] See Imbens and Angrist (1994) on the importance of the monotonicity of treatment take-up with respect to an instrumental variable.

A can take more than two values.[6] In the appendix we show that the estimand of interest,

$$\rho = \frac{Y^+ - Y^-}{A^+ - A^-}, \tag{1}$$

identifies a weighted average of causal effects of increasing the mayor's age by one year, where each weight depends on the relative likelihood of observing a specific pair of candidate ages in close elections.[7] As usual, the causal effects apply only to outcomes following close elections.

In practice we estimate the equations

$$\begin{aligned} A_{jt} &= \alpha + \delta D_{jt} + P(X_{jt}) + D_{jt} \cdot P(X_{jt}) + \nu_{jt} \\ Y_{jt} &= \gamma + \rho A_{jt} + P(X_{jt}) + D_{jt} \cdot P(X_{jt}) + \xi_{jt} \end{aligned} \tag{2}$$

using data from elections decided by a relatively narrow margin of victory. We estimate ρ using the outcome of the election, D_{jt}, as an instrument for the mayor's age, and controlling for polynomials in the margin of victory on each side of the vote threshold. We report several specifications which cluster the standard errors at the municipality level. The approach described above is equivalent to local polynomial regression using a uniform kernel (see Hahn et al. 2001). We also report estimates of ρ using local polynomial regression and a triangular kernel.

3.3 Partially Identified Regression Discontinuity

By focusing on close elections in which the outcome is virtually random, the RD design alleviates the concern that municipality characteristics may drive both election outcomes and policy. However, the validity of the RD design may be questioned if other policy-relevant mayor characteristics are correlated with age. Recall that identification in the RD design relies on the continuity at $x = 0$ of $\mathbb{E}[Y_{A_0}|X = x]$, the conditional expectation of the potential

[6] Another RD design with variable treatment intensity is featured in Brollo, Nannicini, Perotti, and Tabellini (2013), who study the impact of federal transfers to municipal governments in Brazil. Their setting is a fuzzy RD design due to cases of misassignment of federal funds. In our case the design is sharp, because A jumps deterministically from A_0 to A_1 across the threshold $X = 0$ in each election. In other words, every election is a "complier."

[7] This result is obtained by combining the identification results of Hahn, Todd, and Van der Klaauw (2001) and Angrist and Imbens (1995). It relies on the assumption that the conditional expectation of the potential outcome in the event that the younger candidate wins, $\mathbb{E}[Y_{A_0}|X = x]$, is continuous at $x = 0$. See the appendix for details, and see the next section for a strategy to address violations of this assumption.

outcome when the younger candidate wins.[8] This assumption is violated if the conditional distribution of relevant observed and unobserved mayor characteristics other than age jumps at the threshold. Intuitively, if both average age and, say, average political experience are discontinuous at the threshold, we risk conflating the effects of age and experience in our estimation framework. Luckily, our set of mayor covariates is sufficiently rich that we are able to control for the characteristics that are correlated with age and that seem most relevant to policy *ex ante*. Important mayor characteristics include gender, political experience, and education.[9] These covariates, along with the indicator for whether the mayor was born in the same city, tend to be discontinuous in expectation at the threshold, as our balance tests will demonstrate. Therefore it is important to check the robustness of our RD estimates to the inclusion of these covariates in the estimating equations.

However, there may also be unobserved mayor characteristics whose distributions are discontinuous at the threshold, preventing us from point-identifying the treatment effect. For ease of exposition, consider the partially linear model,

$$Y = \gamma + \rho A + g(\boldsymbol{Z}) + \varepsilon,$$

where $\boldsymbol{Z}$ is a vector of observed mayor characteristics, and ε contains unobserved mayor characteristics that affect the outcome. If $\varepsilon^+ - \varepsilon^- \neq 0$, then ρ is not point-identifiable.[10] However, if we assume that unobserved selection effects at the threshold are no larger than observed selection effects at the threshold, then we can identify upper and lower bounds for ρ. This is the approach of Altonji et al. (2005), who estimate bounds on the effect of Catholic school education on student outcomes. The identified interval for ρ is derived under the assumption that $(\varepsilon^+ - \varepsilon^-)$ is no larger than $(g(\boldsymbol{Z})^+ - g(\boldsymbol{Z})^-)$ in absolute value. This assumption is most credible when $\boldsymbol{Z}$ contains all observable characteristics that are unbalanced at the threshold, and when $\boldsymbol{Z}$ is believed to contain most policy-relevant characteristics that are correlated with age. We estimate the bounds using local linear regression and a second-order polynomial approximation to $g(\boldsymbol{Z})$, and we obtain confidence intervals for the identified interval using a bootstrap procedure proposed by Horowitz and Manski

[8] See Hahn et al. (2001) on the nonparametric identification of treatment effects in the RD design.

[9] See Brollo and Troiano (2014) and Gagliarducci and Paserman (2012) on the importance of the politician's gender; see Besley et al. (2011) on the importance of the politician's education.

[10] This is because $\varepsilon^+ - \varepsilon^- \neq 0$ implies that $\mathbb{E}\left[Y_{A_0}|X = x\right]$ is discontinuous at $x = 0$.

(2000).[11] See the appendix for further details on identification, estimation, and inference in this model.

4 Results

4.1 Balance Checks

In Figure 1 we verify the absence of manipulation in our running variable, via the test introduced by McCrary (2008). The estimated discontinuity in the density of the running variable is -0.001 with a standard deviation of 0.033. These results suggest that in a close election between candidates of different ages, neither candidate has any opportunity to manipulate the results of the election, and older (or younger) candidates are not more likely to be elected during close, mixed-age elections.

The RD identification strategy relies on the fact that the age of the mayor is on average higher when the older candidate won the election than when the younger candidate won the election. In Table 5 we test for discontinuities in mayor and municipality characteristics at the margin-of-victory threshold. In close elections the winning older candidate is on average 8 years older than the winning younger candidate. The graphical results of Figure 2 imply that the mayor's average age in cities where the older candidate barely won is higher than the average age of mayors where the older candidate barely lost.

However, it is possible that candidates who won a close election against another candidate of a different age may differ according to characteristics other than age. Table 5 shows that four mayor covariates have statistically significant discontinuities at the threshold. In close elections the older winning candidate has one year more of political experience in appointments in the city administration and half a year less of education than the winning younger candidate. The older winning candidate is also 2 percentage points less likely to be female and 8 percentage points more likely to be born in the same city where he or she governs. We take account of these four unbalanced covariates in the empirical analysis to test the robustness of conventional RD estimates of the effect of the mayor's age. It should be noted that the economical significance of these confounding variables is much smaller compared to that of the main variable of interest: age. Other important individual covariates are balanced at the threshold, such as their poltical inclination (i.e. probability of belonging

[11] See Tamer (2010) for an overview on conducting inference on partially identified parameters.

to the conservative party), whether the mayor is term-limited, past political experience (in any appointment), and the number of rivals that the mayor faced in the electoral ballot. Figure 3 presents plots of the mayor characteristics relative to the older candidate's margin of victory. Out of twelve municipality variables tested, none has a statistically significant discontinuity at the threshold. Visual inspection of those variables in Figure 4 and Figure 5 also supports the balancedness of city-specific covariates. We conclude that municipality characteristics are balanced around the threshold in close elections, consistent with previous work on the regression discontinuity design in close elections.

4.2 The Effect of Age on Political Governance and Reelection

First we estimate the effect of the mayor's age on political governance and reelection. In the first panel of Table 6 we present estimates of the coefficient on age in the fixed-effects model, both with and without controls for experience, gender, years of schooling, and whether the mayor was born in the same city. An increase in the mayor's age by one year is associated with an increase in the average age of the mayor's coalition and executive committee by 0.12 years and 0.02 years, respectively. Put another way, a one standard deviation increase in the mayor's age (9.7 years) is associated with an increase in the average age of the mayor's coalition and executive committee by 3 percent and 0.4 percent relative to their respective means. Additionally, a one-year increase in age reduces the mayor's probability of running again for office by 0.9 percentage points and reduces the probability of reelection by 1 percentage point, conditional on not being term limited. This means that a one standard deviation increase in the mayor's age reduces the probability of running again by 14 percent and reduces the probability of reelection by 19 percent relative to their respective means. All of the fixed-effects estimates are statistically significant at least at the 5 percent level. Overall the coefficient estimates seem not to be sensitive to the inclusion of controls for other mayor characteristics. The treatment effects are similar when scaled by the average difference in age between the winning older candidate and the winning younger candidate in close elections (8 years).

The second and third panels of Table 6 present conventional regression discontinuity estimates of the effect of the mayor's age on political governance and reelection outcomes. The estimates in both panels use the optimal bandwidth selected according to the procedure of Calonico, Cattaneo, and Titiunik (2014a,b). The second panel presents estimates of ρ from the model in (2), using the outcome of the election as an instrument for the mayor's age and controlling for first- or second-order polynomials in the margin of victory on each side of the threshold. The standard errors in the second panel are clustered at the municipality level. The third panel presents bias-corrected estimates using the robust RD estimator in Calonico et al. (2014b). The estimates are very similar across the two panels. Interpreting ρ in (2) as a structural parameter,[12] a one-year increase in age causes an increase of 0.12 years in the average age of the coalition and an increase of 0.04 years in the average age of the executive committee. In other words a one standard deviation increase in the mayor's age increases the average age of the coalition and the average age of the executive by 3 percent and 0.9 percent relative to their respective means. Additionally, a one-year increase in age reduces the mayor's probability of running again by 0.7 percentage points and reduces the probability of reelection by 1 percentage point, conditional on not being term limited. Thus a one standard deviation increase in the mayor's age reduces the probability of running again by 11 percent and reduces the probability of reelection by 21 percent relative to their respective means. The effects of the mayor's age on the age of the coalition, the probability of running again, and the probability of reelection are statistically significant in all specifications. The effect on the age of the executive committee tends to be statistically insignificant. As usual, all of the RD estimates are externally valid only for mayoral terms following close elections.

4.3 The Effect of Age on Revenue and Expenditure

Next we look at the effect of the mayor's age on average revenue and expenditure over the term, both measured in euros per capita. The first panel of the Table 7 presents estimates of the coefficient on age in the fixed-effects model, both with and without controls for mayor characteristics. The second and third panels of Table 7 present conventional regression discontinuity estimates of the effect of the mayor's age on revenue and expenditure. Of the 18 point estimates presented in the table, only one is significant at the 10 percent level. In addition, the absolute magnitudes of the estimates are economically modest.[13]

[12] I.e., assuming a linear relationship between the outcome and age. See, however, the nonparametric identification result in the appendix for a more nuanced interpretation of the RD estimand.

[13] The fixed-effects estimates suggest that a one-year increase in the mayor's age increases average revenue by 65 cents per capita, increases average capital expenditure by 45 cents per capita, and reduces average current expenditure by 18 cents per capita. This means that a one standard deviation increase in the mayor's age increases average revenue by 0.5 percent, increases average capital expenditure by 0.8 percent, and reduces average current expenditure by 0.3 percent, all relative to their respective means. These estimates are all statistically insignificant.

As shown in the second and third panels, the signs of the RD estimates are in general sensitive to the order of the local polynomial as well as the kernel used. The effect of a one-year increase in age on average revenue ranges from −1 to almost 7 euros per capita, the effect on average capital expenditure ranges from −1 to 2 euros per capita, and the effect on average current expenditure ranges from −36 cents to 3 euros per capita. Therefore the effect of a one standard deviation increase in age on revenue ranges from −1 percent to 5 percent, the effect on capital expenditure ranges from −3 percent to 4 percent, and the effect on current expenditure ranges from −0.5 percent to 4 percent, relative to their respective means.

Overall, there is no evidence that older and younger mayors collect different amounts of revenue or have different expenditure levels on average. Those results are confirmed by visual inspection of Figure 7. In light of this result, it may appear puzzling why younger mayors are more likely to get reelected.

4.4 The Effect of Age on Political Budget Cycles

Motivated by the literature on political budget cycles and their effects on reelection, we test whether the mayor's age affects the cyclicality of revenue and expenditure relative to the electoral cycle. The estimates are presented in Table 8. The revenue and expenditure variables are measured in terms of their change from the beginning of the term to the end of the term, in euros per capita. The fixed-effects estimates in the first panel show that a one-year increase in the mayor's age decreases the change in revenue by 4 euros per capita, decreases the change in capital expenditure by 3 euros per capita, and decreases the change in current expenditure by 35 cents per capita. In other words a one standard deviation increase in age decreases the change in revenue by 36 percent, decreases the change in capital expenditure by 22 percent, and decreases the change in current expenditure by 9 percent, relative to their respective means. All of the fixed-effects estimates are statistically at conventional levels.

The regression discontinuity estimates in the second and third panels indicate that an increase in the mayor's age by one year reduces the change in capital expenditure over the term by roughly 9 euros per capita. This means that a one standard deviation increase in age reduces the change in capital expenditure by 79 percent relative to its mean. The effect of age on the change in revenue is almost identical. That is, younger mayors increase capital expenditure at the end of the term relative to the beginning of the term by a larger amount than older mayors, and they increase revenue over the term to pay for the extra expenditure. These estimates are statistically significant in all specifications, usually at least at the 5 percent level. The RD estimates of the effect of the mayor's age on the cyclicality of current expenditure are very small and statistically insignificant. To determine the composition of the revenue change over the mayor's term, we disaggregate revenue into tax revenue, transfer revenue, and non-tax revenue. Table 9 presents estimates for these different revenue categories. It is clear from the RD estimates in the second and third panels that an increase the transfers from higher levels of government is driving the increase in total revenue. These results are visually confirmed in Figures 8 and 9.

4.5 The Effect of Political Budget Cycles on Reelection

Two of our main findings are that younger mayors increase investment right before the election by a greater amount than older mayors, and younger mayors are more likely to get reelected than older mayors. Do younger mayors have a higher probability of reelection *because* they strategically increase spending right before the election, thus fooling voters? This is a difficult question to answer, because spending decisions are endogenous, and may be correlated, among many other things, with the expectations of reelection. For instance, mayors who feel sure about their reelection may be less prone to political budget cycles, and mayors who feel less sure about their reelection may be more prone to cycles. Nonetheless, we can check for suggestive evidence supporting the hypothesis that strategic spending increases tend to raise the likelihood of reelection. Table 10 presents regression estimates of the partial correlation between the change in capital expenditure and the reelection outcome. Estimates are reported with and without the use of fixed effects and controls for the mayor's age, experience, gender, years of schooling, and for whether the mayor was born in the same city. For the sake of readability the independent variable is now measured as the change in capital expenditure in hundreds of euros per capita. The first panel reports estimates using the entire sample, and the second panel reports estimates using mayoral terms following a "close" election (smaller than 10 percentage point margin of victory). The most credible estimates are likely those that use both mayor controls and fixed effects—the last column in the table. These estimates indicate that an increase of one hundred euros in the change in capital expenditure is associated with an increase in the reelection probability by between

0.4 and 0.7 percentage points (baseline: 52 percent). All of the estimates are statistically significant at least at the 5 percent level. While suggestive that younger mayors' strategic spending decisions may contribute to their higher rate of reelection, these estimates should not be interpreted as causal and the magnitudes may be biased either upward or downward. Moreover, mayors that strategically increase spending before the election may exert more effort towards reelection in other dimensions.

4.6 Partially Identified Regression Discontinuity

Table 11 presents estimates of the interval for ρ identified under the assumption that selection on mayor unobservables at the threshold is no greater than selection on mayor observables at the threshold.[14] The term which accounts for discontinuities in mayor characteristics at the threshold (described in the appendix) approximates $g(\boldsymbol{Z})$ with a second-order polynomial in experience, education, gender, and whether the mayor was born in the same city. Left and right limits of conditional expectations are estimated by local polynomial regression of order one or two, as indicated. The estimators use the optimal bandwidth for the point estimator of ρ according to the bandwidth selector of Calonico et al. (2014b). Confidence intervals are calculated by a bootstrap procedure (described in the appendix) using 200 repetitions. The estimated intervals are quite tight, and the bounds are very similar to the conventional point estimates already reported. The intervals for the effects on our main outcomes—average age of the coalition, political cycles in total revenue, political cycles in capital expenditure, whether the mayor ran again, and whether the mayor was reelected—exclude zero with at least 90 percent confidence for both first-order and second-order polynomial specifications. It bears repeating that the estimated intervals allow all four unbalanced mayor covariates to influence the outcomes in a flexible manner, and they permit selection on unobservables at the threshold to be as large as selection on observables at the threshold. Therefore the interval estimates should be viewed as highly conservative. The broad similarity between the interval estimates and the conventional estimates provides strong evidence that the conventional estimates of the effect of the mayor's age are not driven by other characteristics correlated with age.

[14] See the previous section and the appendix for details.

4.7 Other Robustness Checks

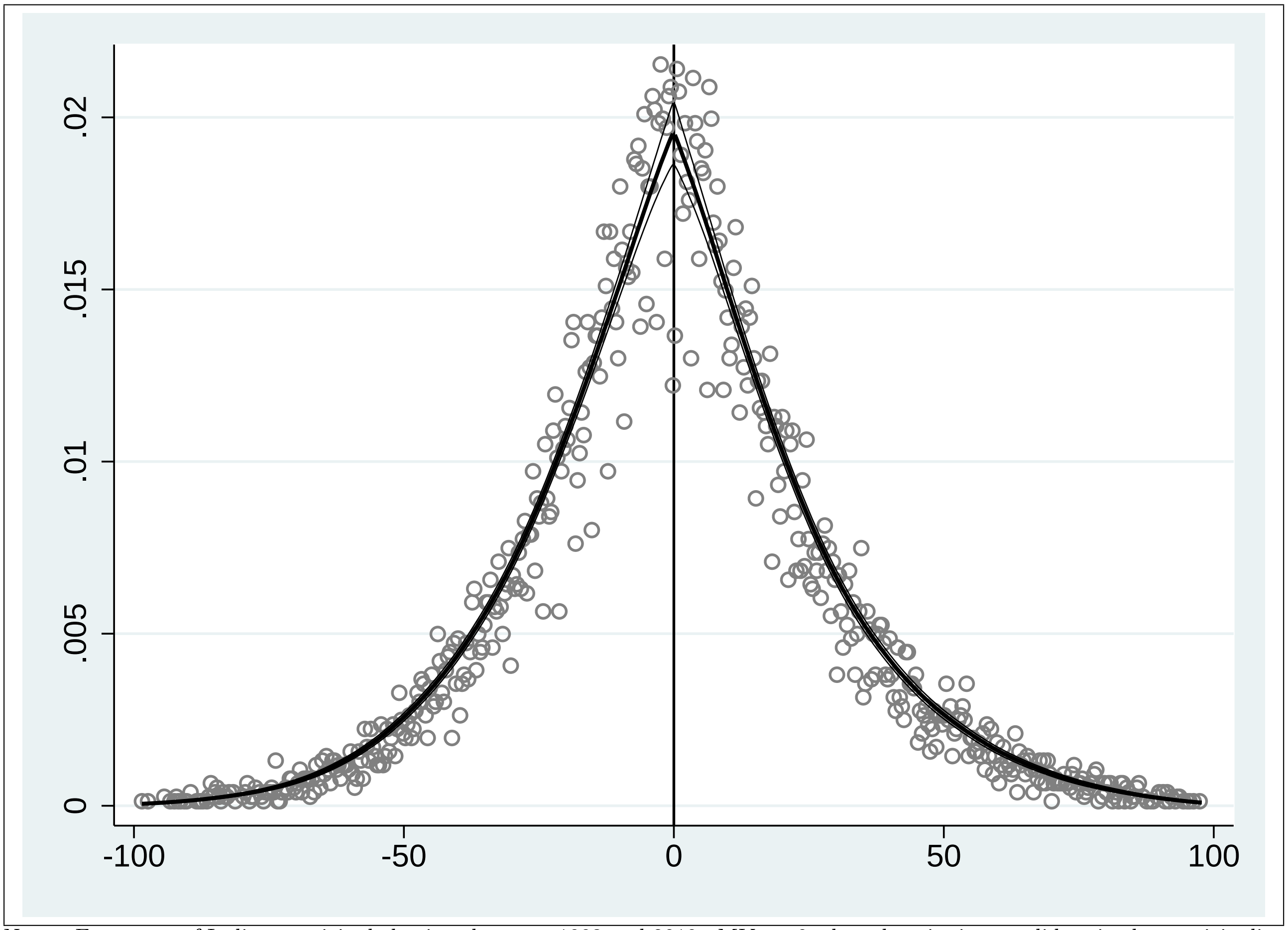
In the online appendix we present results from a series of robustness checks. Tables A.3 and A.4 show that the main results for political and budget policy outcomes are robust to using a different bandwidth selector (Imbens and Kalyanaraman 2012), using a third-order polynomial and the entire sample, including mayor controls directly in the RD regression equation, and using a reduced-form RD estimand. Table A.6 presents RD interval estimates for the different revenue categories, providing supporting evidence that the differential revenue policies of younger and older mayors is driven by transfer revenue.

5 Conclusion

To the best of our knowledge this is the first paper to study the role of a politician's age in determining their policy choices. Using data from local elections in Italy and with regression discontinuity approaches we find that younger politicians are more likely to engage in political budget cycles of the following type: they spend more in preelection years and finance this extra spending with increased transfers from higher levels of government. We attribute this effect to stronger career concerns incentives. We also show that these political budget cycles are successful in terms of reelection: the larger their size the more likely it is that the mayor is reelected.

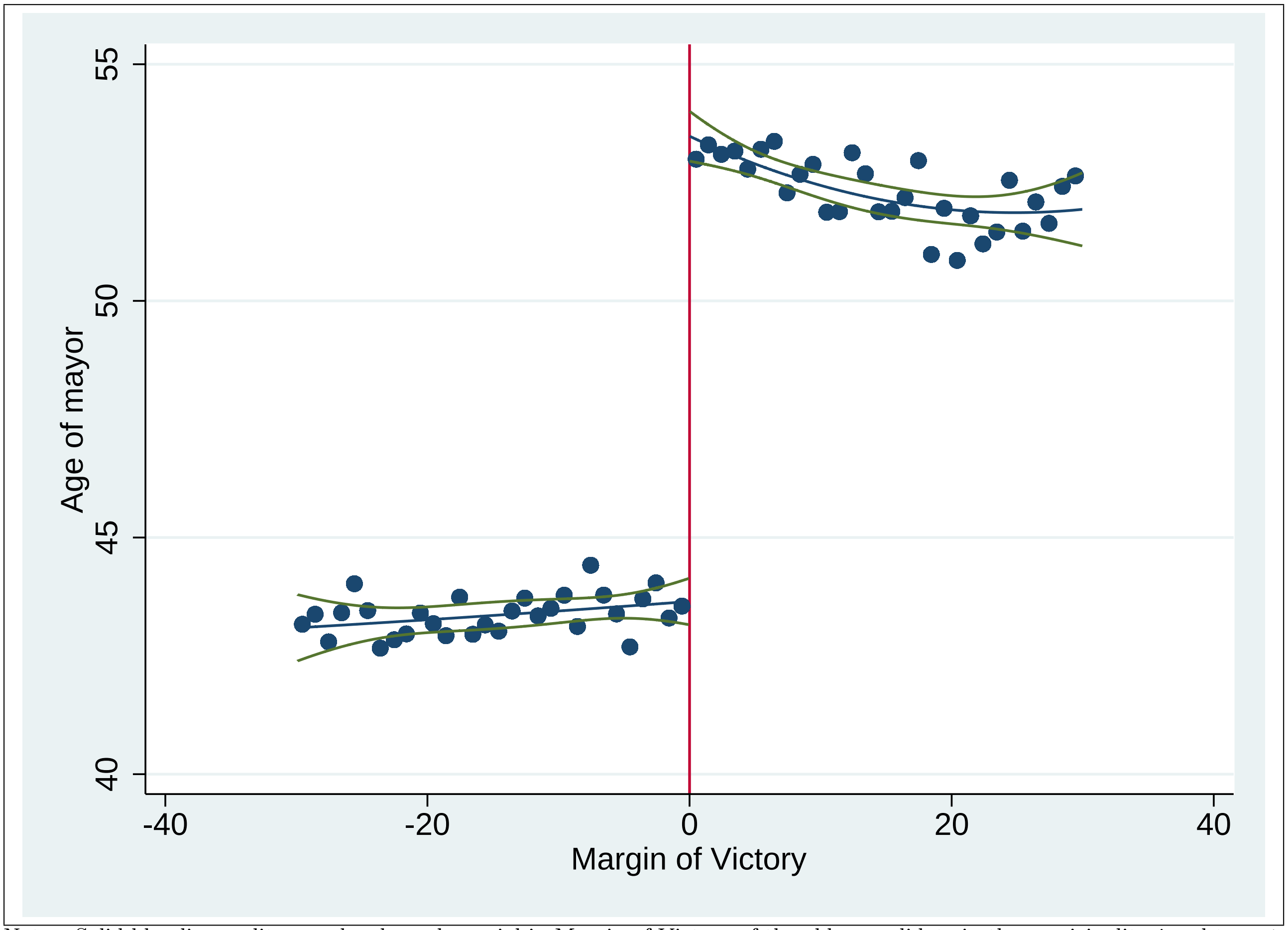
6 Figures

Figure 1: McCrary (2007) Test



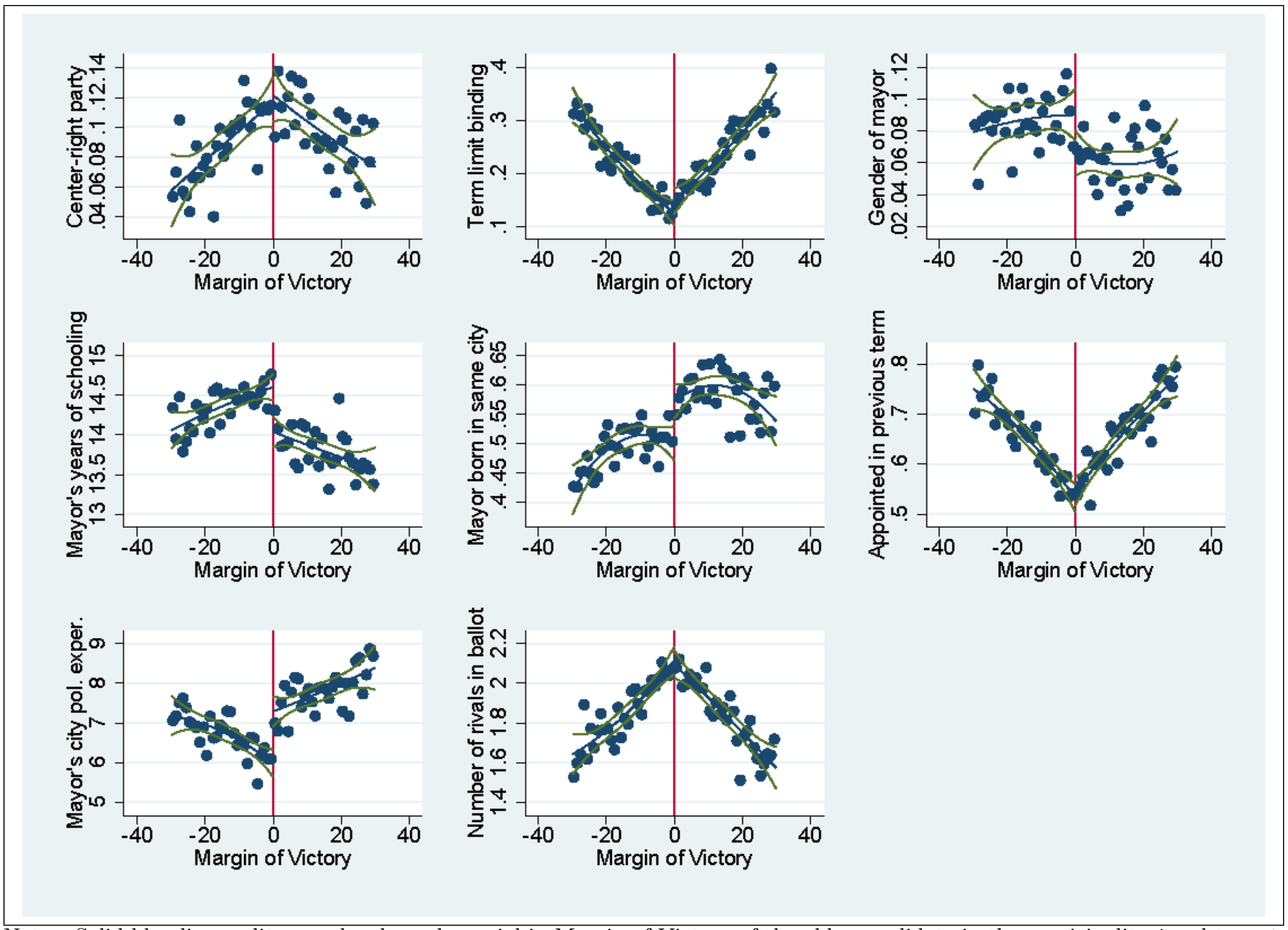
Notes. Frequency of Italian municipal elections between 1993 and 2010. $MV_{it} > 0$ when the winning candidate in the municipality i and term t is older, $MV_{it} < 0$ when the winning candidate is younger.

Figure 2: Balance Checks



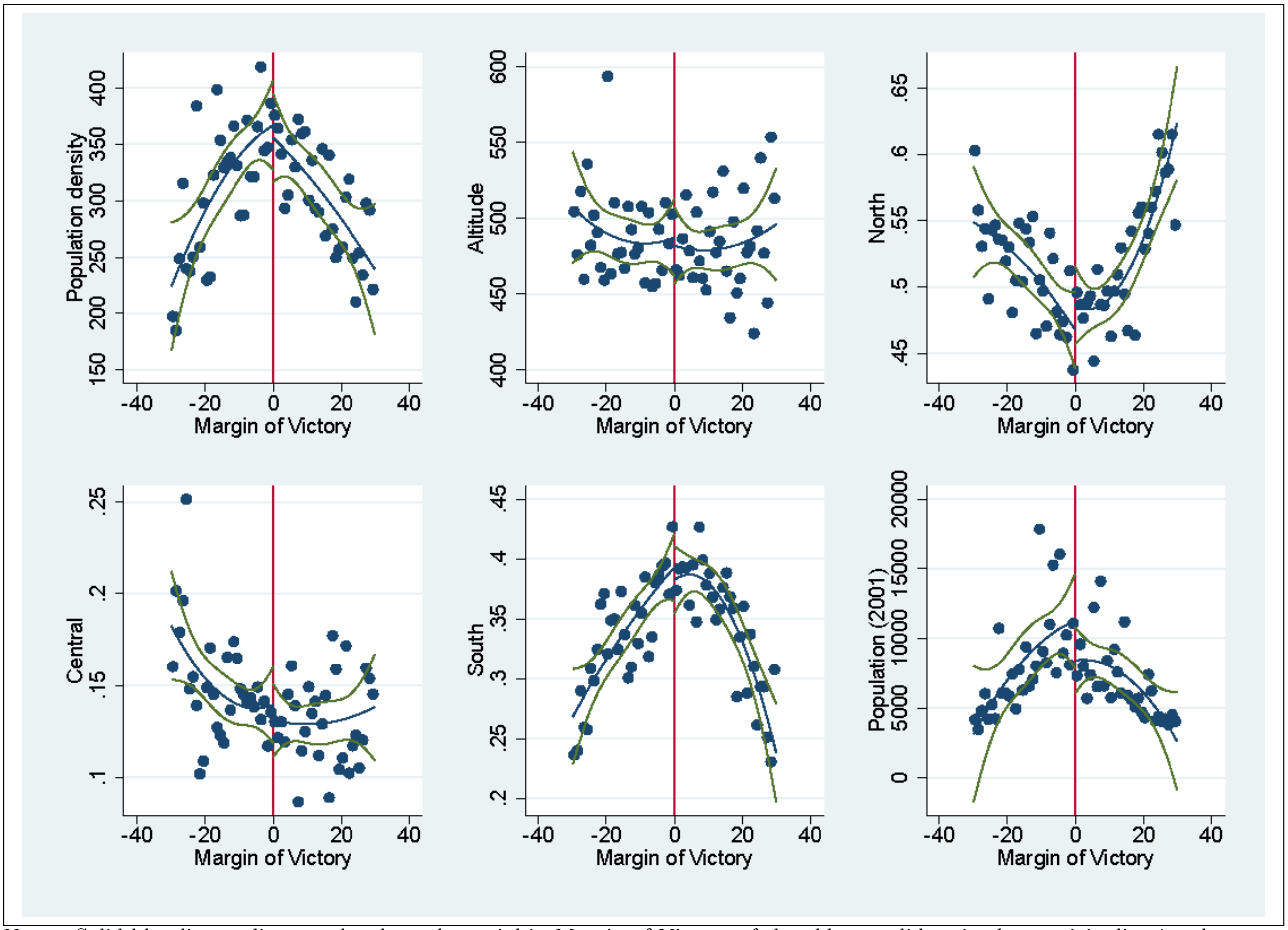
Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. See Table A.1 for variable definitions.

Figure 3: Balance Checks



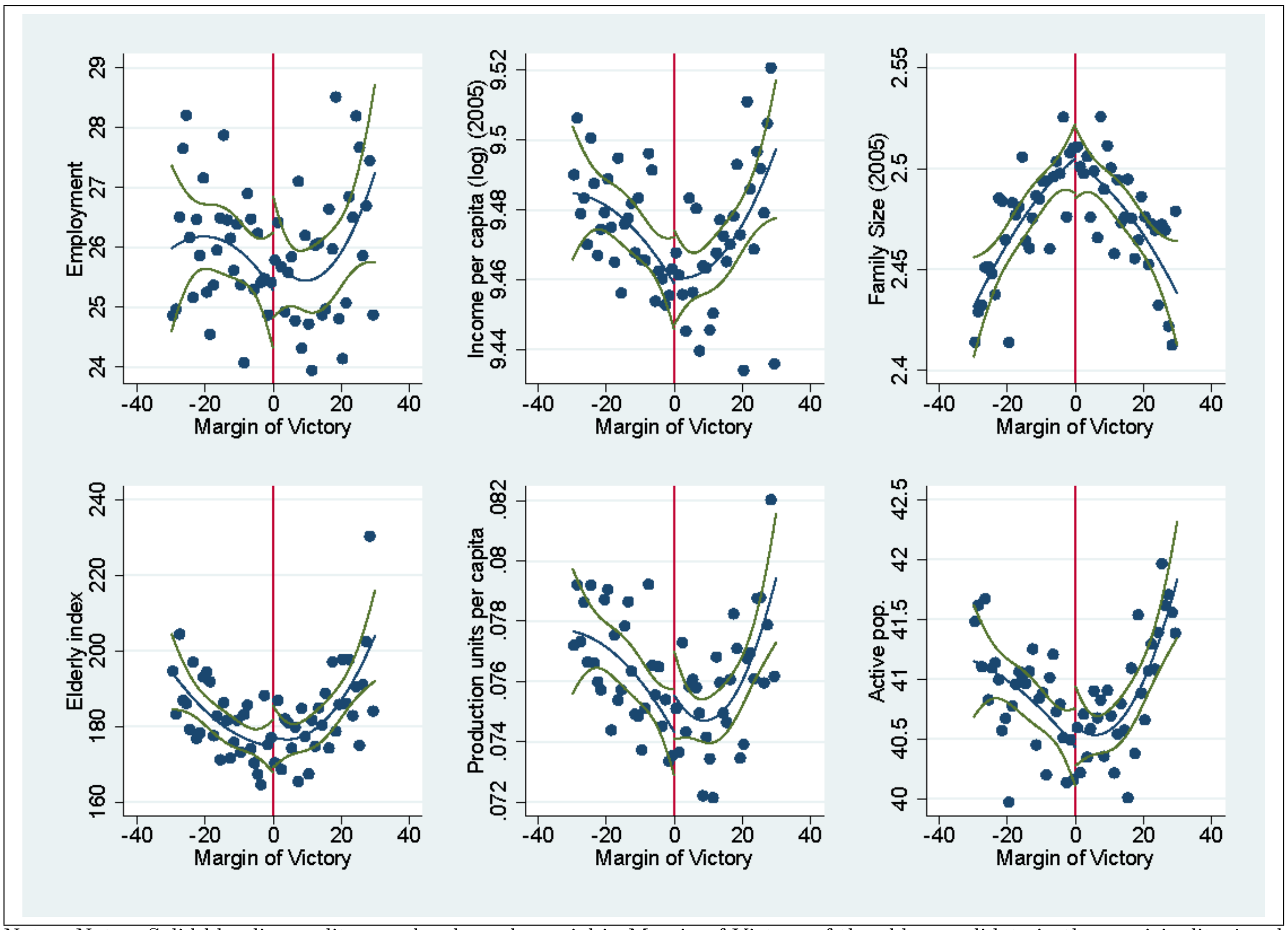
Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. See Table A.1 for variable definitions.

Figure 4: Balance Checks



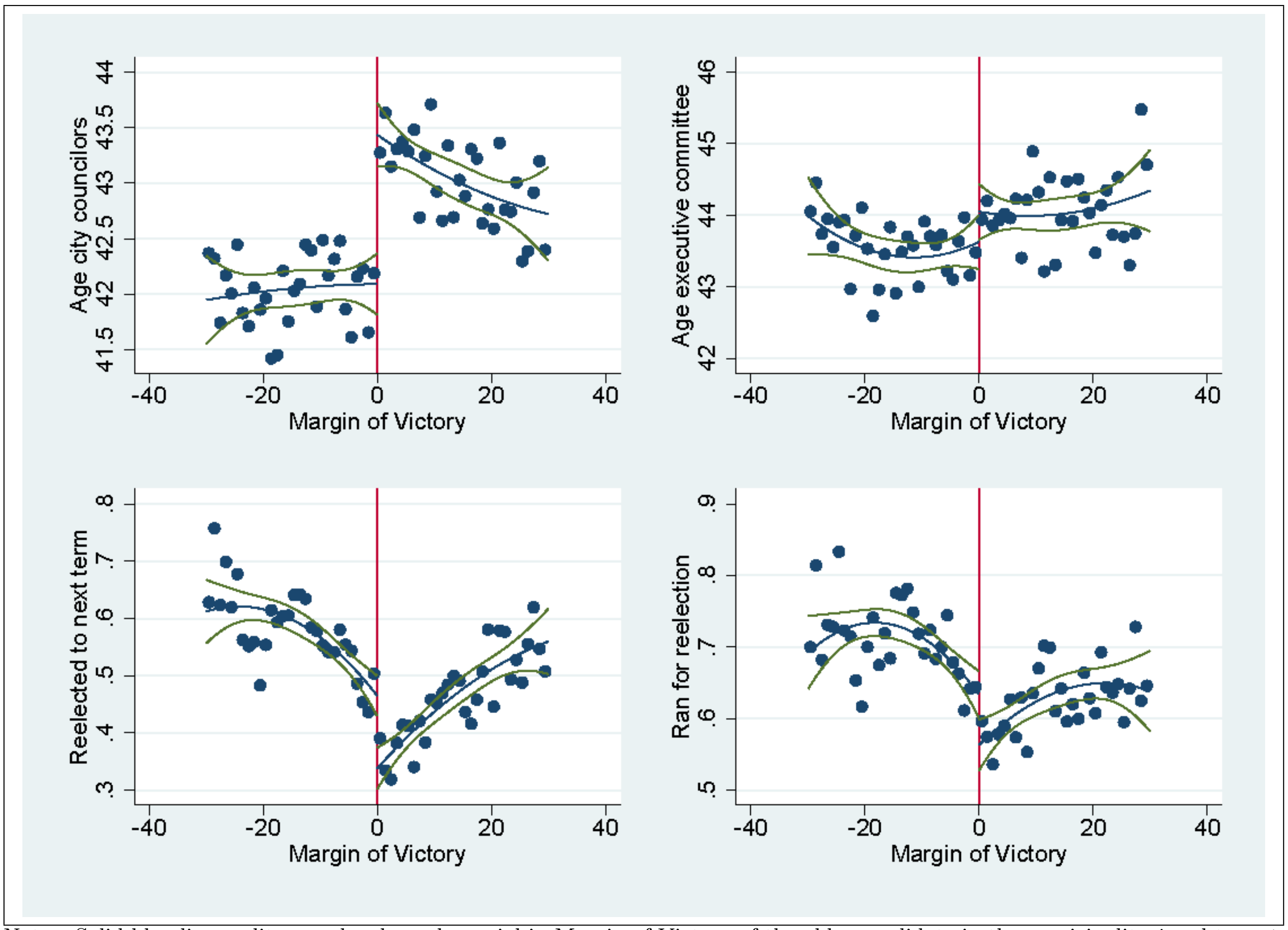
Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. See Table A.1 for variable definitions.

Figure 5: Balance Checks



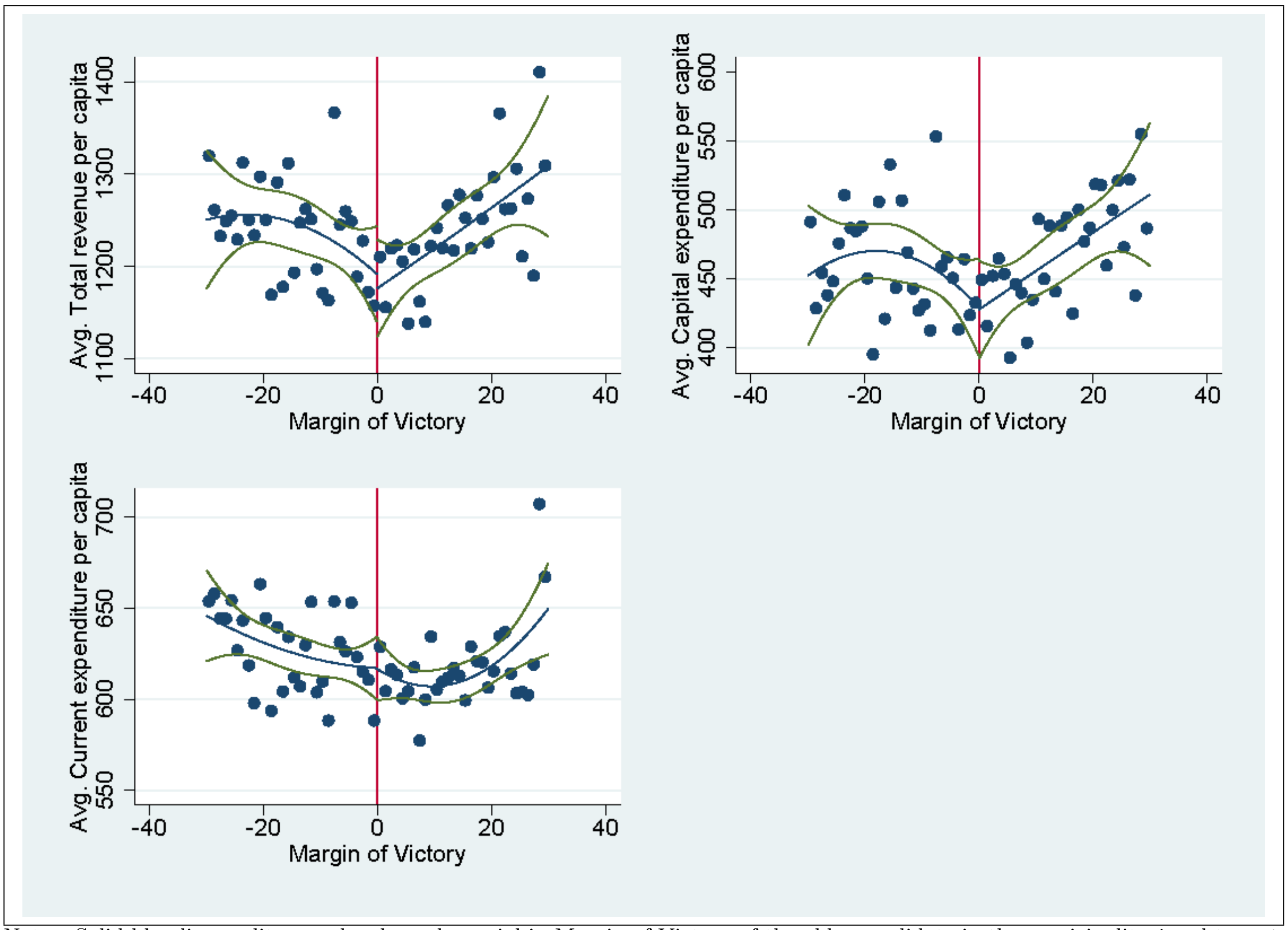
Notes. Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. Sample: municipal terms between 1993 and 2010. See Table **??** for the definition of the variables.

Figure 6: Political Governance and Reelection Outcomes



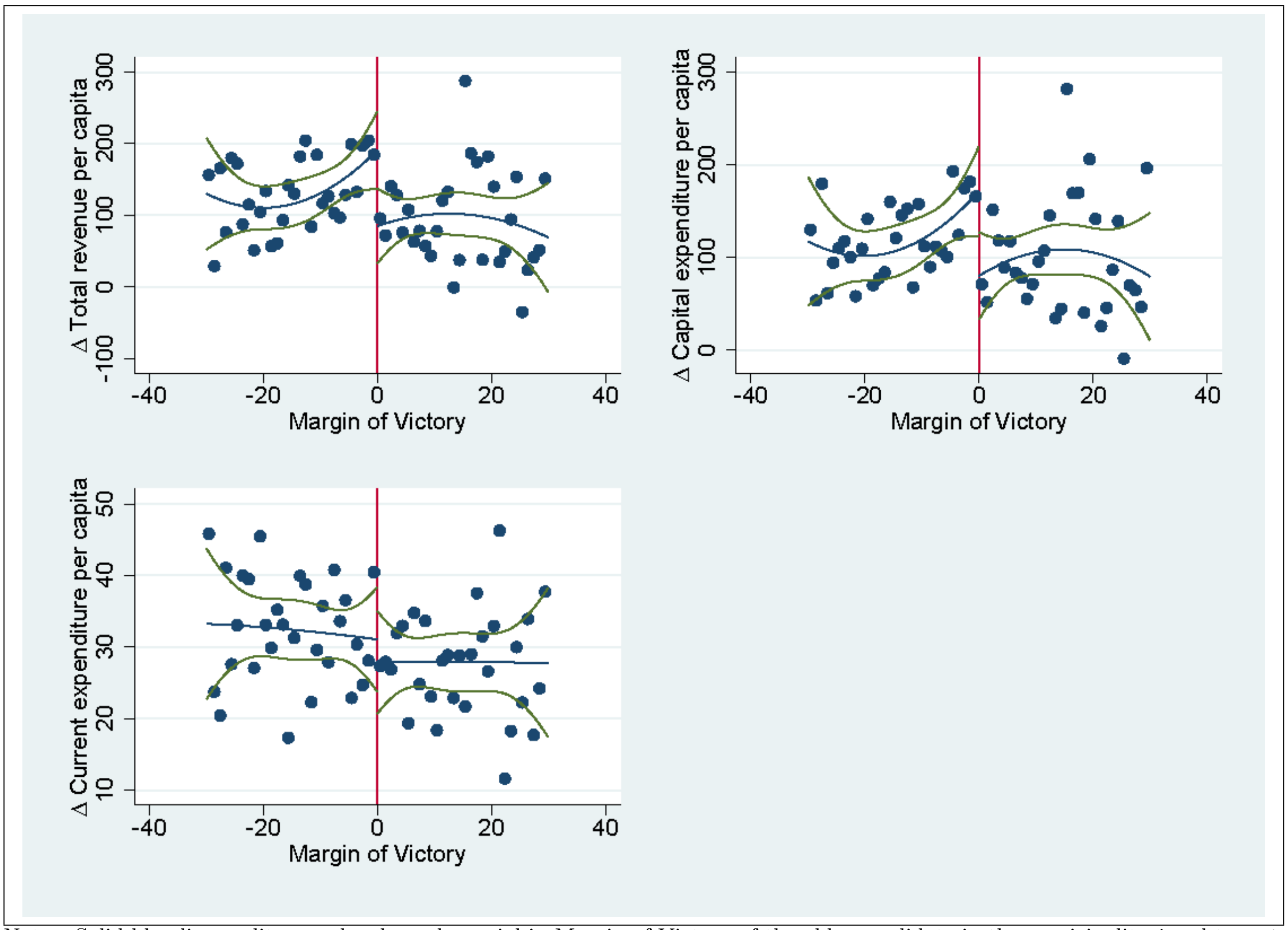
Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes. See Table A.2 for variable definitions.

Figure 7: Average Policies During Term



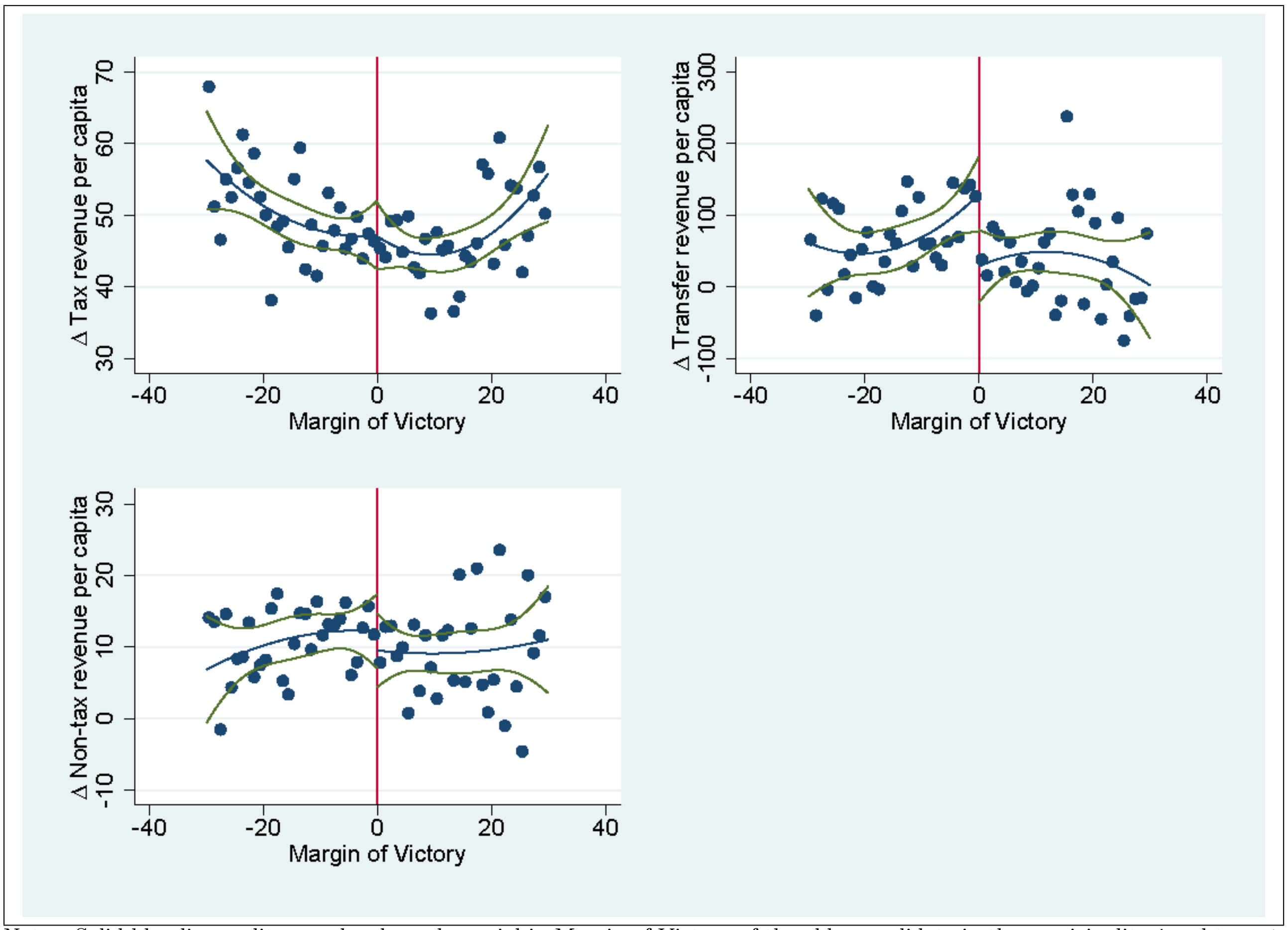
Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. See Table A.2 for variable definitions.

Figure 8: Political Budget Cycles



Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. See Table A.2 for variable definitions.

Figure 9: Political Budget Cycles: Revenues Composition



Notes. Solid blue line: split second-order polynomial in Margin of Victory of the older candidate in the municipality i and term t, fitted separately on each side of the thresholds ($MV_{it} = 0$). $MV_{it} > 0$ when the winning candidate is older, $MV_{it} < 0$ when the winning candidate is younger. Solid green lines: 95 percent confidence interval of the polynomial. Scatter points are averaged over 2 percent intervals. See Table A.2 for variable definitions.

7 Tables

Table 1: Summary Statistics

	Mean	Std. Dev.	Min.	Max.	Obs.
Mayor					
Age of mayor	47.77	9.72	21.00	83.00	20167
Marg. of victory of older cand.	0.26	26.75	−98.66	97.40	20167
Mayor's city pol. exper. (years)	7.56	6.15	0.00	24.97	20167
Appointed in previous term (any office)	0.68	0.47	0.00	1.00	20167
Gender of mayor	0.07	0.26	0.00	1.00	20167
Mayor's years of schooling	13.98	3.05	5.00	17.00	20167
Center-right party	0.09	0.28	0.00	1.00	20167
Term limit binding	0.26	0.44	0.00	1.00	20167
Number of rivals in ballot	1.81	1.16	1.00	16.00	20167
Mayor born in same city	0.54	0.50	0.00	1.00	20167
Municipality					
North	0.54	0.50	0.00	1.00	20167
Central	0.14	0.35	0.00	1.00	20167
South	0.32	0.47	0.00	1.00	20167
Population (2001)	6949.25	44227.36	33.00	2546804.00	20167
Altitude	499.03	446.66	−1.00	4075.50	20167
Population density (2005)	289.60	618.79	1.00	12624.00	20167
Active pop. / total pop. (2005)	40.93	5.71	0.00	60.30	20167
Elderly index (2005)	188.69	150.56	0.00	3500.00	20167
Production units per capita (2005)	0.08	0.03	0.00	0.34	20167
Employed / total pop. (2005)	25.94	17.25	0.00	302.60	20167
Income per capita (log) (2005)	9.48	0.23	8.52	10.71	20167
Family size (2005)	2.46	0.30	1.20	4.20	20167
Political Governance and Reelection Outcomes					
Avg. age in may. coal.	42.56	4.82	25.67	70.00	20167
Avg. age in exec. comm.	43.95	6.64	21.00	74.00	20167
Ran for reelection	0.66	0.47	0.00	1.00	12026
Reelected to next term	0.52	0.50	0.00	1.00	12026
Budget Outcomes					
Avg. total revenue per capita	1270.77	739.79	555.37	5101.41	12050
Avg. capital expenditure per capita	485.94	502.49	68.60	3258.19	12050
Avg. current expenditure per capita	629.16	236.09	348.75	1677.44	12050
Δ Total revenue per capita	117.04	737.94	−2910.63	3399.44	12050
Δ Capital expenditure per capita	109.79	660.36	−2539.07	3053.65	12050
Δ Current expenditure per capita	32.80	97.04	−341.83	379.28	12050
Δ Tax revenue per capita	49.79	62.80	−94.02	252.77	12050
Δ Transfer revenue per capita	54.41	717.57	−2936.47	3222.26	12050
Δ Non-tax revenue per capita	11.52	69.17	−330.80	251.53	12050

Notes: See Tables A.1 and A.2 in the appendix for variable definitions and data sources. Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes.

Table 2: Summary Statistics by Election Outcome

	Younger Candidate Won	Older Candidate Won
Mayor		
Age of mayor	43.51	52.08
	(8.38)	(9.07)
Marg. of victory of older cand.	−19.69	20.48
	(17.07)	(18.26)
Mayor's city pol. exper. (years)	7.06	8.07
	(5.86)	(6.39)
Appointed in previous term (any office)	0.68	0.68
	(0.47)	(0.47)
Gender of mayor	0.08	0.06
	(0.28)	(0.24)
Mayor's years of schooling	14.27	13.69
	(2.82)	(3.24)
Center-right party	0.09	0.09
	(0.28)	(0.28)
Term limit binding	0.24	0.27
	(0.43)	(0.44)
Number of rivals in ballot	1.82	1.79
	(1.17)	(1.15)
Mayor born in same city	0.50	0.58
	(0.50)	(0.49)
Municipality		
North	0.53	0.54
	(0.50)	(0.50)
Central	0.15	0.14
	(0.36)	(0.34)
South	0.32	0.32
	(0.47)	(0.47)
Population (2001)	7680.65	6207.70
	(50869.92)	(36258.84)
Altitude	497.33	500.75
	(445.00)	(448.34)
Population density (2005)	291.50	287.68
	(589.22)	(647.43)
Active pop. / total pop. (2005)	40.95	40.92
	(5.68)	(5.75)
Elderly index (2005)	186.75	190.66
	(136.74)	(163.36)
Production units per capita (2005)	0.08	0.08
	(0.03)	(0.03)
Employed / total pop. (2005)	26.20	25.67
	(17.07)	(17.42)
Income per capita (log) (2005)	9.48	9.48
	(0.23)	(0.23)
Family size (2005)	2.46	2.46
	(0.30)	(0.31)
Observations	10153	10014

Notes: Averages are reported. Standard errors are in parentheses. See Table A.1 for variable definitions.

Table 3: Summary Statistics by Election Outcome

	Younger Candidate Won	Older Candidate Won
Political Governance and Reelection Outcomes		
Avg. age in may. coal.	42.15	42.99
	(4.71)	(4.90)
Avg. age in exec. comm.	43.73	44.18
	(6.52)	(6.74)
Ran for reelection	0.70	0.62
	(0.46)	(0.48)
Reelected to next term	0.57	0.47
	(0.49)	(0.50)
Budget Outcomes		
Avg. total revenue per capita	1268.23	1273.30
	(727.26)	(752.15)
Avg. capital expenditure per capita	481.64	490.23
	(494.75)	(510.12)
Avg. current expenditure per capita	632.69	625.64
	(235.90)	(236.24)
Δ Total revenue per capita	138.33	95.75
	(748.38)	(726.79)
Δ Capital expenditure per capita	121.36	98.22
	(659.91)	(660.66)
Δ Current expenditure per capita	33.99	31.62
	(98.80)	(95.24)
Δ Tax revenue per capita	50.76	48.82
	(63.47)	(62.11)
Δ Transfer revenue per capita	73.76	35.07
	(726.22)	(708.36)
Δ Non-tax revenue per capita	11.14	11.90
	(70.10)	(68.22)

Notes: Averages are reported. Standard errors are in parentheses. See Table A.2 for variable definitions.

Table 4: Regression of Characteristics on Age

Mayor	Exper.	Prior appt.	Gender	School	Center-right	Term limit	# Rivals	Born same city
Age	0.15***	0.000024	−0.0020***	−0.058***	0.00055***	0.0043***	0.0017**	0.0081***
	(0.0044)	(0.00035)	(0.00019)	(0.0023)	(0.00021)	(0.00030)	(0.00082)	(0.00035)
R^2	0.053	0.000	0.005	0.035	0.000	0.009	0.000	0.025
Observations	20167	20167	20167	20167	20167	20167	20167	20167

Municipality	Pop.	Pop. dens.	Prop. active pop.	Elderly	Prod. p.c.	Employment	Income p.c. (log)	Fam. size
Age	51.0**	1.11***	0.017***	0.66***	0.00010***	0.037***	0.0021***	−0.0029***
	(23.6)	(0.40)	(0.0042)	(0.13)	(0.000019)	(0.012)	(0.00016)	(0.00022)
R^2	0.000	0.000	0.001	0.002	0.002	0.000	0.008	0.009
Observations	20167	20167	20167	20167	20167	20167	20167	20167

Municipality	Altitude	North	Central	South
Age	1.04***	0.0039***	−0.00017	−0.0037***
	(0.33)	(0.00036)	(0.00025)	(0.00033)
R^2	0.001	0.006	0.000	0.006
Observations	20167	20167	20167	20167

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.
Notes: See Table A.1 for variable definitions.

Table 5: Discontinuities in Mayoral and Municipality Characteristics

Mayor	Age	Exper.	Prior appt.	Gender	School	Center-right	Term limit	# Rivals	Born same city
RD	8.11***	1.04***	0.012	−0.023***	−0.49***	−0.00044	0.019	−0.034	0.072***
	(0.33)	(0.20)	(0.017)	(0.0088)	(0.11)	(0.011)	(0.013)	(0.045)	(0.019)
Bandwidth	15.5	20.9	17.0	17.3	14.3	20.2	14.1	22.7	12.9
Observations	10060	12461	10817	10909	9456	12132	9366	13153	8700

Municipality	Pop.	Pop. dens.	Prop. active pop.	Elderly	Prod. p.c.	Employment	Income p.c. (log)	Fam. size
RD	−2233.6	35.2	0.061	1.44	0.00086	0.45	0.0027	−0.0017
	(1626.2)	(30.0)	(0.24)	(4.58)	(0.00098)	(0.61)	(0.0095)	(0.011)
Bandwidth	26.1	27.1	9.86	14.1	11.4	12.5	13.0	16.6
Observations	14238	14546	6982	9363	7808	8513	8731	10650

Municipality	Altitude	North	Central	South
RD	−2.50	0.024	0.00030	−0.023
	(17.2)	(0.021)	(0.012)	(0.021)
Bandwidth	12.3	10.7	14.8	10.2
Observations	8359	7400	9704	7196

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered by municipality are in parentheses.

Notes: Estimation by local linear regression using a uniform kernel and the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. See Table A.1 for variable definitions.

Table 6: The Effect of Age on Political Governance and Reelection

FE Estimates	Age coal.	Age coal.	Age exec. comm.	Age exec. comm.	Ran again	Ran again	Reelected	Reelected
Age	0.12***	0.12***	0.022***	0.017**	−0.0088***	−0.0098***	−0.010***	−0.011***
	(0.0040)	(0.0043)	(0.0065)	(0.0067)	(0.00069)	(0.00072)	(0.00068)	(0.00071)
Mayor controls	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Observations	20167	20167	20167	20167	12026	12026	12026	12026

RD Estimates	Age coal.	Age coal.	Age exec. comm.	Age exec. comm.	Ran again	Ran again	Reelected	Reelected
Age	0.10***	0.100***	0.047	0.031	−0.0079***	−0.0077***	−0.012***	−0.012***
	(0.020)	(0.021)	(0.030)	(0.026)	(0.0027)	(0.0027)	(0.0025)	(0.0030)
Bandwidth	18.3	27.9	13.7	23.1	15.0	20.3	18.1	15.6
Order	1	2	1	2	1	2	1	2
Observations	11329	14800	9168	13255	6457	7862	7275	6584

Robust RD Estimates	Age coal.	Age coal.	Age exec. comm.	Age exec. comm.	Ran again	Ran again	Reelected	Reelected
Age	0.14***	0.14***	0.051**	0.046	−0.0073***	−0.0059*	−0.013***	−0.011***
	(0.016)	(0.020)	(0.026)	(0.031)	(0.0024)	(0.0031)	(0.0022)	(0.0032)
Bandwidth	23.3	33.7	18.1	27.8	18.4	23.7	20.9	20.4
Order	1	2	1	2	1	2	1	2
Observations	13316	16199	11243	14784	7340	8623	8021	7912

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.

Notes: Panel estimates use municipality and year-of-election fixed effects and standard errors clustered by municipality. Panel estimates are reported with and without controls for the mayor's experience, gender, and years of schooling, and for whether the mayor was born in the same city (as indicated). Conventional RD estimates are obtained by local polynomial IV regression using old as an instrument for age, clustering standard errors by municipality. A uniform kernel is used and the polynomial is first-order or second-order, as indicated. The bandwidth is chosen using the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. Robust RD estimates are obtained by the estimation procedure of Calonico, Cattaneo, and Titiunik (2014) using a triangular kernel. Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes. See Table A.2 for variable definitions.

Table 7: The Effect of Age on Average Budget Outcomes

FE Estimates	Avg. rev.	Avg. rev.	Avg. cap. exp.	Avg. cap. exp.	Avg. curr. exp.	Avg. curr. exp.
Age	0.55	0.76	0.36	0.53	−0.22	−0.14
	(0.87)	(0.90)	(0.72)	(0.74)	(0.14)	(0.15)
Mayor controls	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Observations	12050	12050	12050	12050	12050	12050
RD Estimates	Avg. rev.	Avg. rev.	Avg. cap. exp.	Avg. cap. exp.	Avg. curr. exp.	Avg. curr. exp.
Age	1.93	−0.39	0.54	−0.82	0.73	−0.14
	(4.45)	(4.17)	(2.93)	(2.63)	(1.47)	(1.52)
Bandwidth	9.88	13.7	10.1	14.4	11.5	14.5
Order	1	2	1	2	1	2
Observations	4140	5516	4222	5704	4745	5744
Robust RD Estimates	Avg. rev.	Avg. rev.	Avg. cap. exp.	Avg. cap. exp.	Avg. curr. exp.	Avg. curr. exp.
Age	3.61	6.23	1.36	2.02	1.02	2.79*
	(3.99)	(4.75)	(2.65)	(3.17)	(1.29)	(1.62)
Bandwidth	11.1	16.7	12.3	18.8	13.2	17.6
Order	1	2	1	2	1	2
Observations	4589	6406	5048	6928	5305	6615

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.

Notes: Panel estimates use municipality and year-of-election fixed effects and standard errors clustered by municipality. Panel estimates are reported with and without controls for the mayor's experience, gender, and years of schooling, and for whether the mayor was born in the same city (as indicated). Conventional RD estimates are obtained by local polynomial IV regression using old as an instrument for age, clustering standard errors by municipality. A uniform kernel is used and the polynomial is first-order or second-order, as indicated. The bandwidth is chosen using the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. Robust RD estimates are obtained by the estimation procedure of Calonico, Cattaneo, and Titiunik (2014) using a triangular kernel. See Table A.2 for variable definitions.

Table 8: The Effect of Age on Political Budget Cycles

FE Estimates	Δ Tot. rev.	Δ Tot. rev.	Δ Cap. exp.	Δ Cap. exp.	Δ Curr. exp.	Δ Curr. exp.
Age	−4.52***	−4.10***	−3.14***	−2.64**	−0.39**	−0.35*
	(1.36)	(1.39)	(1.21)	(1.23)	(0.18)	(0.18)
Mayor controls	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Observations	12050	12050	12050	12050	12050	12050

RD Estimates	Δ Tot. rev.	Δ Tot. rev.	Δ Cap. exp.	Δ Cap. exp.	Δ Curr. exp.	Δ Curr. exp.
Age	−9.25**	−8.94***	−9.06**	−8.43***	−0.10	−0.31
	(4.13)	(3.33)	(3.77)	(3.19)	(0.58)	(0.51)
Bandwidth	12.3	20.6	11.9	17.9	14.0	24.1
Order	1	2	1	2	1	2
Observations	5048	7379	4888	6701	5605	8173

Robust RD Estimates	Δ Tot. rev.	Δ Tot. rev.	Δ Cap. exp.	Δ Cap. exp.	Δ Curr. exp.	Δ Curr. exp.
Age	−8.32**	−8.72**	−8.22**	−8.97**	−0.31	−0.37
	(3.63)	(4.31)	(3.31)	(4.09)	(0.49)	(0.57)
Bandwidth	16.3	25.3	15.9	22.4	18.5	29.4
Order	1	2	1	2	1	2
Observations	6292	8420	6188	7824	6853	9113

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.
Notes: Panel estimates use municipality and year-of-election fixed effects and standard errors clustered by municipality. Panel estimates are reported with and without controls for the mayor's experience, gender, and years of schooling, and for whether the mayor was born in the same city (as indicated). Conventional RD estimates are obtained by local polynomial IV regression using old as an instrument for age, clustering standard errors by municipality. A uniform kernel is used and the polynomial is first-order or second-order, as indicated. The bandwidth is chosen using the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. Robust RD estimates are obtained by the estimation procedure of Calonico, Cattaneo, and Titiunik (2014) using a triangular kernel. See Table A.2 for variable definitions.

Table 9: The Effect of Age on Revenue Categories

FE Estimates	Δ Tax rev.	Δ Tax rev.	Δ Transf. rev.	Δ Transf. rev.	Δ Non-tax rev.	Δ Non-tax rev.
Age	-0.23^{**}	-0.26^{**}	-3.90^{***}	-3.45^{**}	-0.22^{*}	-0.19
	(0.096)	(0.10)	(1.34)	(1.36)	(0.13)	(0.13)
Mayor controls	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Observations	12050	12050	12050	12050	12050	12050

RD Estimates	Δ Tax rev.	Δ Tax rev.	Δ Transf. rev.	Δ Transf. rev.	Δ Non-tax rev.	Δ Non-tax rev.
Age	0.18	0.23	-9.48^{**}	-8.78^{***}	0.16	-0.043
	(0.42)	(0.37)	(4.04)	(3.23)	(0.45)	(0.37)
Bandwidth	11.4	18.2	12.0	20.5	11.8	20.8
Order	1	2	1	2	1	2
Observations	4727	6795	4903	7369	4824	7467

Robust RD Estimates	Δ Tax rev.	Δ Tax rev.	Δ Transf. rev.	Δ Transf. rev.	Δ Non-tax rev.	Δ Non-tax rev.
Age	0.10	0.26	-8.03^{**}	-8.58^{**}	-0.19	-0.18
	(0.36)	(0.42)	(3.54)	(4.23)	(0.37)	(0.43)
Bandwidth	14.6	23.0	15.9	24.5	15.5	25.6
Order	1	2	1	2	1	2
Observations	5764	7973	6188	8264	6048	8476

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.

Notes: Panel estimates use municipality and year-of-election fixed effects and standard errors clustered by municipality. Panel estimates are reported with and without controls for the mayor's experience, gender, and years of schooling, and for whether the mayor was born in the same city (as indicated). Conventional RD estimates are obtained by local polynomial IV regression using old as an instrument for age, clustering standard errors by municipality. A uniform kernel is used and the polynomial is first-order or second-order, as indicated. The bandwidth is chosen using the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. Robust RD estimates are obtained by the estimation procedure of Calonico, Cattaneo, and Titiunik (2014) using a triangular kernel. See Table A.2 for variable definitions.

Table 10: The Effect of Political Budget Cycles on Reelection

Full Sample	Reelected	Reelected	Reelected	Reelected
Δ Cap. exp.	0.0019**	0.0016**	0.0046***	0.0040***
	(0.00083)	(0.00082)	(0.0013)	(0.0013)
Mayor controls	*No*	*Yes*	*No*	*Yes*
Fixed effects	*No*	*No*	*Yes*	*Yes*
R^2	0.001	0.045	0.260	0.290
Observations	9009	9009	9009	9009

Narrow Margin	Reelected	Reelected	Reelected	Reelected
Δ Cap. exp.	0.0042***	0.0035**	0.0067**	0.0068**
	(0.0015)	(0.0015)	(0.0032)	(0.0032)
Mayor controls	*No*	*Yes*	*No*	*Yes*
Fixed effects	*No*	*No*	*Yes*	*Yes*
R^2	0.003	0.049	0.210	0.245
Observations	3484	3484	3484	3484

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.
Notes: The sample is restricted to mayoral terms in which the term limit is not binding. Results are reported with and without controls for the mayor's age, experience, gender, and years of schooling, and for whether the mayor was born in the same city (as indicated). The equations in the first two columns are estimated by OLS, and the equations in the last two columns are estimated using municipality and year-of-election fixed effects. In the second panel the sample is further restricted to mayoral terms in which the mayor was elected by a narrow margin of victory (smaller than 10 percentage points). For the sake of readability, Δ Cap. exp. is measured in hundreds of euros per capita. Standard errors are clustered by municipality. Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes. See Table A.2 for variable definitions.

Table 11: RD Interval Estimates

	Estimate		95% Confidence Interval		90% Confidence Interval				
	Lower	Upper	Lower	Upper	Lower	Upper	Observations	Order	Bandwidth
Age coal.									
(1)	0.132	0.138	0.097	0.173	0.102	0.168	11329	1	18.3
(2)	0.142	0.147	0.105	0.184	0.106	0.182	14800	2	27.9
Age exec. comm.									
(1)	0.059	0.061	0.006	0.114	0.011	0.109	9168	1	13.7
(2)	0.049	0.050	−0.015	0.114	−0.008	0.107	13255	2	23.1
Ran again									
(1)	−0.010	−0.007	−0.014	−0.002	−0.014	−0.003	9872	1	15.0
(2)	−0.009	−0.007	−0.015	−0.001	−0.015	−0.001	12198	2	20.3
Reelected									
(1)	−0.014	−0.013	−0.019	−0.008	−0.018	−0.009	11241	1	18.1
(2)	−0.013	−0.011	−0.020	−0.004	−0.019	−0.005	10096	2	15.6
Avg. rev.									
(1)	−2.253	1.254	−9.733	8.734	−8.710	7.710	6982	1	9.9
(2)	3.221	5.984	−5.911	15.115	−4.912	14.117	9168	2	13.7
Avg. cap. exp.									
(1)	−1.668	1.073	−6.739	6.143	−6.236	5.640	7126	1	10.1
(2)	0.672	2.782	−5.666	9.121	−4.968	8.423	9486	2	14.4
Avg. curr. exp.									
(1)	−0.435	0.082	−2.867	2.514	−2.548	2.195	7913	1	11.5
(2)	2.111	2.638	−1.380	6.129	−0.357	5.105	9561	2	14.5
Δ Tot. rev.									
(1)	−10.340	−8.540	−18.085	−0.794	−16.488	−2.391	8397	1	12.3
(2)	−8.636	−7.468	−17.852	1.748	−15.970	−0.134	12298	2	20.6
Δ Cap. exp.									
(1)	−9.108	−8.077	−16.167	−1.018	−15.133	−2.052	8138	1	11.9
(2)	−8.010	−6.897	−16.927	2.021	−14.403	−0.503	11157	2	17.9
Δ Curr. exp.									
(1)	−0.111	0.179	−1.205	1.273	−1.027	1.095	9329	1	14.0
(2)	−0.456	−0.204	−1.648	0.988	−1.441	0.782	13612	2	24.1

Notes: RD interval estimates approximate the function $g(\boldsymbol{Z})$, described in the text, with a second-order polynomial in experience, education, gender, and whether the mayor was born in the same city. Left and right limits of conditional expectations are estimated by local polynomial regression of order one or two, as indicated above. The estimators use the optimal bandwidth for the point estimator of the treatment effect according to the bandwidth selector of Calonico, Cattaneo, and Titiunik (2014). Confidence sets for the interval estimates are calculated by a bootstrap procedure (described in the appendix) using 200 repetitions. Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes. See Table A.2 for variable definitions.

A Appendix (For Online Publication)

Table A.1: Variable Descriptions and Sources

Variable	**Definition and measure**	**Sample**	**Source**
Age	Age of the mayor, in years	1993–2010	IMI
Marg. of victory	Margin of victory of older candidate, in percentage points	1993–2010	IMI
Exper.	Mayor's city political experience, in years	1993–2010	IMI
Prior appt.	Appointed in previous term (any office), equal to 1 if mayor had prior appointment	1993–2010	IMI
Gender	Gender of the mayor, equal to 1 if the mayor is a woman	1993–2010	IMI
School	Education of the mayor, in years of schooling	1993–2010	IMI
Center-right	Mayor's party, equal to 1 if the mayor is a member of a center-right party	1993–2010	IMI
Term limit	Eligibility for reelection, equal to 1 if mayor has a binding term limit	1993–2010	IMI
# Rivals	Number of rival candidates	1993–2010	IMI
Born same city	Birthplace of the mayor, equal to 1 if mayor is born in the same city	1993–2010	IMI
North	Municipality is in the North	2001	SAIM
Central	Municipality is in the Center	2001	SAIM
South	Municipality is in the South	2001	SAIM
Altitude	Altitude of the city, in meters	2001	SAIM
Pop.	Population, in thousand of inhabitants	2001	Census
Pop. dens.	Population density, measured as the number of people per square kilometer	2005	SAIM
Prop. active pop.	Proportion of population that is over 15 years old and either has a job or is looking for one	2005	SAIM
Elderly	Elderly index, equal to 100 $\times$ (population over 65 years old)/(population under 14 years old)	2005	SAIM
Prod p.c.	Number of production units per capita	2005	SAIM
Employment	Proportion of population that is employed	2005	SAIM
Income p.c. (log)	Log of disposable income per capita in euros	2005	SAIM
Fam. size	Average family size	2005	SAIM

Notes: IMI stands for Italian Ministry of the Interior. SAIM stands for Statistical Atlas of Italian Municipalities. Census stands for the Italian census.

Table A.2: Variable Description and Sources

Variable	**Definition and measure**	**Sample**	**Source**
Age coal.	Average age of the municipal councilors in the mayor's coalition	1993–2010	IMI
Age exec. comm.	Average age of the members of the executive committee	1993–2010	IMI
Ran again	Incumbent mayor decides to run for office again	1993–2010	IMI
Reelected	Incumbent mayor is reelected	1993–2010	IMI
Avg. rev.	Average total revenues over the years of the mayor's term (€ per capita)	1993–2007	IAM
Avg. cap. exp.	Average capital expenditures over the years of the mayor's term (€ per capita)	1993–2007	IAM
Avg. curr. exp.	Average current expenditures over the years of the mayor's term (€ per capita)	1993–2007	IAM
Δ *Tot. rev.*	Difference between total revenues in preelection year and first year of term (€ per capita)	1993–2007	IAM
Δ *Cap. exp.*	Difference between capital expenditures in preelection year and first year of term (€ per capita)	1993–2007	IAM
Δ *Curr. exp.*	Difference between current expenditures in preelection year and first year of term (€ per capita)	1993–2007	IAM
Δ *Tax rev.*	Difference between tax revenues in preelection year and first year of term (€ per capita)	1993–2007	IAM
Δ *Transf. rev.*	Difference between transfer revenues in preelection year and first year of term (€ per capita)	1993–2007	IAM
Δ *Non-tax rev.*	Difference between non-tax revenues (tariffs and fees) in preelection year and first year of term (€ p.c.)	1993–2007	IAM

Notes: IMI stands for Italian Ministry of the Interior. SAIM stands for Statistical Atlas of Italian Municipalities. IAM refers to Italian Association of Municipalities.

Table A.3: Political Governance and Reelection: Robustness Checks

IK Bandwidth	Age coal.	Age exec. comm.	Ran again	Reelected
Age	0.12***	0.044**	−0.0085***	−0.012***
	(0.021)	(0.021)	(0.0024)	(0.0034)
Bandwidth	14.8	29.2	19.5	9.89
Observations	9703	15160	7679	4614

Third-Order Polynomial	Age coal.	Age exec. comm.	Ran again	Reelected
Age	0.11***	0.030	−0.0093***	−0.014***
	(0.017)	(0.021)	(0.0022)	(0.0022)
Observations	20167	20167	12026	12026

With Controls	Age coal.	Age exec. comm.	Ran again	Reelected
Age	0.098***	0.041	−0.0097***	−0.014***
	(0.021)	(0.032)	(0.0029)	(0.0027)
Bandwidth	18.3	13.7	15.0	18.1
Observations	11329	9168	6457	7275

Reduced Form	Age coal.	Age exec. comm.	Ran again	Reelected
RD	1.33***	0.49*	−0.070***	−0.12***
	(0.17)	(0.25)	(0.023)	(0.022)
Bandwidth	23.3	18.1	18.4	20.9
Observations	13316	11243	7340	8021

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.

Notes: The first panel presents estimates by local linear IV regression, clustering standard errors by municipality. The bandwidth is chosen using the Imbens and Kalyanaraman (2012) bandwidth selector. Estimates in the second panel are obtained by third-order polynomial IV regression using the entire sample. Standard errors are clustered by municipality. Estimates in the third panel are obtained by local linear IV regression, controlling for unbalanced mayor covariates: experience, gender, education, and whether the mayor was born in the same city. The bandwidth is chosen using the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. The fourth panel presents reduced-form RD estimates obtained by the sharp RD procedure of Calonico, Cattaneo, and Titiunik (2014) using a triangular kernel. Observations where the incumbent cannot be reelected because of a binding term limit are excluded from the reelection outcomes. See Table A.2 for variable definitions.

Table A.4: Budget Outcomes: Robustness Checks

IK Bandwidth	Avg. rev.	Avg. cap. exp.	Avg. curr. exp.	Δ Tot. rev.	Δ Cap. exp.	Δ Curr. exp.
Age	6.93	0.54	3.81**	−10.3***	−4.44*	−0.100
	(4.66)	(2.93)	(1.78)	(3.52)	(2.37)	(0.60)
Bandwidth	8.41	10.2	7.93	17.9	38.3	13.4
Observations	3623	4222	3418	6701	10313	5432

Third-Order Polynomial	Avg. rev.	Avg. cap. exp.	Avg. curr. exp.	Δ Tot. rev.	Δ Cap. exp.	Δ Curr. exp.
Age	−1.36	−0.82	−0.16	−6.71**	−5.48**	−0.49
	(2.79)	(1.85)	(1.01)	(2.77)	(2.50)	(0.43)
Observations	12050	12050	12050	12050	12050	12050

With Controls	Avg. rev.	Avg. cap. exp.	Avg. curr. exp.	Δ Tot. rev.	Δ Cap. exp.	Δ Curr. exp.
Age	0.37	−0.59	0.58	−10.3**	−9.74**	−0.053
	(4.75)	(3.11)	(1.55)	(4.44)	(4.05)	(0.62)
Bandwidth	9.88	10.1	11.5	12.3	11.9	14.0
Observations	4140	4222	4745	5048	4888	5605

Reduced Form	Avg. rev.	Avg. cap. exp.	Avg. curr. exp.	Δ Tot. rev.	Δ Cap. exp.	Δ Curr. exp.
RD	34.5	13.0	9.68	−78.8**	−77.8**	−2.96
	(38.0)	(25.3)	(12.3)	(34.4)	(31.3)	(4.59)
Bandwidth	11.1	12.3	13.2	16.3	15.9	18.5
Observations	4589	5048	5305	6292	6188	6853

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.

Notes: The first panel presents estimates by local linear IV regression, clustering standard errors by municipality. The bandwidth is chosen using the Imbens and Kalyanaraman (2012) bandwidth selector. Estimates in the second panel are obtained by third-order polynomial IV regression using the entire sample. Standard errors are clustered by municipality. Estimates in the third panel are obtained by local linear IV regression, controlling for unbalanced mayor covariates: experience, gender, education, and whether the mayor was born in the same city. The bandwidth is chosen using the Calonico, Cattaneo, and Titiunik (2014) bandwidth selector. The fourth panel presents reduced-form RD estimates obtained by the sharp RD procedure of Calonico, Cattaneo, and Titiunik (2014) using a triangular kernel. See Table A.2 for variable definitions.

Table A.5: Panel Estimates with Covariate Coefficients

Political	Age coal.	Age exec. comm.	Ran again	Reelected		
Age	0.12***	0.017**	−0.0098***	−0.011***		
	(0.0043)	(0.0067)	(0.00072)	(0.00071)		
Exper.	0.027***	0.058***	0.0069***	0.0052***		
	(0.0065)	(0.010)	(0.0013)	(0.0014)		
Gender	0.044	0.24	−0.10***	−0.13***		
	(0.14)	(0.23)	(0.026)	(0.027)		
School	0.045***	0.052**	−0.0029	−0.0027		
	(0.013)	(0.022)	(0.0023)	(0.0023)		
Born same city	0.095	0.12	0.0095	−0.00017		
	(0.082)	(0.13)	(0.015)	(0.015)		
Observations	20167	20167	12026	12026		
Budget	Avg. rev.	Avg. cap. exp.	Avg. curr. exp.	Δ Tot. rev.	Δ Cap. exp.	Δ Curr. exp.
Age	0.76	0.53	−0.14	−4.10***	−2.64**	−0.35*
	(0.90)	(0.74)	(0.15)	(1.39)	(1.23)	(0.18)
Exper.	1.95	1.29	−0.20	−2.47	−2.25	−0.26
	(1.63)	(1.40)	(0.31)	(2.77)	(2.50)	(0.36)
Gender	−21.5	−7.16	−11.5*	−30.6	−9.83	−1.71
	(26.1)	(21.9)	(6.16)	(45.5)	(40.1)	(6.92)
School	3.90	3.12	1.03**	3.60	3.63	0.12
	(2.87)	(2.39)	(0.47)	(4.49)	(4.08)	(0.65)
Born same city	−21.9	−12.0	−1.91	−4.29	−12.6	−2.29
	(16.1)	(13.0)	(3.28)	(27.8)	(24.7)	(3.82)
Observations	12050	12050	12050	12050	12050	12050

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are in parentheses.
Notes: All equations include city and year-of-election fixed effects. Standard errors are clustered by municipality. See Tables A.1 and A.2 for variable definitions.

Table A.6: Revenue Categories: RD Interval Estimates

	Estimate		95% Confidence Interval		90% Confidence Interval				
	Lower	Upper	Lower	Upper	Lower	Upper	Observations	Order	Bandwidth
Δ Tax rev.									
(1)	−0.224	0.015	−0.858	0.648	−0.805	0.596	7885	1	11.4
(2)	−0.047	0.292	−0.801	1.046	−0.705	0.950	11325	2	18.2
Δ Transf. rev.									
(1)	−9.696	−8.143	−17.269	−0.570	−15.787	−2.052	8169	1	12.0
(2)	−8.387	−7.498	−17.317	1.432	−15.540	−0.345	12283	2	20.5
Δ Non-tax rev.									
(1)	−0.097	−0.087	−0.984	0.801	−0.904	0.720	8040	1	11.8
(2)	−0.232	−0.151	−1.139	0.756	−1.034	0.651	12430	2	20.8

Notes: RD interval estimates approximate the function $g(\boldsymbol{Z})$, described in the text, with a second-order polynomial in experience, education, gender, and whether the mayor was born in the same city. Left and right limits of conditional expectations are estimated by local polynomial regression of order one or two, as indicated above. The estimators use the optimal bandwidth for the point estimator of the treatment effect according to the bandwidth selector of Calonico, Cattaneo, and Titiunik (2014). Confidence sets for the interval estimates are calculated by a bootstrap procedure (described in the appendix) using 200 repetitions. See Table A.2 for variable definitions.

A.1 Econometric Details

A.1.1 Nonparametric Identification

In the absence of selection effects at the threshold, we can nonparametrically identify an average causal response (ACR) at the threshold by combining the identification results of Angrist and Imbens (1995) and Hahn et al. (2001). Heuristically, we start with an identification result for the IV estimator based on a multivalued treatment variable and a dichotomous instrumental variable. We then condition on the running variable and take left and right limits with respect to the running variable.

Let Y denote the observed outcome, let A denote the winning candidate's age, let X (the running variable) denote the older candidate's margin of victory, and let D be an indicator equal to unity if the older candidate wins. Let Y_j denote the policy outcome in the event that the winning politician is j years old, where $j \in \{1, 2, \dots, J\}$. In addition, let $A_D \in \{1, 2, \dots, J\}$ be the age of the winning politician, conditional on the election outcome, D. Using monotonicity ($A_1 > A_0$) and continuity of $\mathbb{E}\left[Y_{A_0}|X = x\right]$ at $x = 0$, it follows that[15]

$$\frac{Y^+ - Y^-}{A^+ - A^-} = \rho \equiv \sum_{j=1}^{J} \omega_j \, \mathbb{E}\left[Y_j - Y_{j-1}|A_1 \geq j > A_0, X = 0\right],$$

$$\text{where} \quad \omega_j = \frac{\mathbb{P}\left(A_1 \geq j > A_0|X = 0\right)}{\sum_{k=1}^{J} \mathbb{P}\left(A_1 \geq k > A_0|X = 0\right)}.$$

The parameter ρ is a weighted average of causal responses to a unit change in the politician's age (treatment), for those elections whose treatment status is affected by the instrument D at the threshold. We focus on elections in which the first- and second-place candidates have different ages, so that D always affects the treatment status. Thus, the causal effect of increasing the winning candidate's age from $j-1$ to j is simply weighted by the relative likelihood of viewing an election in which the older contender is at least j years old and the younger contender is no more than $j-1$ years old, conditional on the election being close.

In our application we worry that the expected potential policy outcome when the younger politician wins is discontinuous at the threshold, because expected politician observables such as experience, education, gender and place of birth are discontinuous at the threshold. In

[15] See Hahn et al. (2001) and Angrist and Imbens (1995).

that case we have

$$\frac{Y^+ - Y^-}{A^+ - A^-} = \frac{\sum_{j=1}^{J} \mathbb{E}\left[Y_j - Y_{j-1}|A_1 \geq j > A_0, X=0\right] \mathbb{P}\left(A_1 \geq j > A_0|X=0\right) + \Delta}{\sum_{k=1}^{J} \mathbb{P}\left(A_1 \geq k > A_0|X=0\right)},$$

$$\text{where} \quad \Delta = \lim_{x \to 0^+} \mathbb{E}\left[Y_{A_0}|X=x\right] - \lim_{x \to 0^-} \mathbb{E}\left[Y_{A_0}|X=x\right].$$

Now ρ is not identifiable because $\Delta \neq 0$. The expected outcome holding the politician's age constant at A_0 is discontinuous at the threshold, because the conditional distributions of relevant observables (experience, gender, education, place of birth) and unobservables are discontinuous at the threshold. If we could point-identify Δ, then ρ would be identifiable and

$$\frac{Y^+ - Y^- - \Delta}{A^+ - A^-} = \rho.$$

However, because Δ depends in part on selection on unobservables, it is not identifiable. With additional assumptions we can identify an interval that contains ρ. Decompose Δ in the following way:

$$\Delta = \Omega + C,$$

where Ω is the effect of selection on unobservables, and C is the effect of selection on observables. If we account for "enough" observable characteristics in C, then it is reasonable to make the following assumption.

Assume: $|\Omega| \leq |C|$.

This is akin to the assumption in Altonji et al. (2005) that selection on unobservables is no larger than selection on observables. The main difference is that our assumption applies only to unobservable selection effects *at the threshold* ($X = 0$). The assumption allows us to bound Δ:

$$\Delta \in \begin{cases} [0, 2C] & \text{if } C \geq 0 \\ [2C, 0] & \text{if } C < 0. \end{cases}$$

These bounds lead to the partial identification result,

$$C \geq 0: \quad \rho \in \left[\frac{Y^+ - Y^- - 2C}{A^+ - A^-}, \frac{Y^+ - Y^-}{A^+ - A^-}\right]$$
$$C < 0: \quad \rho \in \left[\frac{Y^+ - Y^-}{A^+ - A^-}, \frac{Y^+ - Y^- - 2C}{A^+ - A^-}\right].$$

Given that C is an estimable function of observed variables, we now have estimable bounds for the treatment effect.

A.1.2 Semiparametric Partial Identification

In order to estimate the identified interval, we first need an explicit expression for C. For simplicity we use a partially linear model in which age enters linearly and politician observables, denoted by $\boldsymbol{Z}$, enter in a possibly nonlinear manner:[16]

$$Y = \gamma + \rho A + g(\boldsymbol{Z}) + \varepsilon.$$

We assume that $g(\boldsymbol{Z})$ can be well-approximated by a second-order polynomial, denoted by $\boldsymbol{\beta}'\boldsymbol{W}$, where $\boldsymbol{W}$ is a function of $\boldsymbol{Z}$. For example, if $\boldsymbol{Z} = (z_1, z_2)'$, then $\boldsymbol{W} = (z_1, z_2, z_1 \cdot z_2, z_1^2, z_2^2)'$. Now the model can be written as

$$Y = \gamma + \rho A + \boldsymbol{\beta}'\boldsymbol{W} + \varepsilon.$$

Because we know that $\mathbb{E}[\boldsymbol{W}|X = x]$ is discontinuous at $x = 0$, we worry that $\mathbb{E}[\varepsilon|X = x]$ is also discontinuous at $x = 0$. Taking conditional expectations and limits, we have

$$Y^+ - Y^- = \rho\left(A^+ - A^-\right) + \boldsymbol{\beta}'\left(\boldsymbol{W}^+ - \boldsymbol{W}^-\right) + \varepsilon^+ - \varepsilon^-,$$
$$\text{or} \quad \rho = \frac{1}{(A^+ - A^-)}\left[\left(Y^+ - Y^-\right) - \boldsymbol{\beta}'\left(\boldsymbol{W}^+ - \boldsymbol{W}^-\right) - \left(\varepsilon^+ - \varepsilon^-\right)\right]$$

As before, we assume that selection on unobservables at the threshold is no larger than selection on observables at the threshold.

Assume: $\quad \left|\varepsilon^+ - \varepsilon^-\right| \leq \left|\boldsymbol{\beta}'\left(\boldsymbol{W}^+ - \boldsymbol{W}^-\right)\right|$

[16] Note that we are only interested in identifying treatment effects locally around $X = 0$, and that the true equation is approximately linear in a small enough neighborhood around $X = 0$.

Let $C = \boldsymbol{\beta}'(\boldsymbol{W}^+ - \boldsymbol{W}^-)$. Then ρ belongs to one of two possible intervals, depending on the sign of C:

$$C \geq 0: \quad \rho \in \left[\frac{Y^+ - Y^- - 2C}{A^+ - A^-}, \frac{Y^+ - Y^-}{A^+ - A^-}\right]$$

$$C < 0: \quad \rho \in \left[\frac{Y^+ - Y^-}{A^+ - A^-}, \frac{Y^+ - Y^- - 2C}{A^+ - A^-}\right].$$

A.1.3 Estimation

We can estimate Y^+, Y^-, A^+, A^-, $\boldsymbol{W}^+$, and $\boldsymbol{W}^-$ using local polynomial regression. The coefficients $\boldsymbol{\beta}$ can be estimated by OLS using observations in a neighborhood of the threshold demarcated by the bandwidth h. The estimator for C is

$$\widehat{C} = \hat{\boldsymbol{\beta}}'\left(\widehat{\boldsymbol{W}}^+ - \widehat{\boldsymbol{W}}^-\right),$$

$$\text{where} \quad \hat{\boldsymbol{\beta}} = \arg\min_{\gamma,\rho,\boldsymbol{\beta}} \sum_i \mathbb{1}\left[-h < X_i < h\right](Y_i - \gamma - \rho A_i - \boldsymbol{\beta}'\boldsymbol{W}_i)^2.$$

The resulting estimator is an interval whose endpoints are the lower- and upper-bound estimates of ρ: $[\hat{\rho}_L, \hat{\rho}_U]$.

A.1.4 Inference

We use the bootstrap procedure of Horowitz and Manski (2000) to obtain confidence intervals for $[\hat{\rho}_L, \hat{\rho}_U]$. For each bootstrap sample we calculate an interval $[\hat{\rho}^*_L, \hat{\rho}^*_U]$. The bootstrap $1-\alpha$ confidence interval for $[\hat{\rho}_L, \hat{\rho}_U]$ is the interval $[\hat{\rho}_L - z^*_\alpha, \hat{\rho}_U + z^*_\alpha]$, where z^*_α is the smallest number such that at least $1-\alpha$ percent of the bootstrap intervals are contained within the confidence interval. The confidence intervals are calculated using 200 bootstrap repetitions.

References

Akhmedov, A. and E. Zhuravskaya (2004): "Opportunistic Political Cycles: Test in a Young Democracy Setting," *Quarterly Journal of Economics*, 119, 1301–1338.

Alesina, A. (1988): "Credibility and Policy Convergence in a Two-Party System with Rational Voters," *American Economic Review*, 78, 796–806.

Alesina, A., G. Cohen, and N. Roubini (1997): *Political Cycles and the Macroeconomy*, Cambridge, MA: MIT Press.

Alesina, A. and M. Paradisi (2014): "Political Budget Cycles: Evidence from Italian Cities," Working Paper 20570, National Bureau of Economic Research.

Altonji, J. G., T. E. Elder, and C. R. Taber (2005): "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *Journal of Political Economy*, 113(1), 151–184.

Angrist, J. D. and G. W. Imbens (1995): "Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity," *Journal of the American Statistical Association*, 90(430), 431–442.

Ben-Porath, Y. (1975): "The Years of Plenty and the Years of Famine - A Political Business Cycle," *Kyklos*, 28, 400–403.

Besley, T., J. G. Montalvo, and M. Reynal-Querol (2011): "Do Educated Leaders Matter?" *The Economic Journal*, 121(554), F205227.

Bisin, A., A. Lizzeri, and L. Yariv (2015): "Government Policy with Time Inconsistent Voters," *American Economic Review, forthcoming.*

Bordignon, M., T. Nannicini, and G. Tabellini (2013): "Moderating Political Extremism: Single Round vs. Runoff Elections under Plurality Rule," Discussion Paper 7561, IZA.

Brender, A. and A. Drazen (2005): "Political Budget Cycles in New Versus Established Democracies," *Journal of Monetary Economics*, 52, 1271–1295.

——— (2008): "How Do Budget Deficits and Economic Growth Affect Reelection Prospects? Evidence from a Large Panel of Countries," *American Economic Review*, 98, 2203–2220.

Brollo, F., T. Nannicini, R. Perotti, and G. Tabellini (2013): "The Political Resource Curse," *American Economic Review*, 103(5), 1759–1796.

Brollo, F. and U. Troiano (2014): "What Happens When a Woman Wins an Election? Evidence from Close Races in Brazil," Working paper, University of Michigan.

Calonico, S., M. D. Cattaneo, and R. Titiunik (2014a): "Robust Data-Driven Inference in the Regression-Discontinuity Design," *The Stata Journal*, forthcoming.

——— (2014b): "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs," *Econometrica*, 82(6), 2295–2326.

Casaburi, L. and U. Troiano (2014): "Ghost-House Busters: The Electoral Response to a Large Anti Tax Evasion Program," Working paper.

Drazen, A. and M. Eslava (2003): "The Political Budget Cycle in Columbia," Working paper.

Gagliarducci, S. and T. Nannicini (2013): "Do Better Paid Politicians Perform Better? Disentangling Incentives from Selection," *Journal of the European Economic Association*, 11, 369–398.

Gagliarducci, S. and M. D. Paserman (2012): "Gender Interactions with Hierarchies: Evidence from the Political Arena," *Review of Economic Studies*, 79, 1021–1052.

Grembi, V., T. Nannicini, and U. Troiano (2014): "Policy Responses to Fiscal Restraints: A Difference-in-Discontinuities Design," Working paper.

Hahn, J., P. Todd, and W. Van der Klaauw (2001): "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design," *Econometrica*, 69(1), 201–209.

Horowitz, J. L. and C. F. Manski (2000): "Nonparametric Analysis of Randomized Experiments with Missing Covariate and Outcome Data," *Journal of the American Statistical Association*, 95(449), 77–84.

Imbens, G. and K. Kalyanaraman (2012): "Optimal Bandwidth Choice for the Regression Discontinuity Estimator," *Review of Economic Studies*, 79(3), 933–959.

Imbens, G. W. and J. D. Angrist (1994): "Identification and Estimation of Local Average Treatment Effects," *Econometrica*, 62(2), 467–475.

McCrary, J. (2008): "Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test," *Journal of Econometrics*, 142(2), 698–714.

Persson, T. and G. Tabellini (2002): "Do Electoral Cycles Differ Across Political Systems?" Working paper.

Prato, C. (2015): "Electoral Competition and Policy Feedback Effects," .

Rogoff, K. (1990): "Equilibrium Political Budget Cycles," *American Economic Review*, 80, 21–36.

Rogoff, K. and A. Sibert (1988): "Elections and Macroeconomic Policy Cycles," *The Review of Economic Studies*, 55, 1–16.

Shi, M. and J. Svensson (2006): "Political Budget Cycles: Do They Differ Across Countries and Why?" *Journal of Public Economics*, 90, 1367–1389.

Tamer, E. (2010): "Partial Identification in Econometrics," *Annual Review of Economics*, 2, 167–195.

Washington, E. (2008): "Female Socialization: How Daughters Affect Their Legislator Fathers Voting on Womens Issues," *American Economic Review*, 98(1), 311–332.