Politicians' Age and Long-Term Policy: Evidence from Brazilian Municipalities*

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Abstract

A fundamental difficulty in policy-making is that policies often have costs today but benefits far into the future. This difficulty is particularly salient to climate change and environmental conservation policies. A critical dimension in this trade-off is the age of politicians. Younger politicians have a longer lifespan, which could lead them to weigh more future policy benefits. However, younger politicians might be more prone to show short-term economic results to climb the political ladder. We study this trade-off in the case of Brazilian mayors and deforestation, using a regression discontinuity design for close elections. We find that when a young politician is elected, there is a reduction in deforestation and greenhouse gas emissions intensity, without significant effects on municipal gross domestic product. The results also show that younger politicians allocate more budget to education and capital investment, suggesting that the time horizon aspect dominates the trade-off. These results illustrate the importance of youth political participation for long-term policy.

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1 Introduction

A fundamental difficulty in policy-making is that policies often have costs today but benefits far into the future. This difficulty is particularly salient to climate change and environmental conservation policies. It is estimated that greenhouse gas emissions stay in the atmosphere for decades (IPCC, 2021); so actions to reduce emissions today will accrue benefits for the next generations. Politicians' age is a key characteristic in the decision to reduce emissions today (policy costs) to lower climate change impacts in the future (policy benefits). Younger politicians have a longer lifespan, which could lead them to weigh more future policy benefits. However, younger politicians might be more prone to show short-term economic results to climb the political ladder. Given the theoretical ambiguous effect of politicians' age on long-term policies, we study the question empirically. In this paper we study the effect of electing a young mayor on deforestation using data from Brazilian municipalities.

In theory politicians' age might affect long-term anti-deforestation policy in multiple ways (Alesina et al., 2019). First, a young politician is more likely to be alive to experience the benefits of a policy with benefits far into the future. Consequently, younger politicians would be more likely to reduce deforestation today to diminish future negative impacts of climate change. Second, younger politicians might have more career concerns, prioritizing short-term economic growth over environmental conservation. Third, younger politicians might have more energy to carry out more projects. These extra projects might represent additional environmental damage or the chance to address environmental problems. Given all these possible channels, the effect of politicians' age on local deforestation is ex-ante ambiguous.

Brazil is an ideal setting to study the effect of politicians' age on deforestation for many reasons. First, the country contains 60% of the Amazon rain-forest, the largest tropical forest on the planet. In addition, Brazil has thousands of municipalities (the analogous of

U.S. counties), which provides us with multiple observation units. Although mayors in Brazil are not directly responsible for environmental law enforcement, mayors can affect deforestation when under strong electoral incentives (Bragança and Dahis, 2022) via the agricultural and social programs implemented (Holland, 2016). For example, 118 mayoral candidates were on the national environmental agency's "watch list" for: deforestation, illegal burning, exploitation of protected native forests, or providing false information to environmental agencies (MongaBay, 2021). Brazil has also been monitoring deforestation with satellite data since the early 2000s, which makes for data sources without misreporting concerns.

We combine data from several sources. Our main dependent variable is the percentage of forest area that is deforested in a given year, from de Almeida et al. (2021). We also use data for Brazilian Amazon municipal elections for the years 2004-2016 from the Superior Electoral Court (TSE). In our main specification, we define a young candidate as being in the lowest 20^{th} percentile of the candidates' age distribution in the election. This is approximately a candidate less than 35 years old. Similarly, we define a senior candidate as being above the 80^{th} percentile of the candidates' age distribution in the election, approximately 55 years. We show robustness of our results to the definition of young candidates.

Our empirical strategy uses a regression discontinuity (RD) design for close elections involving young candidates to estimate a causal effect. The close elections are a natural experiment comparing municipalities that barely elected a young mayor with those where the young candidate barely lost the election. We provide the standard RD validity tests to show the absence of manipulation or discontinuities in covariates around the fifty percent cutoff.

We find that young mayors have better environmental performance without affecting the local economy. We find that when a young mayor is in office, there is a 0.49 p.p. reduction in the yearly deforestation rate (as a share of municipality's area). Compared to a mean of 0.74% forest area deforested each year, the effect size amount to a reduction

of 66%. We also find that a young candidate also reduces the emissions intensity. Importantly, electing a young candidate does not have statistically significant effects on municipal gross domestic product. We find that results are stable across young candidates' characteristics, except for the municipality's access to internet. Young mayors cause even lower deforestation when access to internet is higher, suggesting a channel of better availability of information and social media presence.

Turning to mechanisms, we first find that young mayors do not prioritize the primary sector. When a young mayor is elected, we find a reduction in the agricultural sector measured in per capita terms, as a percentage of the total GDP and emission intensity. We also find a larger share of the municipality's budget for education and capital investment. These results, combined with the positive environmental effects, suggest that the time horizon aspect dominates the career concerns when electing a young mayor.

We contribute to three main strands of the literature. First, we contribute to the burgeoning literature that studies the effects of agents' age on government policies. Alesina et al. (2019) and Bertrand et al. (2015) find that younger politicians have more career concerns. To the best of our knowledge, we are the first to study the effects of politicians' age on local environmental performance.

Second, we contribute to the literature that studies the political economy of deforestation. At the national level, deforestation can be affected by central government policies (Burgess et al., 2019). At the municipal level deforestation is higher when the mayor is a farmer (Bragança and Dahis, 2022), when the mayor's campaign was financed by donors (Harding et al., 2021), when municipalities split (Burgess et al., 2012) and when the election was contested (Sanford, 2021; Morjaria, 2018). The effect of electing a donor-funded politician has an effect size of 53-109% compared to the deforestation mean (Harding et al., 2021), comparable to the effect size of 68-90% of electing a young politician.

The environmental justice literature has so far focused on the unequal distribution of environmental damages across income and race (Hsiang et al., 2019). Our work highlights

the importance of political representation for younger cohorts, who will be disproportionately impacted by climate change (Thiery et al., 2021).

The reminder of the paper is organized as follows. Section 2 discusses the Brazilian context. Section 3 presents the identification strategy. Section 4 describes the data. Section 5 presents the results and Section 6 concludes.

2 Institutional Background

Brazil is the fifth largest country in the world in terms of area. The country contains 60% of the Amazon rain-forest, the largest tropical forest on the planet. We focus on the Legal Amazon municipalities, because is where the deforestation data is available. Municipalities are the smallest administrative unit in Brazil. There are currently 5572 municipalities in Brazil, of which 772 are in the Amazon. However, the Amazon municipalities represent about 50% of the country's area.

Municipal governments are managed by a mayor elected using plurality rule in municipalities with less than 200,000 voters and majority rule in municipalities with more than 200,000 voters. Mayors serve a four-year term, and can be re-elected once. The Brazilian municipalities also have a local council. Municipal councilors are elected through an open list proportional representation system. Elected mayors and councilors take office on January 1st next year, after elections in November. We analyze data from elections every four years from 2004 to 2016, covering mayor periods from 2005-2008 to 2017-2020.

The minimum age to be elected mayor is 21 years old, while for councilor it is 18.[1] The median candidate age in all elections in our data is 44 years old, while the median elected candidate age is 48 (see Figure 1). Other eligibility requirements are being Brazilian, having full electoral rights, having enlisted for the army, living in the relevant geography, and being affiliated to a party.

[1] See https://www.tse.jus.br/eleitor/glossario/termos/elegibilidade.

According to the 1988 Constitution municipalities are responsible for providing an array of public goods and services, such as basic education and health. Jurisdiction over environmental conservation is somewhat a gray area. Historically enforcement has been done by the federal government through agencies such as the Brazilian Institute for the Environment and Renewable Resources (*Ibama*), Chico Mendes Institute for Biodiversity Conservation (*ICMBio*), the federal police, and others. Nevertheless, mayors may influence deforestation directly or indirectly, for example, via incentives to developing local agriculture or with infrastructure projects, and with forbearance (Holland, 2016).

3 Empirical Framework

In order to study the effect of young mayors on deforestation, we use a Regression Discontinuity Design. This quasi-experimental approach compares municipalities where a young candidate barely won the election versus municipalities where the young candidate lost by a small margin. The first step is to define the age limit to define a candidate as young. In the main specification we use the following rule:

$$Young_{mt} = \begin{cases} 1, & \text{if } Age_{mt_e} <= P_{20}(Age_{mt_e}) \\ 0, & \text{if otherwise} \end{cases}$$

where Age_{mt_e} is the age of the mayor at the time of the previous election (t_e), and $P_{20}(Age_{m't_e})$ refers to the 20th percentile of the age of all politicians in the country running for election that year.

After identifying young candidates, we identify mayoral elections where a young candidate won or obtained second place. Then we estimate the effect of electing a young

mayor on deforestation using the following equation:

$$y_{mt} = \beta \times YoungWon_{mt_e} + f^{+}(Margin^{+}_{mt_e}) + f^{-}(Margin^{-}_{mt_e}) + \lambda_t + \gamma \times Z_{mt} + \varepsilon_{mt} \quad (1)$$

where y_{mt} is the percentage of the forest area deforested in municipality m on year t. The forest area for each municipality is the forest standing in the year 2000. $YoungWon_{mt_e}$ is a dummy equal to one if a young candidate won the previous election (t_e), and consequently is in office at time t. $f^{+}(Margin^{+}_{mt_e})$ and $f^{-}(Margin^{-}_{mt_e})$ are local polynomials of the margin of victory ($+$) or defeat ($-$) of the young candidate in the previous election. λ_t are time-fixed effects to control for different yearly shocks, like the weather and national policies. Z_{mt} are municipality time-variant controls such as the logarithm of population and mayor controls such as sex, second-term, right-wing, and married. Finally, we use Hinkley (HC1) errors (ε_{mt}) in the main specification, but present robustness to other error types.

In the main specification, we compare young mayors against any mayor that is not classified as young. On average the young mayor is 17.7 years younger than the rival candidate. Still, there is a concern that the strategy sometimes comparies a candidate that is 35 years old against a candidate that is 36 years old. Therefore we also present results using only elections with a young and a senior candidate compete for first place. We define a senior candidate as one that is above the 80th percentile of the age distribution, which is approximately 55 years.

Following the literature, we restrict the use of polynomial order to those of low order (Gelman and Imbens, 2019). We use a linear local polynomial in our main specification. In the case of the bandwidth selection, we use the data-driven approach proposed by Calonico et al. (2014). We employ in the main specification a triangular kernel for weighting observations. We present robustness to polynomial degree, bandwidth and kernel in the Appendix.

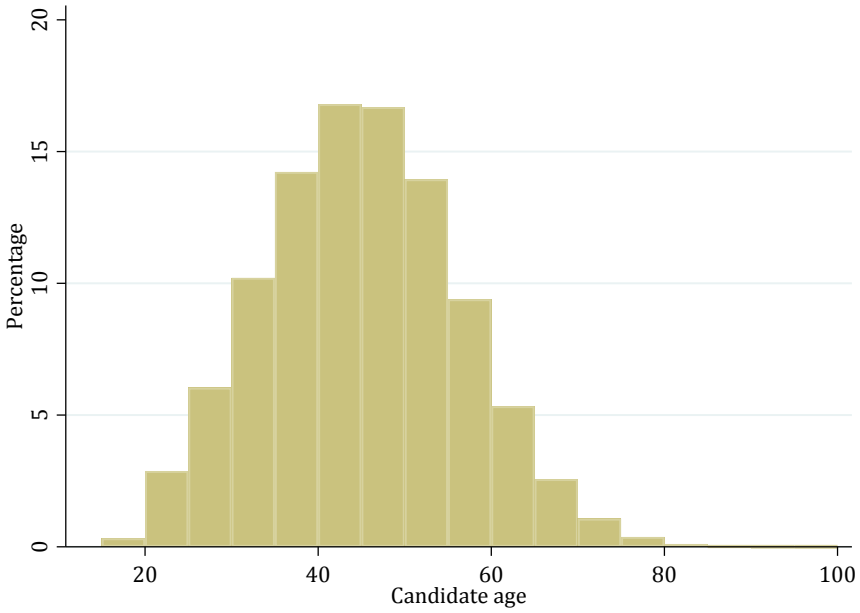
In addition, to understand the mechanism driving the results, we estimate the same equation with different dependent variables – such as economic variables and expenditure type. We also add interactions to compute potential heterogeneous effects of having a young mayor in office.

4 Data

Deforestation. The area deforested each year is provided by the National Institute for Space Research (INPE) through the Measurement of Deforestation by Remote Sensing program (PRODES). INPE computes deforestation by analyzing satellite images covering only the Legal Amazon, with a resolution of 20 meters x 30 meters pixels. An area is categorized as deforested if there is a "suppression of areas of primary forest physiognomy due to anthropic actions" (de Almeida et al., 2021, p.3) and the deforested polygon is larger than 6.25 hectares. The data is yearly using the "PRODES year", which begins on August 1st and ends on July 31st of the following year.

Election results and candidates information. We use elections from 2004 to 2016 from the Superior Electoral Court (TSE), preprocessed by the Data Basis project (Dahis et al., 2022). The dataset contains information on the elections of each municipality and information about the candidates, such as age or marital status. In addition, from the political party information, we establish whether the candidate is left or right-wing. Figure 1 shows the age distribution of candidates during the whole study period. Figure A.1 shows the map of the Brazilian Amazon with the distribution of municipalities that enter the regression discontinuity sample by year. While Table A.1 reports the number of municipalities by year that enter the RD sample.

Figure 1: Candidates' age distribution



Notes: This histogram displays the age distribution of all candidates in ordinary elections in Brazil during the elections included in the study period: 2004 to 2016.

Emissions. We use the emissions data from System for Estimating Greenhouse Gas Emissions and Removals (SEEG) (Sistema de Estimativa de Emissões e Remoções de Gases de Efeito Estufa, Observatório do ClimaSEEG, n.d.).[2] SEEG classifies emissions in different levels depending on the activity that produced the emissions. Emissions are measured in tons of carbon dioxide equivalent (CO_2e), so that different gases are comparable based on their global warming potential. We add this data to proxy environmental behavior by municipality and economic activity.

We also use other databases such as SICONFI for municipal expenditures, Municipal Agricultural Research, and Agricultural Census. All data is pre-processed by the Data Basis project Dahis et al. (2022) and is available on their website.[3]

[2]For more information about methodology used see De Azevedo et al. (2018).
[3]See `https://basedosdados.org`

4.1 Summary statistics

Table 1 presents summary statistics of the data we have. Columns 1-4 present the mean and standard deviation for four different groups of municipalities: (1) all Brazilian municipalities except those in the Legal Amazon; (2) municipalities in the Legal Amazon that do not enter the regression discontinuity design; (3) Amazon municipalities where a young candidate closely won the last election; (4) Amazon municipalities where a young candidate barely lost the last election (the "control" group). Columns 5 presents the difference between the group of municipalities where the Young won (3) versus the group where the Not young won (4). Column 6 asses if there is a discontinuity in the characteristics at the close election cutoff. Panel A presents characteristics of the municipality, while Panel B characteristics of the mayors.

Panel A shows that around 15% of elections in Brazil have a young candidate in the top two, and the percentage is similar in Amazon municipalities. By construction, all the elections in the regression discontinuity sample (columns (3) and (4)) have a young candidate in the top two. Municipalities have on average 30,000 inhabitants in all groups, but Amazon municipalities are around ten times as large in terms of area. As stated before, the deforestation data is only available for Amazon municipalities. These municipalities had on average 4,500 km^2 of forest in the year 2000 and deforest each year 0.7% of the forest. These variables are similar in treatment and control groups columns 5 and 6 show.

Panel B of Table 1 presents summary statistics of the mayor characteristics. Only 10% of the mayors are female and three quarters are right wing. As we have statistically significant differences between Young and Not young mayors, we control by sex, second-term, right-wing, and married in the regressions. Table A.2 presents additional summary statistics.

Table 1: Summary statistics

Variable	Brazil	Legal Amazon	Young	Not young	Young (3) vs Not Young (4)	
					Difference	RD
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Municipality						
Deforestation as % forest	-	0.68	0.86	0.73	0.13	-0.20
	(-)	(1.21)	(1.14)	(1.21)	(0.17)	(0.15)
Forest area in 2000 (km2)	-	4,497.97	4,885.57	4,465.01	420.56	1022.96
	(-)	(13,066.94)	(11,490.71)	(10,695.70)	(1,601.16)	(1129.59)
Municipality Area (Km2)	723.33	6,529.75	6,661.75	6,430.95	230.80	510.54
	(1498.43)	(13,711.07)	(12,702.37)	(11,307.69)	(1,733.37)	(1320.05)
Population (thousands)	35.72	32.40	31.26	25.55	5.71	-10.95
	(219.89)	(103.97)	(108.90)	(53.56)	(12.27)	(7.15)
% elections with young top2	14.71	11.14	100.00	100.00	0.00	0.00
	(35.43)	(31.47)	(0.00)	(0.00)	(0.00)	(0.00)
N	19,159	2,890	93	99		
Panel B: Mayor						
Male	0.91	0.88	0.87	0.88	-0.01	0.07
	(0.29)	(0.33)	(0.34)	(0.33)	(0.05)	(0.09)
Right	0.77	0.76	0.73	0.73	0.00	-0.22*
	(0.42)	(0.43)	(0.45)	(0.45)	(0.06)	(0.13)
Married	0.78	0.72	0.56	0.71	-0.15**	-0.16
	(0.41)	(0.45)	(0.50)	(0.46)	(0.07)	(0.12)
College	0.48	0.39	0.46	0.28	0.18***	0.25*
	(0.50)	(0.49)	(0.50)	(0.45)	(0.07)	(0.13)
Second term	0.27	0.25	0.09	0.15	-0.06	0.02
	(0.44)	(0.43)	(0.28)	(0.36)	(0.05)	(0.10)
N	19,192	2,896	93	99		

Notes: Mean and standard deviation (in parenthesis) of the municipality and mayor attributes disaggregated by groups. Column 1 includes municipalities that are neither in our main specification sample nor in the Legal Amazon. Column 2 contains all municipalities belonging to Legal Amazon that are not in our main sample. Columns 3 and 4 municipalities of our main regression sample disaggregated by Young and Not Young groups. Columns 5 and 6 show the results for differences testing between Young (column 3) and Not young (column 4). Column 5 uses a t-test, and Column 6 uses a Regression Discontinuity with year fixed-effects and controlling by the logarithm of the population. Panel A contains information with variation across municipalities and electoral terms in the case of deforestation from PRODES and just by municipalities in the rest of the variables. Panel B provides information about the candidates and elections of the sample, so there is one observation per municipality for four years. *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

5 Results

5.1 Effect of electing a young mayor on deforestation

We first study the effect of politician's age on deforestation. Table 2 presents the results of estimating Equation (1). Column 1 presents the results without controlling for characteristics of the mayor, while column 2 includes controls. For each regression in these first columns, we recalculate the optimal bandwidth for the given data. In the last columns, we fix the bandwidth to that of the main specification (column 2, Panel A) so that we compare results with the same margin of victory. Panel A compares young candidates to any other not young candidate. Panel B compares young candidates against senior candidates. Finally, panel C compares senior candidates against any other candidate. Column 1 in Panel A shows that when a young mayor is elected, there is a reduction in deforestation of 0.43 percentage points compared to municipalities where the young mayor barely lost the election. Compared to the mean of 0.72% of the forest area deforested each year, this is a reduction of almost 60% in deforestation. The reduction is of similar magnitude (66%) when we control by mayor characteristics (column 2).

The effect is larger when we restrict the control group to elections with a senior candidate (column 1, Panel B). But we obtain a similar coefficient once we include mayor controls. This is explained by the fact that young and senior candidates differ in other dimensions beyond age. Panel C shows a slight increase in deforestation comparing municipalities with senior mayors with the rest of the municipalities, but statistically we cannot reject the effect is null. Note that we do not include a Panel comparing Senior vs Young candidates, because the results are symmetric to Panel B. Figure A.2 shows the Regression Discontinuity plot for the main specification.

Table 2: Electing a young mayor reduces deforestation

Dependent variable:	Deforestation as % forest 2000			
	(1)	(2)	(3)	(4)
Panel A:	Margin: Young vs Not young			
Young won	-0.43**	-0.49***	-0.47**	-0.49**
	(0.20)	(0.19)	(0.20)	(0.19)
Mean Dep. Variable Control	0.72	0.74	0.74	0.74
Age Diff.	17.52	17.70	17.70	17.70
Bandwidth	12.46	11.23	11.23	11.23
N	776	724	724	724
Panel B:	Margin: Young vs Senior			
Young won	-1.23**	-0.54	-0.95**	-0.56*
	(0.49)	(0.35)	(0.44)	(0.33)
Mean Dep. Variable Control	0.94	0.94	0.88	0.88
Age Diff.	26.62	27.27	28.02	28.02
Bandwidth	8.03	8.92	11.23	11.23
N	150	173	205	205
Panel C:	Margin: Senior vs Not senior			
Senior won	0.07	0.11	0.09	0.12
	(0.14)	(0.15)	(0.15)	(0.15)
Mean Dep. Variable Control	0.79	0.79	0.76	0.76
Age Diff.	16.72	16.65	16.76	16.76
Bandwidth	12.16	11.47	11.23	11.23
N	1868	1762	1759	1735
Mayor Controls	No	Yes	No	Yes

Notes: This table presents the effect of having a young mayor or senior mayor on deforestation. Coefficients are estimated using Equation (1). Columns (1) and (2) use the optimal bandwidth of each regression. Columns (3) and (4) are restricted to the optimal bandwidth of column 2 in Panel A. Columns (2) and (4) control by gender, left or right-wing of the mayor's party, second-term, and married status. Panel A uses the sample of all municipalities with one young candidate among the top two candidates. Panel B restrict the sample to municipalities with exactly one young and one senior candidate in the two top places. In Panel C, the sample contains all elections in which a senior candidate was between the top two candidates. Age Diff. is the average difference in age between the top two candidates. All regressions include year fixed-effects and control by population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Heterogeneity We know proceed to study what additional characteristics of young mayors affect deforestation. Table 3 presents heterogeneous effects of estimating Equation (1). Column 2 shows that a young female mayor reduces deforestation even more than a male young mayor. Although only 12% of young mayors are female (see bottom row with the mean of the interaction variable). Column 3 shows that right-wing mayors are

less effective at reducing deforestation. For young mayors the differential effect is not statistically significant, but for senior mayors it is. Column 4 studies whether young married mayors have a different effect on deforestation. One could expect that married mayors might have kids and therefore more inclined to protect the environment. Although the coefficient shows a negative sign, as expected, it is not statistically significant. Column 5 presents the effect of being a young mayor in his second-term mandate.

Column 6 studies whether young farmer mayors have a differential effect on deforestation. The sign is positive, although the effect is not statistically significant. This result is in line with (Bragança and Dahis, 2022). Column 7 studies the heterogenous effects of having a college degree. College is important to have lower deforestation for senior mayors, but not for young mayors. This is probably because these days environmental education is more widespread in high school these days. Column 8 displays the heterogeneous effect of having more internet access in the municipality. The presence of the internet could affect deforestation in several ways: individuals can access global information about climate change, can complain about deforestation or the performance of the mayor in social media. We find that greater internet access is important for young mayors, that are probably more connected.

Table 3: Heterogeneous effects

Dependent variable:	Deforestation as % forest 2000							
		Interaction variables (columns)						
		Male	**Right**	**Married**	**2nd term**	**Farmer**	**College**	**Internet Access**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A:	Margin: Young vs Not young							
Treat	-0.49**	-1.23**	-0.77**	-0.43*	-0.51**	-0.52**	-0.52**	-0.39**
	(0.20)	(0.51)	(0.31)	(0.22)	(0.21)	(0.20)	(0.24)	(0.18)
Treat X Interaction		0.85*	0.39	-0.08	0.21	0.30	0.11	-0.06**
		(0.45)	(0.27)	(0.22)	(0.27)	(0.32)	(0.17)	(0.02)
Mean dep. var. Control	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Mean interact.	-	0.88	0.74	0.55	0.09	0.10	0.45	1.24
N	724	724	724	724	724	724	724	724
Panel B:	Margin: Senior vs Not senior							
Treat	0.11	0.16	-0.36	-0.21	0.15	0.08	0.26	0.10
	(0.15)	(0.24)	(0.23)	(0.17)	(0.15)	(0.15)	(0.16)	(0.15)
Treat X Interaction		-0.06	0.64***	0.44***	-0.31*	0.23	-0.47***	-0.01
		(0.22)	(0.18)	(0.15)	(0.16)	(0.18)	(0.12)	(0.02)
Mean dep. var. Control	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Mean interact.	-	0.88	0.79	0.75	0.24	0.20	0.36	1.81
N	1762	1762	1762	1762	1762	1762	1762	1762

Notes: Heterogeneous effect of having a young or senior mayor on deforestation. Coefficients are estimated by using Equation (1) but adding an interaction term between the treatment dummy and the variable of interest. The sample of this Table is the same as Column (2) of Table 2. Column 1 presents the results of the main specification with mayor controls. Columns 2 to 7 present the treatment interacted with mayor related variables. Column 8 shows the treatment interacted with a municipality variable, the density of internet access. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which a senior candidate was between the top two candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Robustness. Figure A.3 presents the results of the sensitivity analysis to the bandwidth in the main specification (column 2 of Panel A in Table 2). We vary the bandwith between half and twice the optimal bandwith. Table A.3 presents the results when we vary the age limit to define a candidate as young. We still observe a reduction when we use percentiles of age between 10% and 25%, but at 30% the candidates have similar age and we do not observe effects. The main results are even larger, when we apply a quadratic polynomial in the margin of victory (see Table A.5). The main results are also robust to different error estimations (see Table A.4), and different kernel density estimations (see Table A.6 for uniform kernel). Table A.7 presents results for a placebo exercise, making the treatment

assignment based on the results of the next elections. There are no statistical significant effects of the future elections on current period deforestation, as expected. Figure A.4 shows the results of the main specification when dropping different observations of the closest elections to avoid the results being just driven by a few observations with higher weights. Figure A.5 presents results when we apply different threshold to drop potential outliers on deforestation and in forest area. The coefficients are smaller when we drop the areas with more deforestation (Figure A.5a) as expected because the mean will be also reduced. Table A.8 shows the results excluding the second-term mandates.

5.2 Other outcomes

We now study what happens in economic variables and other environmental measures when a young mayor is elected. Table 4 changes the dependent variable, to study the effect of electing a young mayor on the municiaplity gross domestic product. Column 1 Panel A shows a positive coefficient; however, the coefficient is not statistically significant. When we disaggregate the GDP measure by economic sector, we find a reduction in the agricultural sector when electing a young mayor measured as per capita and percentage of the total GDP of the municipality. In the case of senior mayors (Panel B), we find a positive effect on GDP per capita based, driven by an increment in the agricultural sector in per capita terms but without a significant increase in the weight of the agricultural sector as percentage of GDP. Columns 6 and 7 of Panel B show the increase in the agricultural sector for senior mayors (column 2) is reflected in an increase in agricultural planting area and livestock, measured as the number of bovines. Table A.10 presents results the analogous table, selecting the optimal bandwidth for each regression. The conclusions are similar.

Table 4: Young mayors do not affect per capita GDP

Dependent variable:	GDP per cap.			% GDP		Agro	
	Total	Agro	Industry	Agro	Industry	Planting Area (Ha)	N Bovine
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A	Margin: Young vs Not young						
Young won	225.24	-2579.01*	2145.15**	-7.34***	3.49*	-352.19	-49.12
	(3015.08)	(1409.98)	(1049.78)	(2.14)	(1.83)	(237.66)	(37.02)
Mean Dep. Var. Control	14,000.87	4,088.18	1,446.81	26.80	9.37	947.51	139.90
Bandwidth	11.23	11.23	11.23	11.23	11.23	11.23	11.23
N	724	724	724	724	724	724	724
Panel B	Margin: Senior vs Not senior						
Senior won	4946.53**	1143.63*	1283.69	0.38	0.54	748.55***	97.81***
	(2282.64)	(668.76)	(1526.12)	(1.35)	(1.28)	(224.08)	(21.36)
Mean Dep. Var. Control	13,394.89	3,335.92	2,266.46	25.36	9.97	944.37	107.46
Bandwidth	11.47	11.47	11.47	11.47	11.47	11.47	11.47
N	1762	1762	1762	1762	1762	1758	1762

Notes: This table presents the effect of having a young or senior mayor on economic outcomes restricted to municipalities of the main specification sample (Column 2 of Table 2). Coefficients are estimated using Equation (1) but changing the dependent variable. Columns 1 to 3 dependent variables are computed by dividing the nominal GDP or the value added by each sector by the population in 2004. The dependent variable of columns 4 and 5 is calculated by dividing the added value of the agro and Industry sectors respectively by the total nominal GDP of each year. Columns 6 and 7 are computed using data from Municipal Agricultural Research (Pesquisa Agrícola Municipal). Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost an senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table 5 studies what happens to the greenhouse gas emissions intensity of GDP and environmental fines when electing a young mayor. Column 1 shows a large reduction in the emissions intensity of aggregate GDP. Part of this reduction is caused by a reduction in emissions associated with the agricultural sector. These results complement those presented in the GDP table. There is no effect on Transport and Energy sectors. The results for young mayors are aligned with the results in Panel B for senior mayors. Panel B shows a statistically significant increase in emissions intensity of the agricultural sector and energy sector when a senior mayor is in office. Still, there is no significant effect on the total emissions despite the positive sign of the coefficient. Column 5 shows the number of fines that could be interpreted as a mechanism of punishment and a potential mechanism of

deforestation reduction. However, results show a negative coefficient, although no statistically significant in Panel A, and an increment in the number of fines when senior mayors are in office. Table A.11 presents the results disaggregating by type of environmental fine. Table A.9 presents results with the optimal bandwidth for each specification.

Table 5: Effect of electing young mayor on emissions and fines

Dependent variable:	**GDP emission intensity (kgCO2/R$)**				**N**
	Total	**Agro**	**Transport**	**Energy**	**Fines**
	(1)	(2)	(3)	(4)	(5)
Panel A:	Margin: Young vs Not young				
Young won	-8.35***	-1.22***	-0.01	0.00	-8.29
	(1.98)	(0.32)	(0.00)	(0.01)	(5.98)
Mean Dep. Variable Control	5.57	1.98	0.04	0.09	11.03
Bandwidth	11.23	11.23	11.23	11.23	11.23
N	680	680	680	680	724
Panel B:	Margin: Senior vs Not senior				
Senior won	4.03	0.33*	0.00	0.04**	6.10**
	(2.53)	(0.19)	(0.00)	(0.02)	(2.42)
Mean Dep. Variable Control	2.89	1.81	0.04	0.10	12.87
Bandwidth	11.47	11.47	11.47	11.47	11.47
N	1644	1644	1644	1644	1762

Notes: Effect of having a young or senior mayor on emissions intensity and environmental fines restricted to the main specification sample (column 2 of Table 2). Coefficients are estimated using Equation (1) but changing the dependent variable. All columns are computed by dividing the CO2 emissions in kg by the GDP of each year. All emissions data are provided by Sistema de Estimativa de Emissões e Remoções de Gases de Efeito Estufa, Observatório do ClimaSEEG (n.d.). Data are available until 2018. Column 1 uses the total emissions, while columns 2 and 4 use the Agro and Energy levels. Column 3 uses Transport emissions, which is a sub-level of Energy. Column 5 uses the number of fines provided by IBAMA. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost an senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.12 studies the effect of electing a young mayor on agricultural sector variables. Column 1 shows a reduction in the production value in Panel A and Panel B, but the effect is not statistically significant when we analyze the performance of the senior mayor. Also, we see no significant effects on productivity (column 2). Regarding the livestock sector,

we find a reduction in the number of cows in municipalities with a young mayor and an increase in municipalities with an senior mayor. The results are not statistically significant in column 3 as they were in column 7 of Table 4 because there are few observations, given that the Census does not happen yearly. Nonetheless, the sign is consistent in the two columns.

5.3 Mechanisms

Table 6 studies whether municipal expenditures are a driver of the environmental performance of young mayors. Column 1 of Panel A shows that young mayors do not affect the share of the budget allocated to the environmental sector, while senior mayors (Panel B) reduce it by 0.39 percentage points. This reduction is 100% of the mean. There is evidence of more investment by young mayors in long-term policy, such as education and capital investments. There is a reduction in health expenditures of almost 10% in when electing a young mayor and an increase in the budget allocated in the agro sector. However, the weight of this sector in the total budget is less than 1%.

Table A.13 presents results restricted to the optimal bandwidth of the main regression. Table A.14 presents the results using the expenditure per capita instead of the percentage. We can see an increment in all the budget items when a young mayor and a decrease in environment and education when a senior is in the mayor's office. This increment in all items could be the cause of not having found an effect on the environmental item when we studied items as a share of the total budget. Table A.15 and Table A.16 present the results using the share measured in terms of value and the number matching grants by item as dependent variable respectively. In these results, we can see how the senior mayors reduced the weight of matching grants dedicated to environmental issues by 100 % reducing its value but not their number.

Table 6: Effect on municipal expenditure

Dependent variable:	% Municipal Expenditure on				
	Environment	Education	Health	Agro	Capital
	(1)	(2)	(3)	(4)	(5)
Panel A:	Margin: Young vs Not young				
Young won	-0.01	2.58**	-1.02*	0.34**	1.79*
	(0.18)	(1.29)	(0.54)	(0.16)	(1.09)
Mean Dep. Variable Control	0.35	19.40	10.67	0.60	8.55
Bandwidth	11.23	11.23	11.23	11.23	11.23
N	324	324	324	324	324
Panel B:	Margin: Senior vs Not senior				
Senior won	-0.39***	-2.28***	0.58	0.22**	0.12
	(0.11)	(0.78)	(0.41)	(0.09)	(0.69)
Mean Dep. Variable Control	0.36	19.61	11.17	0.53	7.93
Bandwidth	11.47	11.47	11.47	11.47	11.47
N	777	777	777	777	777

Notes: This table shows the effect of having a young or senior mayor on municipal expenditure using a sample restricted to the same as the main specification (column 2 of Table 2). Coefficients are estimated using Equation (1) but changing the dependent variable. All columns use settled expenses by the municipality from the SICONFI database. Data are only available from 2013. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

6 Conclusion

In this paper, we study how politicians of different age groups affect environmental conservation and investment in various long-term policies. We find evidence that electing young mayors in Brazil causes a reduction in deforestation, GDP emissions intensity, and agricultural planted area. We find roughly opposite effects when electing a senior mayor. We also find an increase in the share of the budget allocated for education and capital investment when electing a young mayor. These results support that young mayors' longer time horizon affects their policy decisions.

Our preliminary work highlights the importance of political renovation for environmental conservation. With climate change mainly affecting young generations, these results provide motivation for affirmative action based on age for elected bodies. Our work also leaves various paths of research open. For example, whether voters incorporate the candidates' age tradeoffs in voting decisions; or whether the Brazil result generalizes to other contexts where emissions are not driven mainly by deforestation but by energy and industrial production.

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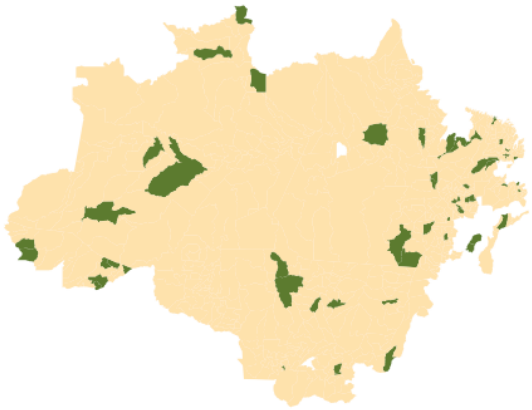
A Appendix

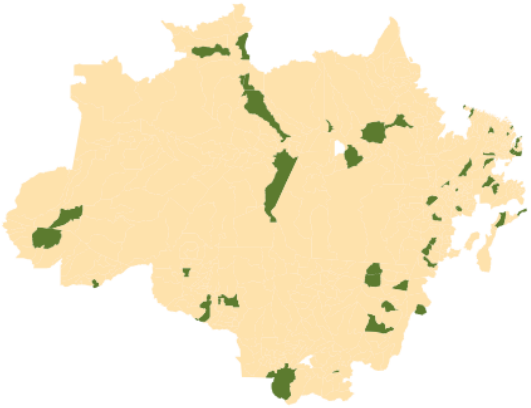
Figure A.1: Municipalities sample by election year

(a) Sample in 2004 elections

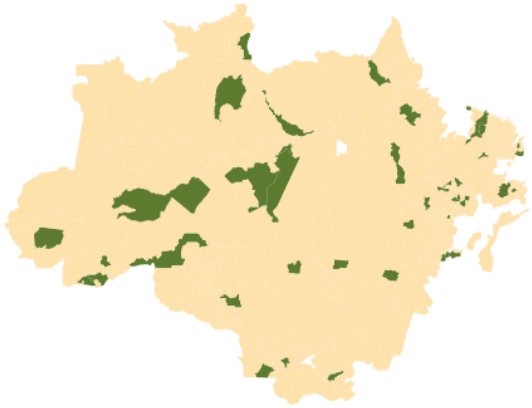
(b) Sample in 2008 elections



(c) Sample in 2012 elections

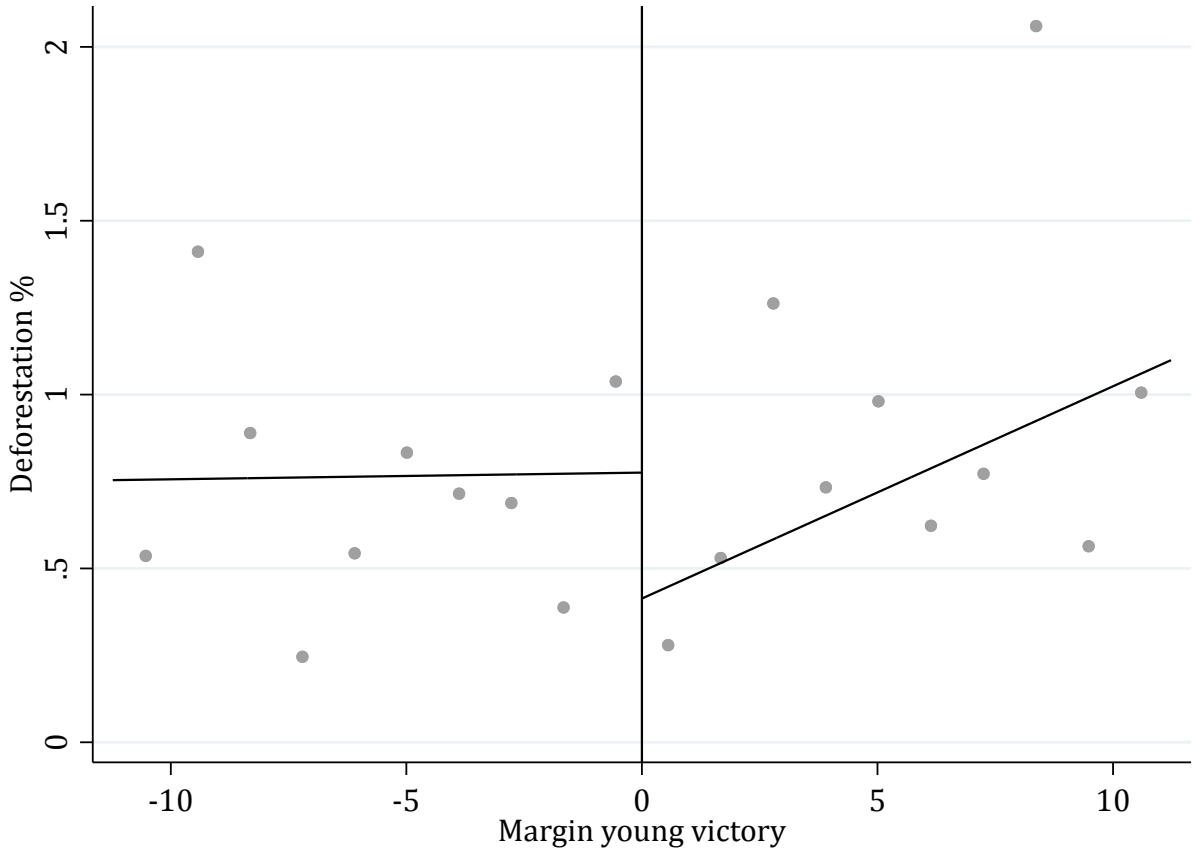


(d) Sample in 2016 elections



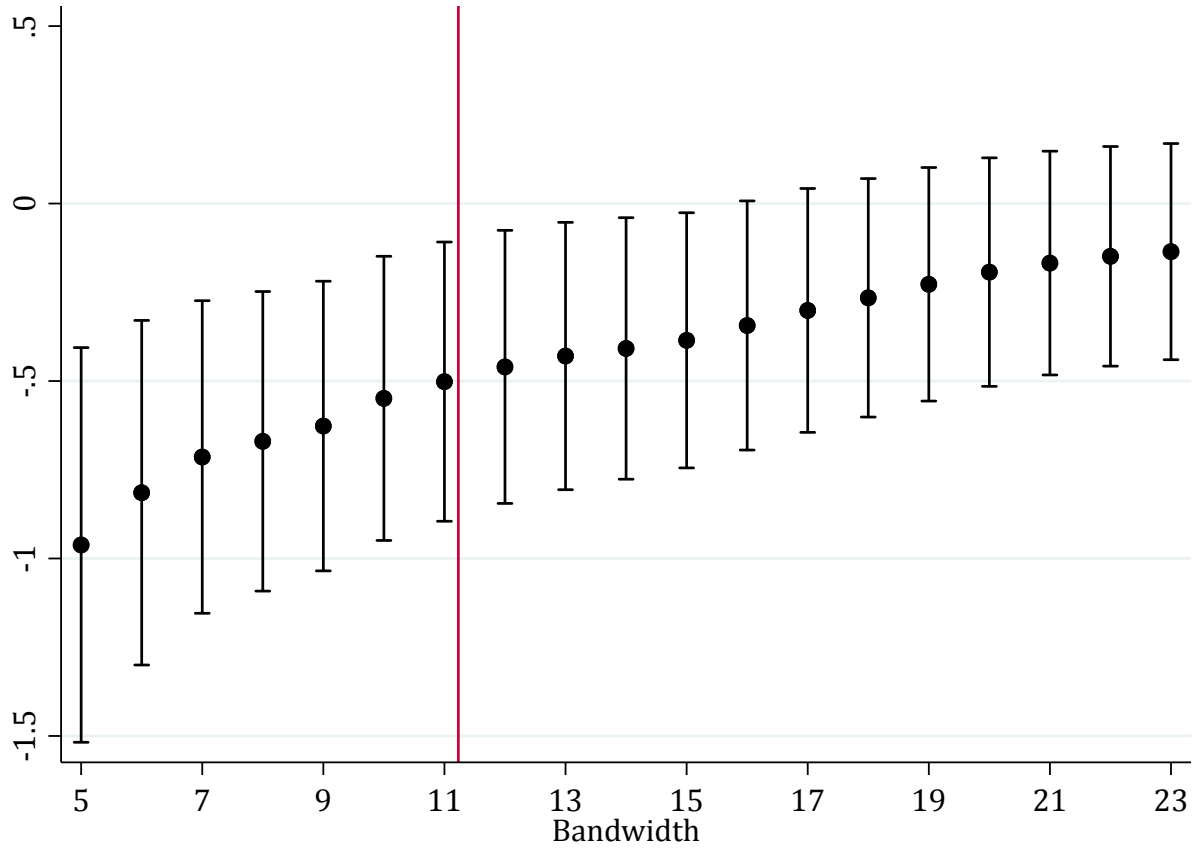
Notes: This figure represents the distribution of municipalities belonging to the sample of the main regression.

Figure A.2: Visual Regression Discontinuity Design



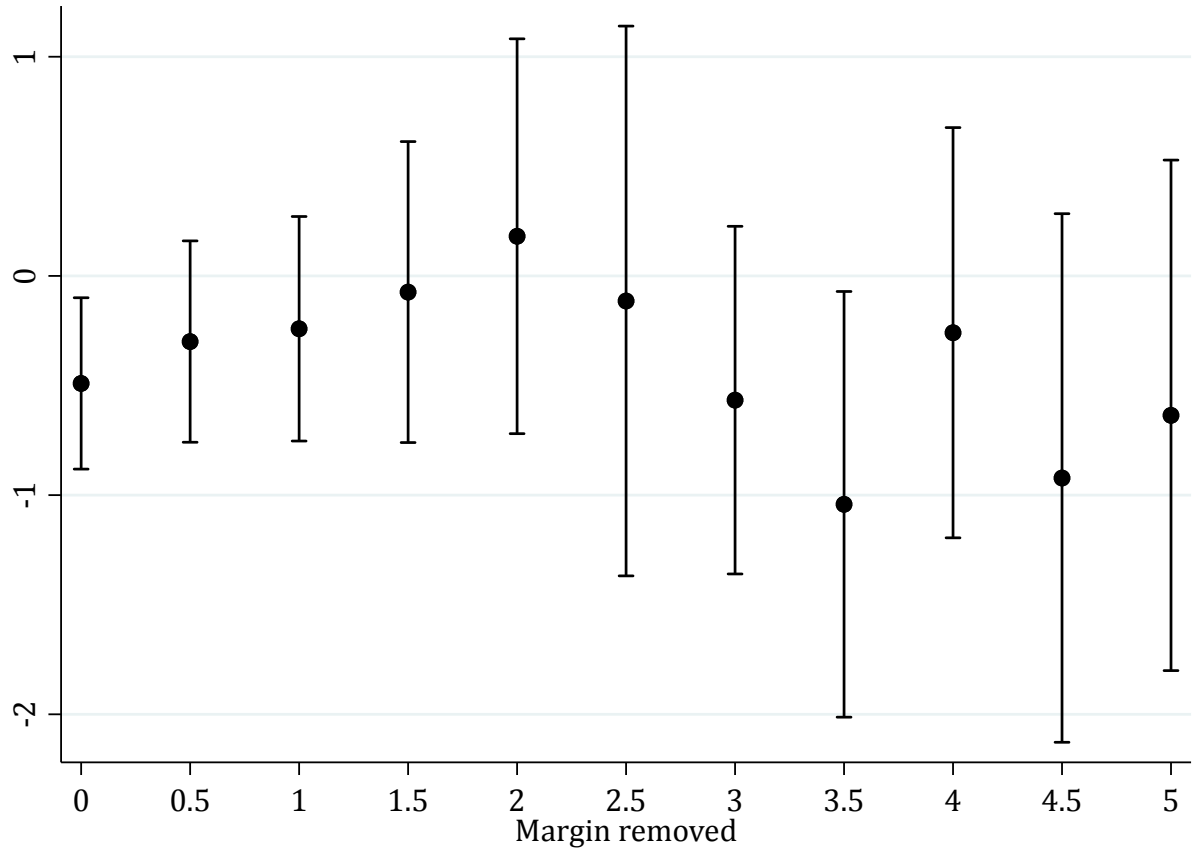
Notes: Regression Discontinuity plot of the main specification (column 2 of Panel A in Table 2). Observations are grouped in 10 bins at each side of the winning cutoff. The regression controls for population, gender, left/right leaning of the mayor's party, second-term, married status, and it also includes year fixed-effects.

Figure A.3: Sensitivity analysis to bandwidth



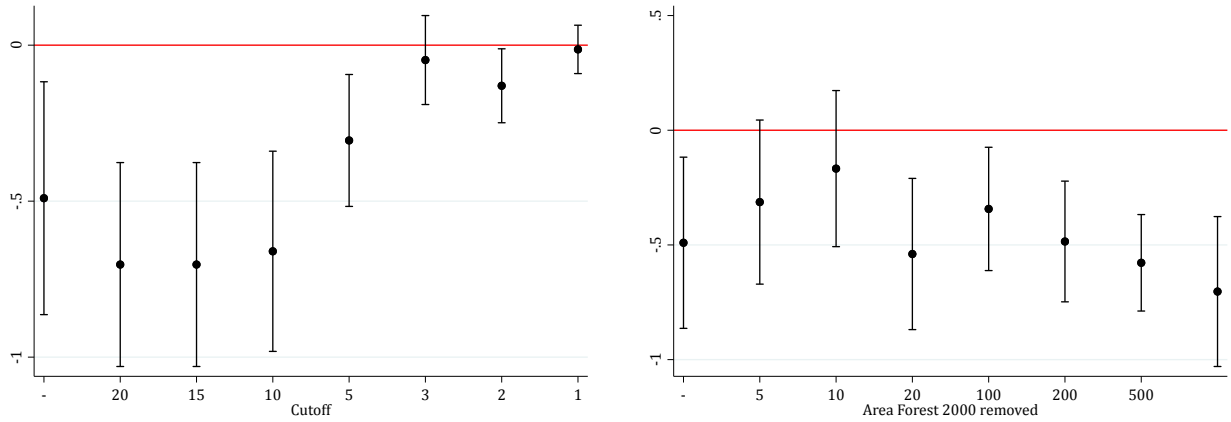
Notes: Sensitivity analysis of the main specification (column 2 of Panel A in Table 2) varying the bandwidth between half and twice the optimal bandwidth. The red line represents the optimal bandwidth. Regressions were estimated using Equation Equation 1. They have year fixed-effects and control by population, gender, left or right-wing of the mayor's party, second-term, and married status. 95% confidence intervals are shown.

Figure A.4: Sensitivity analysis observations close to the cutoff



Notes: Sensitivity analysis of the main regression (column 2 of Panel A in Table 2) dropping observations close to the margin of victory cutoff, leaving a "doughnuts hole". All regressions are estimated using Equation Equation 1. They have year fixed-effects and control by population, gender, left or right-wing of the mayor's party, second-term, and married status. 95% confidence intervals are shown.

Figure A.5: Sensitivity analysis to outliers



(a) Excluding deforestation outliers

(b) Excluding forest area outliers

Notes: Results for the main regression (column 2 of Panel A in Table 2) excluding outliers. Deforestation outliers (Figure A.5a) are those with a deforestation rate above the cutoff indicated. For forest area outliers (Figure A.5b) are municipalities with forest area below the cutoff indicated.

Table A.1: Sample distribution

Year:	Young vs Not young	Young vs Senior	Senior vs Not senior
	(1)	(2)	(3)
2005	42	10	132
2006	42	10	132
2007	42	10	132
2008	42	10	132
2009	54	14	105
2010	54	14	105
2011	54	14	105
2012	54	14	105
2013	52	14	115
2014	52	14	115
2015	52	14	115
2016	52	14	115
2017	44	7	118
2018	44	7	118
2019	44	7	118
Total	724	173	1762

Notes: Number of municipalities by year used in column 2 of Table 2. Column 1 corresponds to Panel A sample, columns 2 and 3 refers to Panel B and C respectively.

Table A.2: Summary statistics

Variable	Mean	Std Dev	Min	Max	N
	(1)	(2)	(3)	(4)	(5)
Panel A: Municipality year					
Deforestation as % forest 2000	0.81	1.69	0.00	22.18	724
Forest area in 2000 (km2)	4511.46	10,675.65	0.20	87,030.90	724
Year	2012.09	4.15	2,005.00	2,019.00	724
Population (thousands)	28.41	86.16	2.07	1,082.94	724
Panel B: Municipality term					
Margin young vs everyone	-0.15	6.24	-11.09	11.16	192
Margin young vs senior	-0.54	5.22	-8.79	8.55	45
Margin senior vs everyone	0.12	6.31	-11.29	11.43	470
Male	0.88	0.33	0.00	1.00	192
Right	0.73	0.45	0.00	1.00	192
Married	0.64	0.48	0.00	1.00	192
Panel C: Other variables					
% Environmental expenditure	0.36	0.64	0.00	4.42	480
% Education expenditure	19.78	5.78	0.00	34.84	353
% Health expenditure	10.74	2.61	0.00	16.52	252
% Agro expenditure	0.63	0.68	0.00	3.54	331
GDP (R$ Current prices) per cap.	14605.91	16,547.88	1,440.19	180,941.36	878
Agro as % GDP	26.40	15.46	0.09	72.73	925

Notes: Summary statistics (mean, standard deviation, minimum, maximum, and number of observations) of variables we use. Panel A contains information with variation across the municipality-year: deforestation from PRODES. Panel B provides information about the candidates and elections of the sample, so there is one observation per municipality for four years. Panel C shows other variables with data by municipality-year; nonetheless, the sample is restricted due to data availability. Exchange rate: 1R$ $\sim$ 0.2 USD$. The Energy Emissions intensity from Brazil was 0.5 for 1 (kgCO2/R$) in the United States in 2019.

Table A.3: Robustness to treatment definition

Dependent variable:	Deforestation as % forest 2000					
	p30	p25	p20	p15	p10	LEI No 11.692
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:	Margin: Young vs Not young					
Young won	-0.04	-0.22	-0.49***	-0.77***	-0.28	0.35
	(0.15)	(0.15)	(0.19)	(0.28)	(0.41)	(0.50)
Mean Dep. Variable Control	0.84	0.70	0.74	0.86	0.94	0.99
Optimal band	13.38	14.80	11.23	10.90	10.65	10.38
N	1454	1270	724	463	228	173
Panel B:	Margin: Senior vs Not senior					
Senior won	-0.08	-0.01	0.11	0.34*	0.37*	0.85***
	(0.12)	(0.13)	(0.15)	(0.17)	(0.19)	(0.31)
Mean Dep. Variable Control	0.75	0.77	0.79	0.71	0.77	0.61
Optimal band	13.89	12.80	11.47	7.66	6.89	8.19
N	2401	2104	1762	986	661	264

Notes: This table presents the results when we vary the definition of young and senior to other percentiles. Coefficients are estimated by using Equation (1). Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions have year fixed-effects and control by population, gender, second-term, right-wing, and married. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.4: Robustness to the error estimation

Dependent variable:	Deforestation as % forest 2000			
	(1)	(2)	(3)	(4)
Panel A:	Margin: Young vs Not young			
Young won	-0.43**	-0.49**	-0.47**	-0.49**
HC0	(0.20)	(0.19)	(0.20)	(0.19)
HC1	(0.20)	(0.19)	(0.20)	(0.19)
HC2	(0.20)	(0.19)	(0.20)	(0.19)
HC3	(0.20)	(0.19)	(0.20)	(0.19)
Mean Dep. Variable Control	0.72	0.74	0.74	0.74
Major Controls	No	Yes	No	Yes
Bandwidth	12.53	11.29	11.23	11.23
N	779	724	724	724
Panel B:	Margin: Senior vs Not senior			
Senior won	0.07	0.11	0.09	0.11
HC0	(0.14)	(0.15)	(0.15)	(0.15)
HC1	(0.14)	(0.15)	(0.15)	(0.15)
HC2	(0.14)	(0.15)	(0.15)	(0.15)
HC3	(0.14)	(0.15)	(0.15)	(0.15)
Mean Dep. Variable Control	0.79	0.79	0.79	0.79
Major Controls	No	Yes	No	Yes
Bandwidth	12.22	11.54	11.47	11.47
N	1868	1766	1786	1762

Notes: This table presents the estimation result varying the kind of error correction used. Optimal bandwidths differ slightly from the main regressions due to different biases and weighting. Columns 1 and 2 are computed considering the optimal bandwidth. Columns 3 and 4 are restricted to the optimal bandwidth of column 2 in Table 2. Columns 2 and 4 control by gender, left or right-wing of the mayor's party, second-term, and married status. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions have year fixed-effects and control by population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.5: Robustness to the order of the polynomial

Dependent variable:	Deforestation as % forest 2000			
	(1)	(2)	(3)	(4)
Panel A:	Margin: Young vs Not young			
Young won	-0.69***	-0.71***	-0.88***	-0.86***
	(0.23)	(0.22)	(0.26)	(0.24)
Mean Dep. Variable Control	0.69	0.71	0.74	0.74
Major Controls	No	Yes	No	Yes
Bandwidth	14.90	13.70	11.23	11.23
N	884	830	724	724
Panel B:	Margin: Senior vs Not senior			
Senior won	0.26	0.32	0.38*	0.45**
	(0.19)	(0.20)	(0.22)	(0.23)
Mean Dep. Variable Control	0.79	0.78	0.79	0.79
Major Controls	No	Yes	No	Yes
Bandwidth	15.64	14.21	11.47	11.47
N	2210	2076	1786	1762

Notes: This table presents results using a second-order polynomial. Columns 1 and 2 are computed considering the optimal bandwidth using the second-order polynomial. Columns 3 and 4 are restricted to the optimal bandwidth of the main specification of Table 2 (column 2). Columns 2 and 4 control by gender, left or right-wing of the mayor's party, second-term, and married status. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions include year fixed-effects and control by population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.6: Kernel robustness

Dependent variable:	Deforestation as % forest 2000			
	(1)	(2)	(3)	(4)
Panel A:	Margin: Young vs Not young			
Young won	-0.44**	-0.34*	-0.38*	-0.36*
	(0.22)	(0.18)	(0.21)	(0.20)
Mean Dep. Variable Control	0.74	0.70	0.74	0.74
Major Controls	No	Yes	No	Yes
Bandwidth	10.71	13.04	11.23	11.23
N	694	812	724	724
Panel B:	Margin: Senior vs Not senior			
Senior won	-0.01	0.01	-0.00	0.01
	(0.14)	(0.14)	(0.14)	(0.14)
Mean Dep. Variable Control	0.79	0.79	0.79	0.79
Major Controls	No	Yes	No	Yes
Bandwidth	11.65	11.52	11.47	11.47
N	1802	1766	1786	1762

Notes: This table presents results of Table 2 using uniform kernel. Columns 1 and 2 are computed considering the optimal bandwidth using the uniform kernel. Columns 3 and 4 are restricted to the optimal bandwidth of the main specification of Table 2 (column 2). Columns 2 and 4 control by gender, left or right-wing of the mayor's party, second-term, and married status. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions include year fixed-effects and control by population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.7: Placebo results

Dependent variable:	Deforestation as % forest 2000			
	(1)	(2)	(3)	(4)
Panel A:	Margin: Young vs Not young			
Young won	-1.74	-1.49	-1.86	-1.63
	(1.13)	(1.09)	(1.15)	(1.14)
Mean Dep. Variable Control	1.34	1.39	1.34	1.39
Major Controls	No	Yes	No	Yes
Bandwidth	11.90	12.71	11.23	11.23
N	183	191	183	179
Panel B: Margin	Margin: Senior vs Not senior			
Senior won	-0.53	-0.50	-0.50	-0.46
	(0.68)	(0.70)	(0.84)	(0.87)
Mean Dep. Variable Control	1.18	1.18	1.26	1.26
Major Controls	No	Yes	No	Yes
Bandwidth	17.59	17.45	11.47	11.47
N	1168	1145	870	855

Notes: This table presents the placebo analysis. Coefficients are estimated using Equation Equation 1, but the treatment is assigned considering the results of the next elections. Columns 1 and 2 are computed considering the optimal bandwidth. Columns 3 and 4 are restricted to the optimal bandwidth of the main regression (column 2 of Table 2). Columns 2 and 4 control by gender, left or right-wing of the mayor's party, second-term, and married status. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions have year fixed-effects and control by population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.8: Results without second term

Dependent variable:	Deforestation as % forest 2000			
	(1)	(2)	(3)	(4)
Panel A:	Margin: Young vs Not young			
Young won	-0.51**	-0.64***	-0.53**	-0.59***
	(0.22)	(0.21)	(0.22)	(0.21)
Mean Dep. Variable Control	0.65	0.66	0.66	0.66
Age Diff.	17.58	17.71	17.62	17.62
Bandwidth	12.13	9.87	11.40	11.40
N	659	564	636	636
Panel B:	Margin: Senior vs Not senior			
Senior won	0.12	0.22	0.13	0.20
	(0.17)	(0.17)	(0.17)	(0.17)
Mean Dep. Variable Control	0.77	0.77	0.77	0.77
Age Diff.	17.03	17.09	17.10	17.10
Bandwidth	11.62	11.04	11.40	11.40
N	1390	1332	1378	1358

Notes: This table presents the effect of having a young or senior mayor on deforestation excluding the second-term mandates. Coefficients are estimated by using Equation (1). Columns 1 and 2 use the optimal bandwidth of each regression. Columns 3 and 4 are restricted to the optimal bandwidth of column 2 in Panel A of Table 2. Columns 2 and 4 control by gender, left or right-wing of the mayor's party, second-term, and married status. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions include year fixed-effects and control by population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.9: Results on CO2 emissions with optimal bandwidth

Dependent variable:	**GDP emission intensity (kgCO2/R$)**				**N**
	Total	**Agro**	**Transport**	**Energy**	**Fines**
	(1)	(2)	(3)	(4)	(5)
Panel A:	Margin: Young vs Not young				
Young won	-9.85***	-1.31***	-0.00	0.01	-7.23
	(2.43)	(0.33)	(0.01)	(0.01)	(4.45)
Mean Dep. Variable Control	6.02	1.96	0.04	0.09	9.91
Optimal band	8.63	10.52	8.28	14.78	20.06
N	538	648	516	818 1081	
Panel C:	Margin: Senior vs Not senior				
Senior won	0.25	0.72***	0.01**	0.05**	7.21***
	(2.37)	(0.22)	(0.00)	(0.02)	(2.55)
Mean Dep. Variable Control	3.81	1.58	0.04	0.09	13.19
Optimal band	18.83	6.49	7.29	8.18	10.22
N	2280	990	1096	1254 1605	

Notes: This table displays the effect of having a young or senior mayor on emissions. Coefficients are estimated using Equation (1) but changing the dependent variable. All columns are computed by dividing the CO2 emissions in kg by the PIB of each year. All emissions data are provided by Sistema de Estimativa de Emissões e Remoções de Gases de Efeito Estufa, Observatório do ClimaSEEG (n.d.). Data are available until 2018. Column 1 uses the total emissions, while columns 2 and 4 use the Agro and Energy levels. Column 3 uses Transport emissions, which is a sub-level of Energy. Column 5 uses the number of fines provided by IBAMA. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.10: Results on GDP outcomes using optimal bandwidth

Dependent variable:	GDP per cap.			% GDP		Agro	
	Total	**Agro**	**Industry**	**Agro**	**Industry**	**Planting Area (Ha)**	**N Bovine**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A:	Margin: Young vs Not young						
Young won	764.59	-1650.80	2003.66**	-6.11***	3.44**	-362.77	-65.14**
	(2684.29)	(1119.78)	(963.81)	(1.83)	(1.73)	(237.64)	(26.65)
Mean Dep. Var. Control	15,662.84	4,663.20	1,515.58	27.34	9.47	949.26	127.58
Optimal band	14.60	19.98	12.96	15.91	13.08	12.22	18.85
N	878	1078	801	925	812	754	1025
Panel C:	Margin: Senior vs Not senior						
Senior won	4556.74**	929.11	1813.05	0.52	-0.06	660.19***	131.57***
	(2217.50)	(724.23)	(1609.35)	(1.22)	(1.17)	(217.11)	(24.41)
Mean Dep. Var. Control	13,092.13	3,305.46	2,431.52	25.64	9.42	830.78	114.68
Optimal band	12.49	9.46	9.80	14.27	14.43	10.52	7.75
N	1890	1521	1570	2084	2099	1652	1274

Notes: This table presents the effect of having a young or senior mayor on economic outcomes. Coefficients are estimated using Equation (1) but changing the dependent variable. Columns 1 to 3 dependent variables are computed by dividing the nominal GDP or the value added by each sector by the population in 2004. The dependent variable of columns 4 and 5 is calculated by dividing the added value of the Agro and Industry sectors respectively by the total nominal GDP of each year. Columns 6 and 7 are computed using data from Municipal Agricultural Research (Pesquisa Agrícola Municipal). Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.11: Effect on fines

Dependent variable:	**Fines for crime in**			**Fines divided by previous defo**			
	Non flora	Flora	Deforestation	Total	Non flora	Flora	Deforestation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Margin	**Young vs not young**						
Young won	-2.19*	-6.11	-4.05	-4.41**	-1.15	-3.26*	-2.14
	(1.12)	(5.04)	(2.71)	(2.02)	(0.83)	(1.77)	(1.45)
Mean Dep. Variable Control	2.55	8.48	4.78	3.10	1.18	1.93	1.72
Bandwidth	11.23	11.23	11.23	11.23	11.23	11.23	11.23
N	724	724	724	614	614	614	614
Margin	**Senior vs Not senior**						
Senior won	1.71**	4.39**	1.02	0.90	-0.28	1.17	-0.17
	(0.69)	(2.01)	(1.10)	(1.37)	(0.73)	(0.93)	(0.61)
Mean Dep. Variable Control	3.60	9.27	4.83	4.02	1.88	2.14	1.38
Bandwidth	11.47	11.47	11.47	11.47	11.47	11.47	11.47
N	1762	1762	1762	1463	1463	1463	1463

Notes: This table displays the effect of having a young or senior mayor on fines restricted to the main specification. These data are provided by IBAMA. Columns 1 to 2 present the number of fines disaggregated by crimes against flora and the rest. Column 3 shows results for fines imposed by deforestation crimes. Columns 4 to 7 present results by dividing the number of fines by deforestation in the previous year measured in hectares. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.12: Effect on agricultural variables

Dependent variable:	Agriculture		Livestock
	Production Value (R$)	Productivity (R$ per Ha.)	N Bovine (Census)
	(1)	(2)	(3)
Panel A:	Margin: Young vs Not young		
Young won	-4387.59**	-0.63	-55.50
	(2089.48)	(0.76)	(41.94)
Mean Dep. Variable Control	5726.63	7.07	73.98
Bandwidth	11.23	11.23	11.23
N	724	677	86
Panel B:	Margin: Senior vs Not senior		
Senior won	-314.76	-0.19	5.06
	(2721.60)	(0.57)	(18.69)
Mean Dep. Variable Control	8756.45	6.91	41.48
Bandwidth	11.47	11.47	11.47
N	1758	1618	250

Notes: This table shows the effect of having a young or senior mayor on Agro variables using the sample restricted to main specification. Coefficients are estimated using Equation (1) but changing the dependent variable. Columns 1 is computed using data from Municipal Agricultural Research (Pesquisa Agrícola Municipal). Column 2 is computed by dividing column 6 of Table 4 by column 1 of this table. Column 3 uses Agricultural Census (Censo Agropecuário). Census data is provided every ten years, so we only can use 2006 and 2017 data. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between the two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.13: Effect on municipal expenditure

Dependent variable:	% Municipal Expenditure on				
	Environment	Education	Health	Agro	Capital
	(1)	(2)	(3)	(4)	(5)
Panel A:	Margin: Young vs Not young				
Young won	0.02	2.11*	-0.61	0.28*	1.98*
	(0.13)	(1.19)	(0.61)	(0.15)	(1.13)
Mean Dep. Variable Control	0.38	19.70	10.77	0.60	8.65
Optimal band	18.80	12.64	8.26	11.84	10.69
N	480	353	252	331	302
Panel C:	Margin: Senior vs Not senior				
Senior won	-0.39***	-1.32*	0.32	0.18**	0.05
	(0.11)	(0.71)	(0.34)	(0.09)	(0.68)
Mean Dep. Variable Control	0.40	19.69	11.05	0.52	7.94
Optimal band	10.11	15.06	17.70	13.51	12.02
N	701	930	1012	863	802

Notes: This table shows the effect of having a young or senior mayor on municipal expenditure. Coefficients are estimated using Equation (1) but changing the dependent variable. All columns use settled expenses by the municipality from the SICONFI database. Data are only available from 2013. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.14: Effect on municipal expenditure (per capita)

Dependent variable:	**Municipal Expenditure per capita on**					
	Total	Environment	Education	Health	Agro	Capital
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:	Margin: Young vs Not young					
Young won	3918.10***	45.93**	689.28***	344.29***	71.60***	172.61**
	(968.08)	(21.96)	(121.15)	(113.02)	(21.67)	(69.30)
Mean Dep. Variable Control	5458.30	23.47	1028.56	589.94	41.12	236.49
Bandwidth	14.47	14.47	14.47	14.47	14.47	14.47
N	410	410	410	410	410	410
Panel C:	Margin: Senior vs Not senior					
Senior won	-496.59	-24.30***	-144.35**	-12.79	2.45	-39.71
	(401.09)	(5.16)	(58.80)	(54.19)	(7.85)	(33.50)
Mean Dep. Variable Control	5711.88	21.11	1062.22	643.51	34.34	238.76
Bandwidth	11.56	11.56	11.56	11.56	11.56	11.56
N	777	777	777	777	777	777

Notes: This table shows the effect of having a young or senior mayor on municipal expenditure in per capita terms using a sample restricted to the same as the main specification (column 2 of Table 2). Coefficients are estimated using Equation (1) but changing the dependent variable. All columns use settled expenses by the municipality from the SICONFI database. Data are only available from 2013. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.15: Effect on the number of matching grants

Dependent variable:	Number of matching grants in						
	Total	Agriculture	Education	Environment	Health	Infrastructure	Justice
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Margin	**Young vs not young**						
Young won	0.58	-0.02	-0.01	0.04*	0.07	0.15	0.17
	(0.39)	(0.11)	(0.08)	(0.02)	(0.11)	(0.13)	(0.17)
Mean Dep. Variable Control	2.28	0.42	0.20	0.01	0.40	0.57	0.43
Bandwidth	11.23	11.23	11.23	11.23	11.23	11.23	11.23
N	724	724	724	724	724	724	724
Margin	**Senior vs Not senior**						
Senior won	-0.66***	-0.01	-0.05	-0.01	-0.13	-0.05	-0.25***
	(0.21)	(0.06)	(0.05)	(0.01)	(0.08)	(0.08)	(0.09)
Mean Dep. Variable Control	2.21	0.35	0.23	0.01	0.42	0.52	0.38
Bandwidth	11.47	11.47	11.47	11.47	11.47	11.47	11.47
N	1762	1762	1762	1762	1762	1762	1762

Notes: This table presents the effect of having a young or senior mayor in the number matching grants by item with the sample restricted to the main specification sample. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table A.16: Effect on matching grants as share

Dependent variable:	**Matching grants as % of total in**					
	Agriculture	Education	Environment	Health	Infrastructure	Justice
	(1)	(2)	(3)	(4)	(5)	(6)
Margin	**Young vs not young**					
Young won	-6.36	2.04	0.27	-9.05*	15.81**	0.31
	(5.21)	(5.48)	(0.19)	(5.40)	(7.10)	(5.21)
Mean Dep. Variable Control	15.64	9.89	0.50	16.38	27.18	15.55
Bandwidth	11.23	11.23	11.23	11.23	11.23	11.23
N	484	484	484	484	484	484
Margin	**Senior vs Not senior**					
Senior won	4.31	-3.05	-0.99**	3.14	0.72	-5.72**
	(3.52)	(3.43)	(0.46)	(4.03)	(4.69)	(2.68)
Mean Dep. Variable Control	17.86	11.75	0.53	16.40	26.58	9.75
Bandwidth	11.47	11.47	11.47	11.47	11.47	11.47
N	1121	1121	1121	1121	1121	1121

Notes: This table presents the effect of having a young or senior mayor in allocating matching grants by item as percentage of the total value with the sample restricted to the main specification sample. Panel A takes as sample all municipalities with at least one young candidate among the two first candidates. In Panel B, the sample contains all elections in which almost a senior candidate was between two first candidates. All regressions have year fixed-effects and control by mayor gender, left or right-wing of the mayor's party, second-term, married status, and population. Optimal bandwidth is computed for each specification. Significance level: *$p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.