Gender, Electoral Incentives, and Crisis Response: Evidence from Brazilian Mayors*

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Abstract

While there is evidence of gender differences in policy preferences and electoral strategic behaviors, less is known about how these differences play out during crises. We use a close election RD design to compare the performance of female- and male-led Brazilian municipalities during the COVID-19 pandemic. We find that having a female mayor led to more deaths per capita early in the first wave of the pandemic – a period characterized by great uncertainty about the severity of the disease and the effectiveness of containment policies. In contrast, having a female mayor led to fewer deaths per capita early in the second wave – a period where this uncertainty was reduced, and when the 2020 mayoral election took place. Consistent with the evolution of deaths, we find that female mayors were less likely to implement commerce restrictions at the beginning of the period, while they became more likely to do so at the end. We also show that the second-wave effect coincides with a lower tendency of the population in male-led municipalities to stay at home around election day. Both the first and second wave effects are driven by municipalities whose mayors were not term limited, and thus allowed to run for re-election. These findings suggest that the gender differences we observe stem from female and male mayors reacting differently to electoral incentives. While electorally motivated female mayors were more likely to delay restrictive policies at the beginning, electorally motivated male mayors were more likely to open-up the municipality closer to the election.

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1 Introduction

A large literature documents gender differences in the behavior of elected officials. Compared to male politicians, female politicians have been shown to invest more in certain public goods such as health and education (Chattopadhyay and Duflo, 2004; Clots-Figueras, 2012; Bhalotra et al., 2014; Funk and Philips, 2019), and to be less likely to engage in corruption and strategic electoral behaviors (Brollo and Troiano, 2016).[1] However, there is still little evidence on how these differences play out during crises, when high-stake decisions need to be made hastily and under uncertainty.

This paper studies gender differences in leaders' response to the COVID-19 pandemic, a crisis that posed extraordinary challenges to policymakers all over the world. Focusing on Brazil – the country with the second-highest COVID-19 death toll in 2020 (Roser et al., 2021) – we investigate whether female and male mayors handled the crisis differently, and how it ultimately affected the number of COVID-19 deaths in their municipalities.

This setting offers several advantages. First, Brazilian municipalities are federal entities, which implies that mayors can independently choose over which containment policies to adopt, contrary to many countries where these decisions are taken at the national or regional level. Second, the large number of Brazilian municipalities allows us to use a close election design to assess the causal impact of female leadership. Third, we gathered panel data at the municipal level on the number of COVID-19 deaths, the policies that were implemented, and the share of residents staying at home. We can thus explore the role of containment policies and isolation in explaining the differences in COVID-19 mortality across municipalities and over time.

A key feature of our setting is that a subset of mayors faced electoral incentives during the crisis. The 2020 municipal election took place on November 15, less than nine months after the first confirmed infection in the country. In Brazil, mayors are subject to a two-term limit (Ferraz and Finan, 2011; de Janvry et al., 2012), meaning that only first-time mayors could run for re-election. By exploiting this variation, we can assess whether the gender differences we observe are driven by female and male mayors responding differently to electoral incentives.

We explore the impact of mayors' gender over the period going from February 2020 –

[1]The three first papers study female legislators in India, while the last two look at female mayors in Brazil. The evidence is less conclusive in high-income countries (Ferreira and Gyourko, 2014; Bagues and Campa, 2021).

when the first COVID-19 case was detected in the country – to the end of January 2021 – one month after the mayors elected in November took office. In order to isolate the causal impact of having a female mayor, we use a Regression Discontinuity Design (RDD) and compare municipalities where a female candidate barely won against a male candidate in the 2016 election – the last one before the COVID outbreak – to those where a male candidate barely won against a female candidate.

This strategy enables us to compare municipalities that are similar in every aspect, except in the gender of their mayor. To provide support for the identification strategy, we show that municipalities are indeed balanced on a large set of socio-demographic and political characteristics at the threshold. Moreover, we show that barely elected female and male mayors are similar in terms of incumbency status, age, education, and political orientation. This suggests that our results capture a gender effect, rather than the impact of other observable characteristics of the mayor.[2]

We first measure the impact of female leadership on the number of COVID-19 deaths in the municipality. We find that – even though the gender of the mayor did not impact the time at which municipalities experienced their first COVID-19 fatality – the number of COVID-19 deaths followed a different trajectory over time in female-led compared to male-led municipalities. At the beginning of the first wave (April-May 2020), having a female mayor led to a 0.4 increase in the number of deaths per 10,000 inhabitants, corresponding to a two-fold increase compared to male-led municipalities. This effect disappeared as the country entered the peak of the first wave, with female- and male-led municipalities experiencing a similar number of deaths from June to October 2020. We find a large female-mayor effect again at the end of the year – at the start of the second wave – but in a markedly different direction. Between November 2020 and January 2021, female-led municipalities experienced 1.0 fewer death per 10,000 inhabitants, relative to an average of 2.4 in male-led municipalities. Overall, these two contrasting effects translate into a negative but non-significant impact on the cumulative number of COVID-19 deaths as of January 31, 2021.

We next explore mayors' decisions over containment policies to understand what drives these differences. Using data collected directly from laws and decrees issued by the municipalities, we find that female and male mayors differ primarily in their use of commerce restrictions. Consistent with the evolution in the number of deaths, we show that female

[2]We also show that our results are robust to controlling for municipal-level characteristics, mayors' characteristics other than gender, and to including state fixed effects.

mayors were less likely to close commerce at the beginning of the period, while they became more likely to do so towards the end. First, commerce restrictions were in place 2.5 and 6.5 fewer days in female-led municipalities in March and April 2020, respectively, corresponding to a 78 and 61 percent decrease relative to male-led municipalities. This effect is driven by female mayors' higher likelihood to delay commerce closures, as they started implementing them 33 days later on average. In contrast, female-led municipalities became significantly more likely to close commerce in the two months leading up to the November election. Commerce restrictions were in place 7.3 and 7.5 more days in female-led municipalities in September and October 2020, respectively, corresponding to a two-fold increase relative to male-led municipalities.

Additional evidence suggests that the lower number of COVID-19 deaths in female-led municipalities during the later period is also driven by a higher propensity of residents to stay at home around election day (November 15).[3] Using daily cellphone data, we find that the share of phone users who stayed at home remained generally the same in female- and male-led municipalities throughout the period of analysis, except in the days close to the election.[4] Relative to male-led municipalities, the share of residents staying at home in female-led municipalities was 5 to 7 percent higher the week preceding and following the election. In particular, it was 11.7 percent higher on November 13, and 17.1 percent higher on November 14, the last two days before the election in which campaigning was legally allowed.

In the last part of the paper, we assess whether these gender differences are driven by electoral incentives. At the beginning of the first wave of the pandemic, there was great uncertainty about the severity of the disease and about the effectiveness of containment policies. Mayors planning to run for re-election could see the electoral risk going both ways: they could be criticized for not reacting early enough or, instead, for overreacting if they implemented policies that would prove to be too costly or ineffective by the time of the election. Female mayors planning to run for re-election may have perceived the latter risk as higher for their re-election prospects, making them more reluctant to impose

[3] When referring to election day, we refer to the day of the first round of the 2020 election. Only the largest municipalities had a second round, and they all end up excluded from our sample of analysis (see Section 3.1).

[4] The fact that the share of residents staying at home remained the same over almost all the period is consistent with female- and male-led municipalities differing primarily in their use of commerce restrictions. Commerce restrictions do not restrict mobility per se, as opposed to other measures such as curfews or lockdown. They nonetheless promote social distancing and reduce the risk of infections by preventing people from entering closed spaces.

early restrictive measures. If this is the case, our results for this period should be driven by electorally motivated female mayors.

In contrast, the period leading to the second wave is characterized by lower uncertainty. Crucially, this is also when the municipal election took place. Mayors running for re-election had an incentive to please the electorate before the election, and thus to impose lower restrictions (Pulejo and Querubín, 2021). Additionally, they could have been inclined to organize in-person events during the campaign, thus encouraging people to go out, despite the sanitary recommendations. Male mayors might have been more likely to respond to such incentives, consistent with evidence showing that they are more likely to engage in strategic behaviors during the electoral period (Brollo and Troiano, 2016). If this is the case, our results for the final quarter of 2020 should be driven by electorally motivated male mayors.

To test these hypotheses, we split our sample depending on whether the female or male mayors were term-limited or not. A non-term-limited mayor was allowed to run for re-election, and thus faced electoral incentives in 2020. Consistent with our predictions, we find that the positive impact on deaths at the beginning of the first wave is driven by municipalities where the female mayor could run for re-election, while the negative impact at the end of the period is driven by municipalities where the male mayor could run for re-election.

Overall, our results show that Brazilian female mayors handled the COVID-19 crisis differently, leading to a different evolution in the number of death over time in female-led municipalities compared to male-led municipalities. The results appear mainly driven by the fact that female and male mayors responded differently to political incentives. While electorally motivated female mayors were more reluctant to impose restrictions early on, electorally motivated male mayors were more likely to open up the municipality close to the election.

Contribution to the literature

A growing body of work points to the importance of leaders for economic outcomes (Jones and Olken, 2005; Besley et al., 2011; Yao and Zhang, 2015; Ottinger and Voigtlander, 2021). This paper directly contributes to the literature exploring the impact of female leadership.

In developing countries, several studies find that female representation shapes the provision of public goods. Exploiting the random assignment of women in Indian village councils, Chattopadhyay and Duflo (2004) show that female representation increases investments in infrastructure that is relevant to women's needs. Female politicians also tend to increase spending in education and health relative to male politicians, as evidenced by the impact of female state legislators in India (Bhalotra et al., 2014; Clots-Figueras, 2012) and female mayors in Brazil (Funk and Philips, 2019). The evidence is less conclusive in high-income countries: while Ferreira and Gyourko (2014) and Bagues and Campa (2021) find no effect of female representation on the size or composition of public finances in the US and Spain, Besley and Case (2003) and Lippmann (2021) highlight gender differences in lawmaking by showing that female legislators are more active on family and children's issues.

This paper makes three important contributions to this literature. First, by studying leaders' behavior during the COVID-19 pandemic, we shed light on gender differences in crisis response, on which there is still little evidence to date.[5] Second, while most of the conclusions drawn about the role of female leaders during the COVID-19 crisis are based on observational data, the use of a close election design enables us to assess the causal impact of female leadership.[6] Third, by exploiting the term-limit status of Brazilian mayors, we highlight the role of electoral incentives in shaping female and male mayors' response to the crisis.

We thus also contribute to the large literature investigating the impact of electoral incentives on policymakers' behavior. One branch of the literature posits that holding elections is an effective tool to discipline politicians and align their incentives with voters' interests (Barro, 1973; Ferejohn, 1986). To test this hypothesis, several papers have exploited term-limit rules and compared the decisions of politicians who could or could not run for re-election (Besley and Case, 1995, 2003; Duggan and Martinelli, 2017). In Brazil, consistent with elections working as a disciplining device, Ferraz and Finan (2011) and de Janvry et al. (2012) find, respectively, that having a non-term-limited mayor decreases the share of

[5] One recent paper looking at a crisis context is Eslava (2020). The author finds that that having a female mayor in Colombia reduces the number of guerilla attacks, an effect argued to come from female politicians' better negotiation skills.

[6] A few recent observational studies have used cross-country or cross-state variation to compare the performance of male and female leaders during the COVID-19 crisis (e.g., Garikipati and Kambhampati 2021; Bosancianu et al. 2020; Sergent and Stajkovic 2020). The results obtained so far are mixed and do not offer causal interpretation (Profeta, 2020). One exception is a contemporaneously written paper by Bruce et al. (2021) that looks at the impact of Brazilian mayors' gender on the overall number of deaths in 2020. Instead, our paper studies the evolution of deaths, policies and isolation throughout the period, highlighting contrasting effects at the beginning and end of the year, and stressing the key role of electoral incentives in explaining gender differences.

stolen resources and increases the performance of the conditional cash transfer program.

However, electoral incentives can also lead to sub-optimal outcomes. Knowing that voters are particularly responsive to the state of the economy close to the election (Healy and Lenz, 2014), politicians have an incentive to manipulate monetary and fiscal policies to improve economic performance just before the election, leading to a political business cycle (Alesina, 1988; Drazen, 2001; Brender and Drazen, 2005; Alesina and Paradisi, 2017). In the context of the COVID-19 crisis, Pulejo and Querubín (2021) show that incumbents who could run for re-election implemented less stringent restrictions when the election was closer in time.

Our paper bridges the gap between the gender literature and the electoral-incentive literature, by showing that gender differences in response to the COVID crisis are driven by the fact that Brazilian female and male mayors reacted differently to electoral incentives. Our findings at the beginning of the pandemic show that electoral incentives made female mayors more likely to delay the implementation of restrictive policies. While the underlying reason explaining this behavior is still an open question, one plausible hypothesis is that female mayors perceived voters to be more likely to punish them at the ballot box for implementing harsh policies too soon, rather than for acting too late. This would be consistent with evidence from the Political Science literature showing that voters view female and male leaders differently (Eggers et al., 2018; Fox and Lawless, 2011; Dolan, 2014) and assess their performance differently (Bauer, 2020; Batista Pereira, 2020), in particular during crises (Lawless, 2004). Meanwhile, our results on the later period show that female mayors were less likely to open-up the municipality right before the election, in line with Brollo and Troiano (2016), who find that Brazilian female mayors are less likely to engage in strategic behavior close to the election.

The remainder of the paper is organized as follows. Section 2 presents our setting and the data, and Section 3 describes our sample and empirical strategy. We present the main results in Section 4, and explore the role of electoral incentives in Section 5. Section 6 concludes.

2 Setting and data

2.1 Brazilian local governments and elections

Brazil is divided in 5,570 municipalities, with an average population of around 39,000 residents according to the 2010 census. Municipal governments are the lowest subnational government tier in the country.[7] The constitution recognizes municipalities as "federal entities", which gives them the status of autonomous governments, with the ability to independently decide over local policies. Municipalities' revenues come mainly from constitutionally-mandated inter-government transfers, followed by user fees and local property taxes. Municipal governments are in charge of providing public services of local interest, including water and sanitation, transportation, basic education, and – importantly for this paper – public health.

Municipal governments have an executive branch (*prefeitura*) and a legislative branch (*câmara municipal*). The executive branch is presided by mayors who are elected by popular vote every 4 years, and are subject to a strict two-term limit established by the 1988 constitution. Voter registration and voting is mandatory for adults between the ages of 18 and 70. The electoral rule depends on the municipal population. Municipalities with fewer than 200,000 inhabitants elect their mayors through plurality rule – where the candidate with the most votes wins the election – while municipalities with 200,000 inhabitants or more use a two-round system.

Our empirical strategy relies on the results of the 2016 municipal election, the last election before the onset of the COVID-19 pandemic. The term of the mayors elected in 2016 ran from January 1, 2017 through December 31, 2020. The first round of the next local elections took place in November 15, 2020, and the new mayors took office on January 1, 2021. We define our period of analysis from February 2020 (first registered case in the country) through the end of January 2021.[8]

The 2020 municipal election was originally scheduled on October 4 and postponed to November 15 due to the COVID-19 health emergency. While basic safety protocols were put in place at the voting booth (face mask use and availability of hand sanitizers), the election

[7] The first tier consists of 27 "federative units", made of 26 states and the Federal District. The Federal District does not contain any municipality; it is divided into administrative regions, including the capital Brasilia, and in thus excluded from the analysis.

[8] We include the first month of the new municipal administration as COVID-19 deaths tend to materialize a few weeks after infection, implying that people that died from the disease in January likely became infected while the prior mayor was still in office.

took place in person as the previous ones.[9] During the electoral campaign leading to the election, local media reported multiple breaches of sanitary protocols, in particular large in-person gatherings violating the social distancing recommendations (Tarouco, 2021).

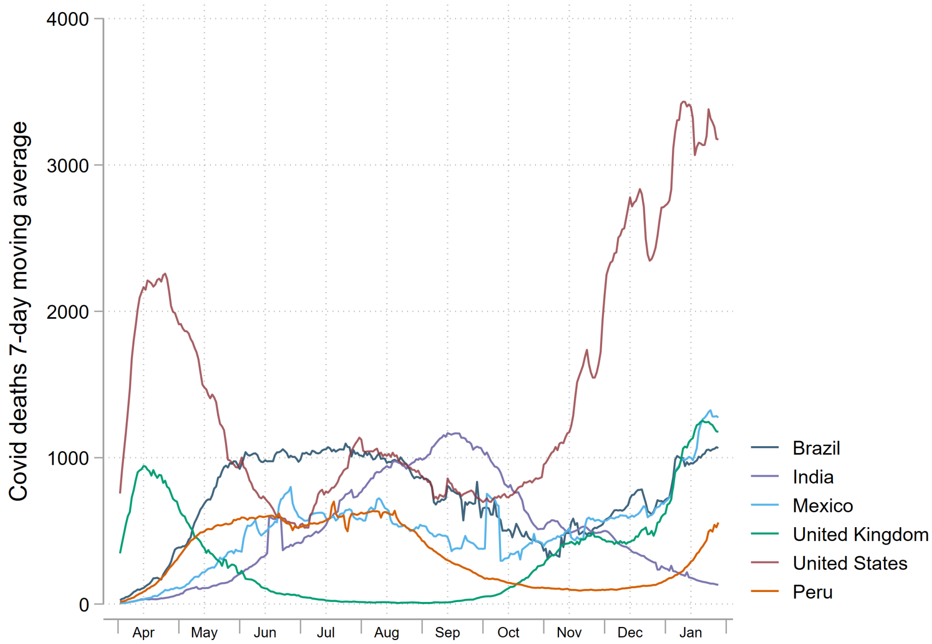
2.2 The COVID-19 pandemic in Brazil

The authorities announced the first confirmed COVID-19 case in Brazil on February 26, 2020, and the first confirmed death three weeks later, on March 17. The disease expanded exponentially across the country, and so did the death toll. While Brazil registered 201 COVID-19 deaths by the end of March, it reached 6,006 by the end of April, and 28,834 by the end of May (Roser et al., 2021). At the beginning, the affected cities were primarily large urban centers located close to international airports, but infections gradually reached smaller and less connected cities as well as rural areas. Following the news of the first confirmed death, multiple states and municipal governments declared state of emergency and some started implementing containment policies such as school and commerce closures, along with public gathering restrictions.

The period of analysis is characterized by the development of the first wave of infections (February 2020 - October 2020), and by the beginning of the second wave (November 2020 - January 2021). The first wave in Brazil was one of the deadliest worldwide. After reporting more than 1,000 deaths per day for the first time on May 19, the country endured similarly high mortality levels for around three months, longer than in any of the other high-mortality countries (Figure 1). On June 10, Brazil's cumulative number of deaths overcame the number of deaths reported by the U.K., and the nation became the second country in the world with the most deaths attributed to COVID-19, behind the U.S. The second wave started in November and proved to be even deadlier than the first. By the end of the period of analysis, the daily number of deaths had reached similar levels as in the peak of the first wave, and the country had accumulated over 224,000 deaths in total. It would go on to reach over 4,000 new deaths per day at its peak, and over half a million accumulated deaths by June 2021.

[9] After consulting a health safety committee, the electoral justice court (TSE) considered online or postal voting infeasible and decided to stick to in-person voting.

Figure 1: Daily number of COVID-19 deaths in Brazil and in the other five countries with the highest mortality (7-day moving average)



Notes: This figure includes the six countries with the highest number of confirmed COVID-19 deaths in the world as of January 31, 2021. It shows the new confirmed COVID-19 deaths, smoothed using a 7-day moving average centered in the date for which the figure is reported. Data from Our World in Data, accessed on June 23, 2021.

2.3 Data

We use data on three outcomes of interest – COVID-19 deaths, municipal containment policies, and the share of people staying at home – in addition to electoral data and municipal characteristics. Appendix Table A1 provides the definition and source of each variable used in the paper.

COVID-19 deaths. The data on COVID-19 deaths come from Brasil.io, an open data platform that collects, cleans, and assembles the COVID-19 information provided by the state-level health secretaries, and makes it publicly available as a daily municipal-level panel (Justen, 2021). We focus on confirmed deaths rather than cases. Deaths has been considered a more reliable measure of the spread of COVID-19 as well as of the spread of other diseases such as SARS and Ebola (Maugeri et al., 2020; O'Driscoll et al., 2021), as they are less likely to go unrecorded. We observe the daily number of COVID-19 deaths from the first registered death on March 17, 2020, until January 31, 2021. We performed quality checks to identify potential data errors and outliers and we only found unusual spikes in a few municipalities located in the state of Mato Grosso. We exclude municipalities part of this state in one of our robustness check (Appendix F) – representing 3 percent of the sample –, as well as when presenting the raw data on the number of deaths in Section 3.1.

In addition, we validate our main results using alternative data from the Brazilian System of Information and Epidemiological Surveillance of Respiratory Infections (SIVEP-Gripe), a patient-level registry of deaths from severe acute respiratory syndrome (SARS) that contains data from both public and private hospitals. This dataset is maintained by the Ministry of Health of Brazil. Both data sources are highly consistent during the period of analysis, as shown in Appendix F.[10]

Containment policies. To study mayors' policy responses, we built a novel policy dataset based on publicly available municipal legislation documents, following the procedure from Chauvin et al. (2021). We accessed multiple online sources, including municipal websites and official gazettes, and collected local laws, decrees, and other mandates issued by the municipal executive branch in response to the COVID-19 crisis. We then extracted the text of the legal documents, parsed their individual articles, and used them to construct a daily panel of indicator variables that denote whether the policy was in place in a given municipality for each day. We consider 10 containment policies, in line with the international policy data featured in the Oxford COVID-19 Government Response Tracker (Hale et al., 2020): commerce, gathering, transport, travel, and workplace restrictions, events cancellations, school closures, curfews, lockdown and face mask mandates. We were able to collect those data for 47.8 percent of our sample over the period from March 1 to October 31, 2020. Four of these policies (gathering restrictions, school closures, events cancellations, and face masks mandates) were implemented by the vast majority of municipalities and sustained for most of the period of study (Appendix Tables A2 and A3), providing little variation to identify the effects of interest. We thus focus on the remaining six in our analysis.

Isolation index. To study the mobility behavior of the population, we use the "Social

[10] As discussed in more detail in Chauvin (2021), the study of COVID-19 at the municipal level makes it challenging to compute the number of deaths using alternative measures. Estimating excess deaths relative to prior years for a given week, for instance, requires historical mortality data with enough variation in each calendar week to accurately predict the number of deaths that would be expected without the pandemic. This is only feasible in highly populated jurisdictions, which is not the case of most of the municipalities in our sample. Likewise, data from seroprevalence surveys to infer infection rates from the presence of antibodies are only available for a small set of municipalities, most of which are not in our sample.

Isolation Index" produced by the private firm InLoco (2021). This index is built using anonymized data from over 60 million cellphones and it indicates the share of active phone users who stayed within 450 meters of their residence in a given municipality on a given day. During the pandemic, the company made a daily municipal-level panel available to researchers. To protect users' privacy, the data are not available on days where the number of active users in the municipality was below a given threshold. Furthermore, the number of municipalities included in the sample gradually decreased over the second half of 2020, reflecting a change in the company's business priorities. For consistency, we focus on a balanced panel of municipalities for which we have data for every day over our period of analysis, from February 26, 2020 to January 31, 2021 (29 percent of the sample).

Electoral data. The electoral data for the 2016 elections come from the Brazilian elections authority (*Tribunal Superior Eleitoral*, TSE). We also performed several data-quality checks using alternative sources such as press articles and municipal gazettes. For each candidate in each municipality, we know her gender, incumbency status, age, education level, party affiliation, and the number of votes she received. We further classify the 32 parties running in the election into 4 main political orientations: "left", "center-left", "center-right and liberals", and "right and Christians".[11]

Municipalities' characteristics. We also use a large set of municipal socio-demographic characteristics to test the validity of our identification strategy and the robustness of our results to the inclusion of controls. Most of these baseline variables are constructed directly from the microdata of the 2010 demographic census (the last one before the 2016 elections). One exception is our measure of density -– the total population living within 1 km of the average inhabitant of the city – which we compute using 2015 data from the Global Human Settlement Layer (Schiavina et al., 2019) following De la Roca and Puga (2017)'s method. We made sure to include variables that have been shown to predict the geographic variation in COVID-19 deaths, such as population, density, the share of residents above 65 years old, proximity to internationally-connected airports, the number of nursing home residents, and household income (Chauvin, 2021).[12]

[11] We use a data driven procedure based on a hierarchical cluster analysis. See Appendix A5 for further details.

[12] The 2010 municipal population is also used to normalize the number of deaths per 10,000 inhabitants. Between 2010 and our period of analysis, five new municipalities were created from seven parent municipalities. Out of these twelve redistricted municipalities, only one qualified to be part of our sample. We removed it to ensure time-consistent geographies throughout our analysis.

3 Empirical strategy

3.1 Sample and descriptive statistics

To estimate the causal impact of female leadership, we use a Regression Discontinuity Design (RDD) and compare municipalities where a female candidate barely won against a male candidate, to municipalities where a male candidate barely won against a female candidate. We thus restrict our sample to Brazilian municipalities where the top two contenders in the 2016 election were one female and one male candidates, accounting for 20.4 percent of all Brazilian municipalities.[13]

We further exclude municipalities for which their COVID-19 outcomes cannot be directly linked to their local government's actions. More precisely, we exclude the 18.6 percent municipalities that are part of a commuting zone (*arranjos populacionais*), as defined by the Brazilian institute of Geography and Statistics (IBGE, 2016). A commuting zone is made of a group of municipalities which are linked through commuting flows and that often coordinate on urban services such as transport. Hence, the number of COVID-19 deaths in a municipality part of a commuting zone are likely to be largely affected by the spread of the virus inside the commuting zone and by the policy choices of its neighbors, in particular the ones of the central city.[14]

Our final sample consists of 983 municipalities. As shown in Figure 2, they are evenly spread out across all Brazilian states, and there is no clear geographical patterns between municipalities where a female candidate was elected (in blue) and municipalities where a male candidate was elected (in red).

Table 1 presents descriptive statistics on our sample.[15] The first panel includes socio-demographic characteristics from the 2010 census. The second panel includes political characteristics based on the first round of the 2016 election.[16] Municipalities in our sample

[13]We exclude 30 municipalities where the votes of one of the top two candidates were invalidated by the electoral justice due to irregularities. In 25 of the municipalities in our sample, the election as a whole was cancelled and a supplementary election took place later on. In these cases, we ignore the results of the ordinary election and consider the top two candidates in the supplementary one. Our results are robust to excluding those municipalities (see Appendix F).

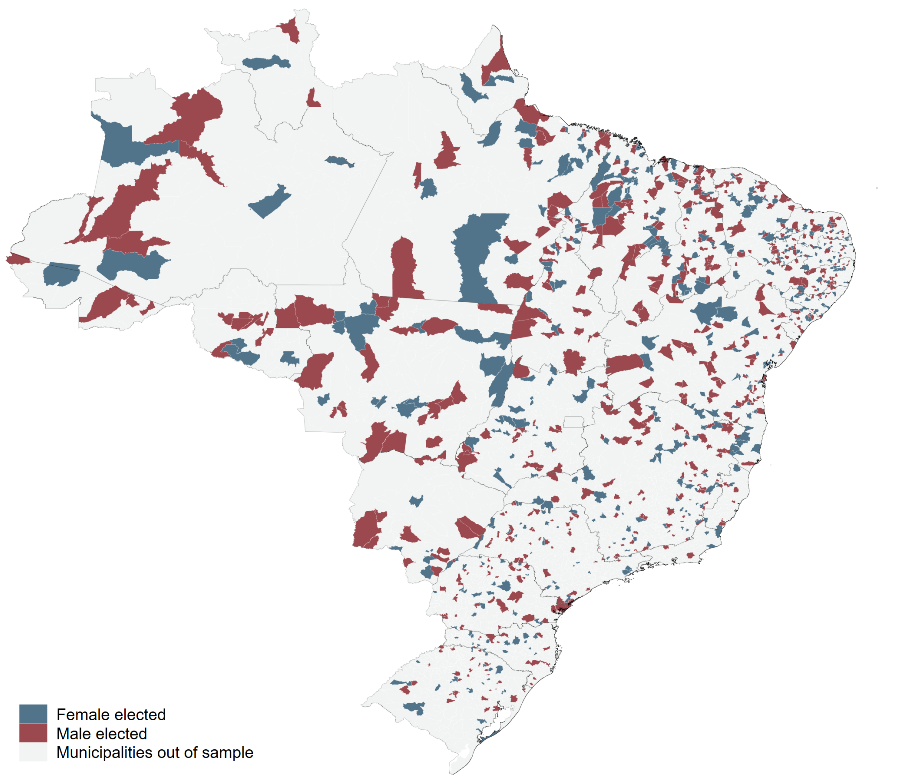
[14]*Arranjos populacionais* are similar to urban commuting zones in the US. As an example, Sao Paulo commuting zone includes 37 municipalities. The spread of COVID-19 in those municipalities was tightly linked to the policies decided by the mayor of Sao Paulo.

[15]Appendix Table G1 presents the same statistics separately for municipalities where a female candidate was elected and municipalities where a male candidate was elected.

[16]After excluding municipalities from commuting zones, all municipalities in our sample are below 200,000

had 13,932 inhabitants on average in 2010, the average monthly median household income was 320 reais (562 US dollars at the contemporary exchange rate), and 2.7 candidates ran in the 2016 elections on average. While municipalities in our sample are smaller and less dense than the average Brazilian municipality, they are similar in all the other characteristics, and representative of an average municipality located outside a commuting zone (Appendix Table G2).

Figure 2: Municipalities in the analysis sample by gender of the election winner



Notes: This figure plots the geographical distribution of municipalities part of our sample of analysis. Municipalities in blue correspond to municipalities where a female candidate was elected in 2016 whereas municipalities in red correspond to municipalities where a male candidate was elected.

To assess whether our sample is representative of the evolution of COVID-19 in Brazil, we plot the number of COVID-19 deaths over time separately for our sample of analysis and for all Brazilian municipalities. As shown in Appendix Figure A2, the two samples experienced a similar number of deaths per capita throughout the period of analysis. The same is true when looking at the share of phone users staying at home over time (Appendix Figure A3). Finally, Appendix Table A2 presents the share of municipalities that implemented

inhabitants and thus had single-round elections.

a given containment policy at least once during the period of analysis, separately for our sample and for a representative 10 percent random sample of municipalities obtained from Chauvin et al. (2021). As for the random sample of municipalities (first two columns), around 90 to 95 percent of municipalities in our sample implemented school closures, gathering restrictions, events cancellation and made facemasks mandatory. In the analysis, we will focus on the remaining six policies for which we have enough variation across municipalities: commerce restrictions, curfew, lockdown, transport restrictions, travel restrictions, and workplace restrictions.

Table 1: Descriptive statistics

	Mean	Sd	Min	Max	Obs
Panel A	*Socio-demographic characteristics*				
population	**13,932**	12,714	1,037	91,311	983
experienced density	**119.7**	186.2	0.005	3468	983
average persons per room	**0.704**	0.243	0.435	4.282	983
commuting time	**21.6**	4.57	9.03	44.6	983
$\geq$65 years old	**0.083**	0.023	0.022	0.179	983
nursing home residents per 10k pop	**3.734**	11.477	0.000	209.9	983
area	**1,763**	5,472	26.51	84,568	983
distance sao paulo	**1,446**	739.8	49.49	3,441	983
km to closest airport connecting to hot spots	**300.9**	214.6	23.07	1,557	983
median household income p/c	**319.6**	144.1	80.00	836.5	983
informality rate	**0.169**	0.055	0.036	0.418	983
unemployment rate	**0.044**	0.021	0.000	0.173	983
college graduate employment share	**0.067**	0.030	0.005	0.192	983
black and mixed population share	**0.591**	0.214	0.019	0.933	983
Panel B	*Political characteristics*				
turnout	**0.855**	0.059	0.673	0.980	983
number candidates	**2.680**	0.954	2.000	9.000	983
center-right & liberal	**0.383**	0.309	0.000	1.000	983
left	**0.070**	0.169	0.000	1.000	983
center-left	**0.251**	0.278	0.000	1.000	983
right & Christian	**0.296**	0.287	0.000	1.000	983

Notes: The sample includes only municipalities outside of any "arranjos populacionais", where one man and one woman were the two front runners in the 2016 election. Socio-demographic variables come from the 2010 census, except for the experienced density that is defined as the total population living within 10 km of the average inhabitant of the municipality and which is computed using the 2015 data from the Global Human Settlement Layer. The political variables refer to the first round of the 2016 municipal election. The last four variables denote the vote share of each of the four main political orientations.

3.2 Specification

We define the running variable X as the victory margin of the female candidate (the difference between her vote share and the vote share of the male candidate), and the treatment variable T as an indicator equal to 1 if the winner is a woman $(X \geqslant 0)$ and 0 if the winner is a man $(X < 0)$. We assess the impact of having a female mayor using the following specification:

$$Y_i = \alpha_i + \tau T_i + \beta_1 X_i + \beta_2 X_i T_i + \mu_i \tag{1}$$

where i indexes municipalities.

We use a nonparametric estimation method, which amounts to fitting two linear regressions on each side of the threshold (Imbens and Lemieux, 2008; Calonico et al., 2014). We follow Calonico et al. (2014)'s estimation procedure that provides robust confidence intervals, and we use the data-driven MSERD bandwidths developed by Calonico et al. (2019) that reduce potential bias the most. In Appendix F, we show the robustness of the main results to using a second order polynomial and a wide range of different bandwidths.

As shown in Appendix Table G3, municipalities close to the threshold are very similar to the average municipality in the full sample, in terms of both socio-demographic and political characteristics.[17]

When presenting the RD results graphically, we follow Calonico et al. (2017): we focus on observations in the estimation bandwidths and we use a linear fit and a triangular kernel, so that the polynomial fit represents the RD point estimator.

3.3 Validity of the design

Density and balance tests

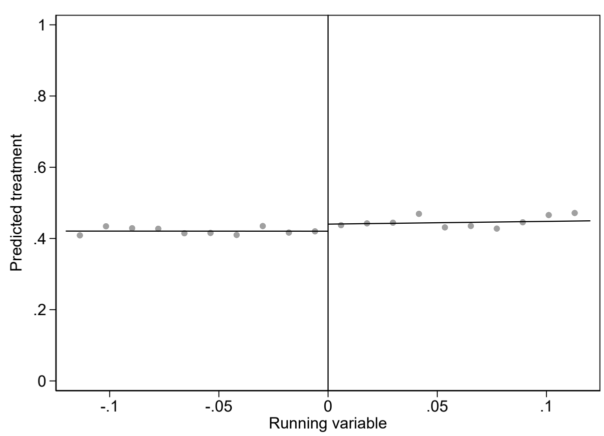
The identification assumption is that all municipalities' characteristics change continuously at the discontinuity, so that the only discrete shift is the change in the mayor's gender. This assumption can be violated if candidates are able to sort themselves across the threshold, which would require them to be able to predict and manipulate their vote share with extreme precision.

[17] For the descriptive statistics, we define municipalities close to the threshold as municipalities where the victory margin is smaller than 4 percentage points. Instead, the estimation bandwidths used in the analysis vary with the outcomes, as they are data-driven.

We perform several tests to bring support for this identification strategy. First, we test for a jump in the density of the running variable using both McCrary (2008)'s method and Cattaneo et al. (2018)'s procedure. As shown in Appendix Figures G1 and G2, the victory margin of the female candidate is smooth at the discontinuity. The p-values associated with the density tests are 0.26 and 0.19, respectively.

Second, we test for the balance of municipalities' characteristics at the threshold using a general balance test, following Anagol and Fujiwara (2016) and Pons and Tricaud (2018). We regress the treatment variable on all 20 covariates presented in Table 1, predict the treatment status of each municipality using the regression coefficients, and test for a jump in the predicted value at the discontinuity. As shown in Figure 3 and Table 2, there is no significant jump at the threshold and the point estimate is small and not significant. In Figure 3 as in all the following RD graphs, each dot provides the average value of the outcome within a given bin of the running variable. Observations on the right of the discontinuity correspond to female-led municipalities, while observations on the left correspond to male-led municipalities.

Figure 3: General balance test



Notes: This figure is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the treatment variable (indicator equal to one if the female candidate won in 2016) predicted by a set of 20 municipal characteristics. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

Table 2: General balance test

	(1)
Outcome	Predicted Treatment
Treatment	0.020
	(0.014)
Robust p-value	0.280
Observations	517
Polyn. order	1
Bandwidth	0.120
Mean, left of threshold	0.420

Notes: The outcome is the treatment variable predicted by a set of 20 municipal characteristics, as described in the text. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

We also test for a jump in each of the baseline characteristic taken individually (tables and graphs in Appendix B). Only one variable out of 20 is significant at the 5 percent level. Taken together, these results suggest that there is no sorting at the discontinuity. Furthermore, we show that the main results are robust in magnitude and statistical significance to controlling for the whole set of covariates (Appendix F).

Gender vs. other characteristics of the winner

The use of a RDD ensures that the gender of the mayor is as good as randomly assigned across municipalities at the threshold. However, it does not ensure that our results can be interpreted as a gender effect if gender is correlated with other characteristics. For instance, if female candidates are more likely to be from a left-wing party, our estimation might be capturing the impact of political ideology instead of gender.

Looking at the characteristics of all 2016 candidates, we see that female candidates are very similar to the average male candidate, in terms of age, incumbency status, and political orientations (Appendix Table G4). One exception is education, as female candidates are much more likely to have completed higher education compared to male candidates (72.4 vs. 49.3 percent, on average).

Ultimately, we are interested in whether female candidates barely winning against male candidates are similar to male candidates barely winning against female candidates. To formally assess whether our effects could be driven by observable characteristics other than gender, we take as outcomes the characteristics of the winner and test for a jump at the threshold. As shown in Table 3 and Appendix Figure B2, while the winner appears less likely to be the incumbent and more likely to have completed higher education when a female candidate won, no coefficient is significant, or close to significance. We further show that controlling for such characteristics leaves the results virtually unchanged (Appendix F). We are thus confident that our results can be interpreted as a gender effect, rather than coming from political experience (incumbency), age, education or ideology.

Table 3: Balance test: characteristics of the winner of the election

Outcome	(1) Incumbent	(2) Age	(3) Education	(4) Center-right & Liberals	(5) Right & Christians	(6) Left	(7) Center-left
Treatment	-0.040	-0.833	0.155	0.051	-0.039	-0.015	0.030
	(0.076)	(1.935)	(0.099)	(0.073)	(0.076)	(0.044)	(0.080)
Robust p-value	0.586	0.818	0.297	0.427	0.479	0.840	0.651
Observations	606	570	483	677	659	516	579
Polyn. order	1	1	1	1	1	1	1
Bandwidth	0.141	0.131	0.107	0.163	0.155	0.119	0.133
Mean, left of threshold	0.260	48.972	0.445	0.311	0.333	0.071	0.270

Notes: In column 1 (resp., 3, 4, 5, 6, 7), the outcome is an indicator variable equal to 1 is the winner of the 2016 election is the incumbent (resp., has completed higher education, is from the political orientation center-right and liberals, right and Christians, left, or center-left). In column 2, the outcome is the age of the 2016 winner at the time of the first round. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

4 Results

4.1 Impact of having a female mayor on COVID-19 deaths

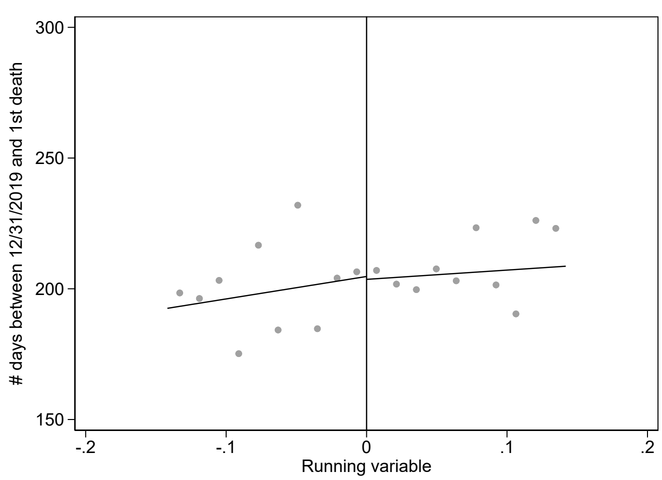
We start by looking at the impact of having a female mayor on the timing of the first reported COVID-19 death. Table 4 and Figure 4 take as outcome the number of days between the last day of 2019 – when the first known case of COVID-19 was reported worldwide – and the first death attributed to the disease in the municipality. We obtain a coefficient close to zero and non-significant, showing that the first death occurred at the same time on average in female- and male-led municipalities (around July 23, 2020, 205 days after the first reported case worldwide).

Table 4: Impact on the timing of the first reported COVID-19 death

	(1)
Outcome	Date of the first death
Treatment	-1.101
	(13.151)
Robust p-value	0.960
Observations	595
Polyn. order	1
Bandwidth	0.142
Mean, left of threshold	204.708

Notes: The outcome is the the number of days between 12/31/2020 and the first death. It is missing for 20 municipalities in which no death occurred up to May 9, 2021 (day at which the data were generated). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure 4: Impact on the timing of the first reported COVID-19 death



Notes: This figure is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the number of days between 12/31/2020 and the first death. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

Given that having a female mayor did not affect the timing at which municipalities started to experience fatalities from the virus, we can use the same time frame to study the evolution of COVID-19 deaths in female- and male-led municipalities. We look at the impact on the total number of deaths in the four main periods characterizing the evolution of COVID-19 in Brazil (see Figure 1): beginning of the first wave (April-May 2020), peak of the first wave (June-August 2020), end of the first wave (September-October 2020), and beginning of the second wave (November 2020-January 2021). We normalize the number of deaths by the 2010 population and multiply by 10,000 so that the outcome measures the total number of deaths in the municipality per 10,000 inhabitants.[18]

As shown in Table 5, on average, having a female mayors led to a 0.39 increase in the number of deaths per 10,000 inhabitants in the first period, a coefficient significant at the 5 percent level. This represents more than a twofold increase compared to the average number of deaths in male-led municipalities at the threshold. Conversely, we find that female-led municipalities experienced 1.0 fewer deaths per 10,000 inhabitants in the last period, on average. This effect is significant at the 5 percent level and corresponds to a 41.1 percent decrease compared to male-led municipalities. We find no effect during the second and third periods, corresponding to the middle and end of the first wave. The coefficients are not significant and the point estimates are much smaller, both in absolute terms and compared to the means.

Figure 5 plots the number of deaths against the running variable for each period separately. Consistent with the formal estimation, we see an upward jump at the threshold at the beginning of the first wave, a downward jump at the end of the period of analysis, and no significant jumps for the other two periods.

Appendix Table C2 and Appendix Figure C2 further assess the impact month by month. We find that the positive impact in the first period is driven by a larger number of deaths in female-led municipalities in May 2020, while the negative impact in the last period is driven by a lower number of deaths in female-led municipalities in November and December 2020.

Finally, we look at how these effects translate into the evolution of the number of cumulative deaths. Figure 6 shows the estimated impact of having a female mayor on the total number of deaths up to a given date, for each day from April 1 to January 31. Each dot on the blue line provides the estimate for a given day, and the blue shaded area depicts

[18] We start in April as no death occurred in municipalities part of our sample in March (a total of 201 occurred across the country).

the 95 percent robust confidence intervals. Consistent with female-led municipalities experiencing more deaths in May, the point estimates on the cumulative number of deaths is positive and significant from mid-May to mid-June. It remains positive but not significant up to October, when it becomes close to zero. Next, in line with female-led municipalities experiencing fewer deaths in November and December, the point estimates become negative starting in mid-November, after the first round of the 2020 election.

Overall, we find that having a female mayor reduced the cumulative number of deaths by 0.97 as of January 31st 2021 (14.4 percent), on average, but the coefficient is not statistically significant (Appendix Table C1 and Appendix Figure C1).

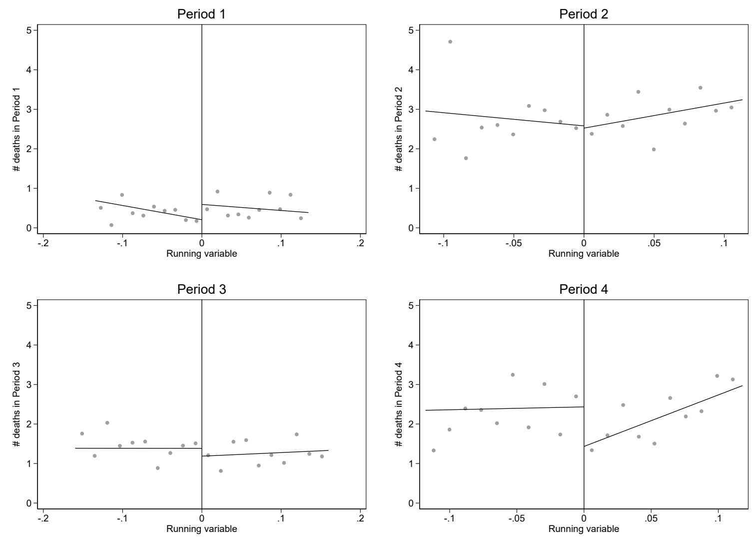
We next turn to the analysis of containment policies and mobility to explore what can explain these patterns.

Table 5: Impact on COVID-19 deaths by periods

	(1)	(2)	(3)	(4)
Ouctome	# COVID-19 deaths per 10,000 inhabitants			
	Period 1	Period 2	Period 3	Period 4
Treatment	0.387**	-0.056	-0.198	-1.001**
	(0.175)	(0.510)	(0.283)	(0.405)
Robust p-value	0.037	0.846	0.472	0.016
Observations	580	498	673	514
Polyn. order	1	1	1	1
Bandwidth	0.134	0.113	0.160	0.118
Mean, left of threshold	0.206	2.580	1.384	2.434

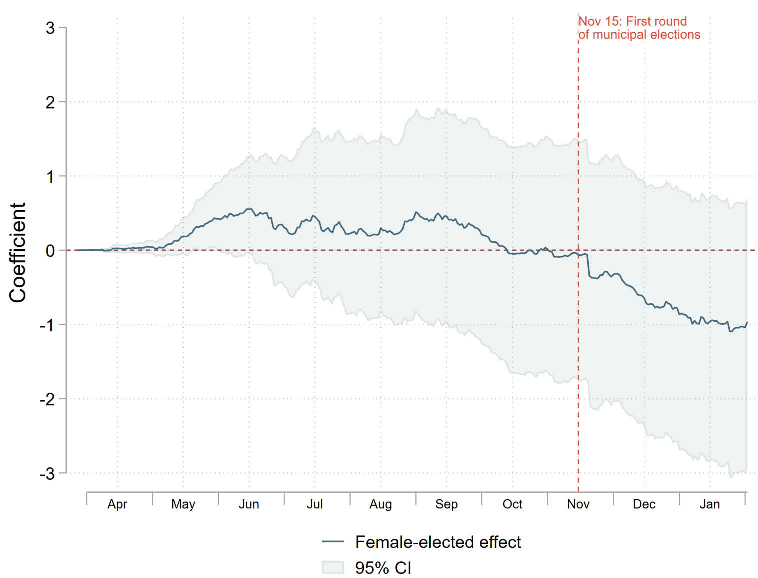
Notes: Each column takes as outcome the total number of deaths per 10,000 inhabitants (using the 2010 census) during the period of interest. Period 1 (resp., 2, 3, and 4) corresponds to April-May 2020 (resp., June-August 2020, September-October 2020, and November 2020-January 2021). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure 5: Impact on COVID-19 deaths by period



Notes: Each graph is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the total number COVID-19 deaths per 10,000 inhabitants in the municipality during the period of interest. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

Figure 6: Impact on the cumulative number of COVID-19 deaths day by day



Notes: This figure plots the RD estimates obtained by taking as outcome the cumulative number of Covid-19 deaths per 10,000 inhabitants, for each day from April 1st to January 31st, 2020.

4.2 Impact of having a female mayor on containment policies

We now explore whether female mayors pursued different policies than male mayors in response to the COVID-19 crisis. As discussed in Section 2.3, we consider six policies: workplace, commerce, travel, and public transport restrictions; lockdown; and curfews. Appendix Figure G3 shows the frequency with which municipalities in our sample implemented these policies between March 1 and October 31, 2020 — the period for which policy data are available. Most municipalities only pursued the first four policies in the early weeks of the pandemic. Curfews were only implemented in 13 and 25 municipalities in March and April respectively; and no municipality in our sample implemented a lockdown before May.

We first look at the impact of having a female mayor on the adoption of a given policy by calendar month. For each policy and month, we define our dependent variable as the total number of days in which the policy was in place in the municipality.

Table 6 presents the results for commerce restrictions. We find that female-led municipalities were significantly less likely to close commerce at the beginning of the pandemic. On average, this policy was implemented 2.5 fewer days during the month of March in female-led municipalities, a large effect relative to the average of 3.2 days in male-led municipalities at the threshold. In April, the effect was of 6.5 fewer days relative to a 10.6 average. Both coefficients are significant at the 5 percent level. We further show that these effects are driven by female mayors' higher likelihood to delay the introduction of commerce restrictions. We estimate the female-mayor effect on the number of days between December 31, 2019 and the first day of implementation of each policy (Appendix Table D1). On average, female-led municipalities implemented commerce restrictions 33 days later than the average male-led municipality at the threshold, an effect that is significant at the 5 percent level.

In contrast, we find that female-led municipalities became significantly more likely to close commerce in the two months leading up to the November election. On average, having a female mayor led to 7.3 and 7.5 more days of commerce closures in September and October, respectively. These effects represent a two-fold increase relative to the average in municipalities that barely elected a male, and they are both significant at the 10 percent level. Figure 7 shows this pattern visually. While we see a large downward jump in March and April, the discontinuity gradually disappears in subsequent periods, before turning into large upward jumps in the last two months.

Table 6: Impact of having a female mayor on commerce restrictions by month

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with commerce restrictions in place							
	03/20	04/20	05/20	06/20	07/20	08/20	09/20	10/20
Treatment	-2.495**	-6.506**	-1.726	0.661	2.544	4.035	7.252*	7.539*
	(0.977)	(2.836)	(4.039)	(4.048)	(4.035)	(3.843)	(4.337)	(4.297)
Robust p-value	0.018	0.037	0.892	0.695	0.365	0.196	0.067	0.056
Observations	243	250	242	234	223	234	232	232
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.108	0.112	0.106	0.100	0.095	0.102	0.099	0.099
Mean, left of threshold	3.182	10.624	10.440	11.026	10.836	8.800	7.861	6.582

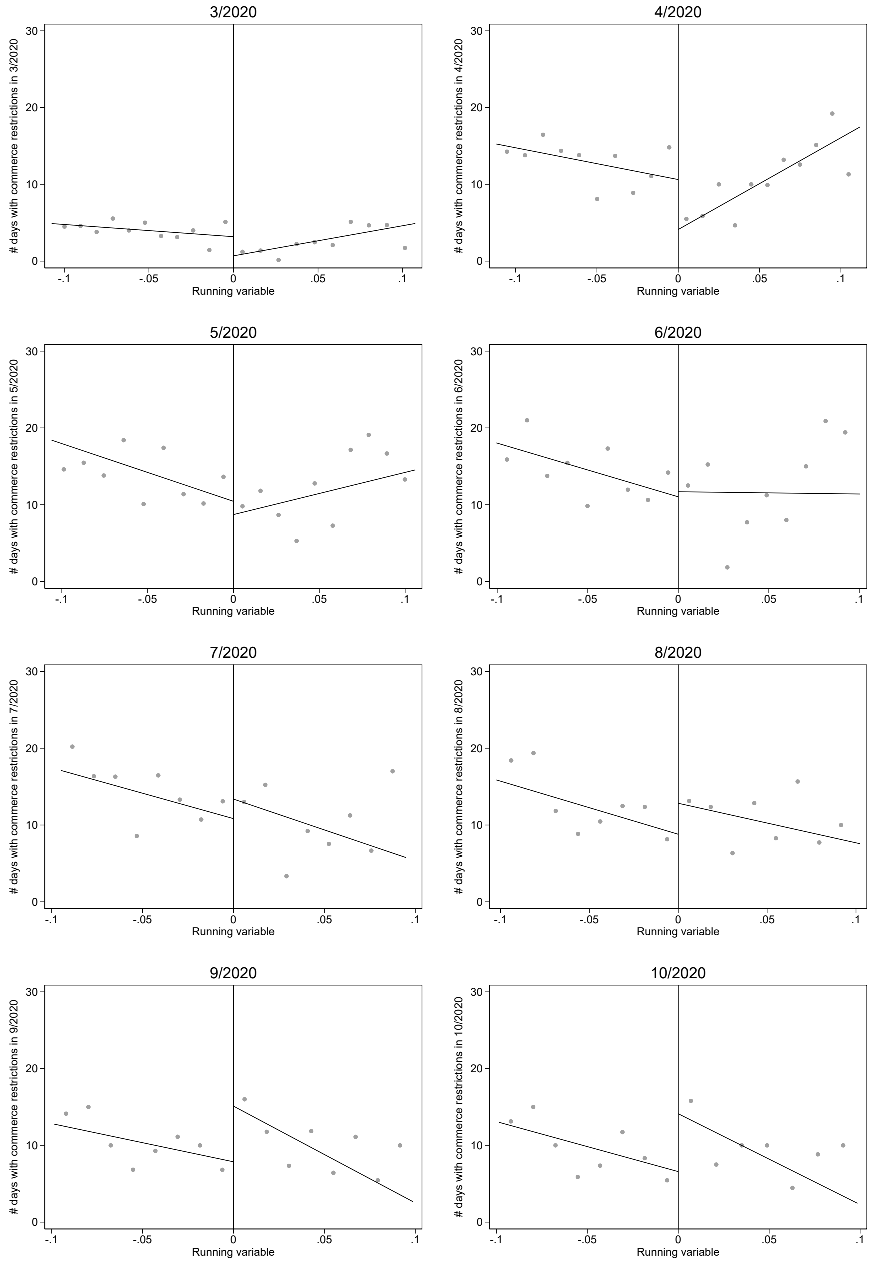
Notes: The sample is restricted to municipalities for which data on policies are available. The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

We do not find significant effects when turning to the other five policies. We observe similar patterns for workplace restrictions – with negative effects at the beginning of the pandemic that turn into positive effects over time – but these results are noisier, and not statistically significant (Appendix Table D2). Female mayors also appeared more likely to implement curfews, and less likely to impose travel restrictions and lockdown throughout the period of analysis, but the effects are imprecisely estimated and none of these results are statistically significant (Appendix Tables D5, D3, and D6).[19] We find no difference between male-led and female-led municipalities in their likelihood of closing public transportation (Appendix Table D4), and no significant effects on the time at which any of these five policies were implemented for the first time (Appendix Table D1).

Appendix Figure D1 summarizes these results by plotting the RD estimate day by day for each policy. Overall, female and male-led municipalities differ mainly in their use of commerce restrictions. Consistent with the evolution of COVID-deaths, female-led municipalities were less likely to close commerce at the beginning of the period, but more likely to do it towards the end.

[19]Because the vast majority of municipalities in our sample did not implement curfews or lockdown at the beginning of the pandemic, the estimates for these policies start in April and May, respectively.

Figure 7: Impact of having a female mayor on Commerce Restrictions by month



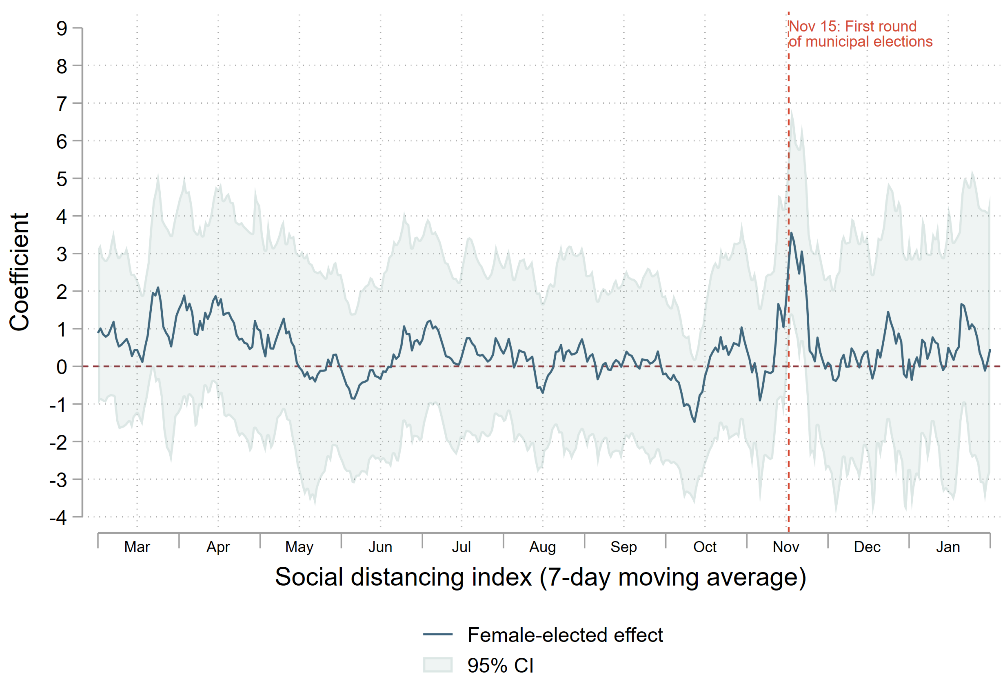
Notes: The sample is restricted to municipalities for which data on policies are available. This figure is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the number of days the policy was implemented in the municipality during the month of interest. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

These results are robust to exploiting within-state variation only, through the inclusion of state-fixed effects (Appendix F). This shows that the differences we find in mayors' policy decisions are not driven by female- and male-led municipalities being subject to different state policies, but can be attributed to their own policy preferences.

4.3 Impact of having a female mayor on isolation

Next, we measure the impact of having a female mayor on residents' mobility. We use InLoco's "isolation index", defined as the share of phone users in the municipality who stayed at home on a given day. Figure 8 shows daily RD estimates of the effect from February 25, 2020 to January 31, 2021. The dependent variable is the 7-day moving average of the isolation index, centered in the current day. Each point on the solid blue line represents the effect of having a female mayor on the average share of residents staying at home in the 7-day time window, and the light blue areas depict 95 percent robust confidence intervals.

Figure 8: Daily RD estimates of the impact of having a female mayor on the isolation index (7-day moving average)



Notes: This figure plots the estimated daily coefficients of the effect of having a female mayor on the 7-day moving average of the isolation index, which measures the share of phone users staying at home on a given day. The moving averages are centred in the current day. We restrict the sample to a balanced panel of municipalities, excluding those with missing values between Feb-25-2020 and Jan-31-2021.

For most of the period of study, we find no statistically significant female-mayor effect on isolation. The point estimates are positive in the first few weeks of the pandemic, but the effects are imprecisely estimated and not significant. In the following months – from May through October – they remain close to zero. This non-significant impact on isolation is consistent with the fact that female and male mayors differ mainly in their use of commerce restrictions. Indeed, contrary to lockdown or curfews for instance, commerce closures do not restrict mobility per se; they mainly reduce the risk of contamination by preventing people from entering closed spaces, and thus by promoting social distancing.

In sharp contrast with the null effects found over most of the period of interest, we find a large, positive, and statistically significant effect of having a female mayor on the share of residents staying at home around the day of the election. In other words, people in female-led municipalities were significantly more likely to stay at home around election day. Table 7 zooms in this period, providing separate estimates on the share of phone users staying at home for each day around Sunday November 15. We find that the positive effect is driven by the two days prior to the election (columns 4 and 5) – corresponding to Friday and Saturday, the last two days in which campaigning was legally allowed – and by a few days in the week immediately after the election.

Table 7: Impact of having a female mayor on the isolation index around election day

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome	Share of phone users staying at home on each day from November 10 to 20										
	10	11	12	13	14	15	16	17	18	19	20
Treatment	0.994	0.114	0.952	3.872**	5.604**	0.719	-0.596	3.681*	4.145*	7.008***	1.222
	(2.102)	(2.120)	(1.419)	(1.857)	(2.484)	(1.947)	(1.861)	(1.766)	(2.494)	(1.716)	(2.215)
R. p-value	0.608	0.941	0.523	0.037	0.023	0.609	0.735	0.055	0.071	0.000	0.498
Obs	151	161	187	122	141	141	161	159	115	129	163
Polyn. order	1	1	1	1	1	1	1	1	1	1	1
Bandwidth	0.120	0.127	0.155	0.092	0.107	0.107	0.127	0.126	0.086	0.096	0.128
Mean	36.662	36.914	35.503	33.105	32.732	36.401	39.339	36.677	36.085	34.238	36.757

Notes: The sample is restricted to municipalities with no missing value between Feb-25-2020 and Jan-31-2021. The outcome is the share of phone users staying at home on a given day. We provide the estimated impact for each day from November 10th to November 20th. The day of the election was Sunday November 15th (column 6). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Appendix Table E1 and Figure E1 consider a a three week time window around election day and estimate weekly female-mayor effects on average isolation. Consistent with the impact being driven by days just around the election day, we find large point estimates and jumps at the discontinuity for the week of the election (Week 46, although not significant) and the following week (Week 47, significant at the 5 percent level). In contrast, we see no jump for the other weeks, the estimates are close to 0 and far from significant.

Overall, having a female mayor increased the share of people staying at home by 5 to 7 percent in the week of the election and the following one, and by around 10 to 20 percent in the exact days driving the impact, on average. As isolation is tightly link with COVID-19 transmission, these results are consistent with the lower number of deaths in female-led municipalities following the election.

4.4 Summary of main findings

The evidence so far suggests that having a female mayor impacted municipalities differently across time. At the beginning of the first COVID-19 wave – in the months of March and April, 2020 – female mayors were on average *less* likely to impose commerce restrictions, and their municipalities experienced *more* deaths in the month that followed (May), relative to male-led municipalities.

In contrast, female mayors became on average *more* likely to impose commerce restrictions in September and October. Moreover, their residents were *more* likely to stay at home in the days surrounding the November 15 election. Consistent with these differences in containment policies and isolation behavior, female-led municipalities experienced *fewer* COVID-19 deaths than male-led municipalities in November and December.

We show that these results are robust in both magnitude and significance to the inclusion of municipal baseline characteristics, mayors' characteristics other than gender, and state fixed effects. They are also robust to the exclusion of unusual observations (Mato Grosso state and supplementary elections), and to specification choices (use of a second polynomial order and different bandwidths). Appendix F describe the robustness tests in more details and presents the corresponding tables and figures.

5 Mechanisms: The role of electoral incentives

As the new municipal election took place in November 15, 2020, mayors' responses to the crisis during the year 2020 might have been affected by their re-election concerns.

This section explores the extent to which our results are driven by mayors' electoral incentives. More precisely, we discuss and test whether our results can be explained by the fact that female and male mayors responded differently to these incentives. To do so, we exploit the two-term limit rule and compare mayors who ran as incumbents in 2016 – thus serving their second term and not allowed to run again in 2020 – to mayors who did not run as incumbents in 2016 – thus allowed to run for re-election in 2020. We call the former "term-limited" and the later "non-term-limited".

We consider three sub-samples depending on the incumbency status of the two front runners in the 2016 election: (1) neither of the two front runners ran as incumbent in 2016, so that the treatment captures the impact of having a non-term-limited female mayor vs. a non-term-limited male mayor (i.e. both have electoral incentives); (2) only the male candidate ran as incumbent in 2016, so that the treatment captures the impact of having a non-term-limited female mayor vs. a term-limited male mayor (ie., only the female mayor has electoral incentives); and (3) only the female candidate ran as incumbent in 2016, so that the treatment captures the impact of having a term-limited female mayor vs. a non-term-limited male mayor (ie., only the male mayor has electoral incentives).

We first explore the role of electoral incentives at the beginning of the pandemic and then turn to the later period, around the 2020 election. For each period, we start by discussing how electoral incentives could have played differently for female and male mayors, and then test whether our effects are indeed driven by electorally motivated mayors.

5.1 Electoral incentives at the beginning of the pandemic

When the first COVID-19 case was discovered in Brazil at the end of February, there were still great uncertainties about how deadly the virus would turn out to be, how it was transmitted, and, thus, about which policies should be pursued. The electoral risk could go both ways for mayors running for re-election at the end of the year. They could be criticized for not having acted early enough to contain the pandemic, or they could be criticized for having implemented too restrictive policies if such policies were proven to be ineffective or too costly by the time of the election.

Electorally motivated female mayors might have perceived the "over-reaction" risk to be higher for their re-election prospects, leading them to delay the implementation of restrictive policies. If this explains the increase in deaths in female-led municipalities at the beginning of the pandemic, we should find that the impact was driven by female mayors who could run in the 2020 election.

Table 8 presents the impact of having a female mayor on total deaths in the first period for each subsample separately. In line with the above hypothesis, the results show that the impact remains large and positive only when the female mayor has electoral incentives (columns 2 and 3). When both mayors are non-term limited, the impact is very close in magnitude to the impact for the full sample (0.38 vs. 0.39, columns 2 and 1), although not significant. Moreover, when the female mayor is non-term limited while the male candidate is, the point estimate is large and significant at the 5 percent level (0.92, column 3). In contrast, the effect disappears when the female mayor is term limited: it is small, negative, and far from significant (-0.15, column 4).

Table 8: Impact of having a female mayor on COVID-19 deaths in Period 1, by term limit status

	(1)	(2)	(3)	(4)
Outcome	Number of Covid-19 deaths in Period 1			
	Full sample	Both not limited	Male limited Female not	Female limited Male not
Treatment	0.387**	0.382	0.918**	-0.154
	(0.175)	(0.270)	(0.347)	(0.290)
Robust p-value	0.037	0.138	0.014	0.592
Observations	580	285	140	116
Polyn. order	1	1	1	1
Bandwidth	0.134	0.130	0.126	0.110
Mean	0.206	0.161	0.127	0.305

Notes: In column 2, the sample is restricted to elections where neither of the two front runners ran as incumbent. In column 3 (resp., 4),the sample is restricted to elections where only the male (resp. female) candidate among the top two ran as incumbent. The outcome is the total number of deaths per 10,000 inhabitants (using the 2010 census) during the first period (April-May 2020). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

The results on policies are less conclusive (Appendix Table G5). While the impact on commerce restrictions is the largest when both mayors are non-term limited (columns 2 and 3), the results are similar whether the female or male mayor is term limited, although no coefficient is significant in those two subsamples (columns 5 and 6, and 7 and 8).

In a context of uncertainty, the fear of being punished by voters for overreacting is line with recent experimental evidence showing that voters hold female politicians – relative to male politicians – to different standards (Bauer, 2020).[20] On the contrary, our results are

[20]Evidence from survey experiments in Finland show that male politicians tend to be characterized

unlikely to be explained by electorally motivated female mayors prioritizing the economy over health in general, or under-estimating the COVID-19 risk in general. First, the literature suggests instead that female politicians invest more in health than male politicians (Bhalotra et al., 2014; Funk and Philips, 2019), and that women in the population took the COVID-19 risk more seriously (Galasso et al., 2020). Moreover, as shown in Section 4.1, the positive impact on deaths disappears when municipalities entered the peak of the first wave, which is in line with our interpretation. As time passes, the uncertainty about the severity of the crisis decreases, and so does the risk of being seen as overreacting.

5.2 Electoral incentives around the 2020 election

By the end of the 2020 summer, Brazil had just experienced one of the deadliests first waves of COVID-19 infections in the world and the number of daily deaths started to decrease for the first time. This period also coincided with the beginning of the campaign season for the upcoming 2020 municipal elections, originally scheduled for October, and eventually postponed to November 15.

As stressed by the political business cycle literature, officials have incentives to implement popular policies just before the election to improve their re-election prospects, ignoring potential negative long-term effects (e.g., Drazen 2001; Orair et al. 2015; Alesina and Paradisi 2017). In the context of the COVID-19 crisis, Pulejo and Querubín (2021) show that incumbent presidents who could run for re-election implemented less stringent restrictions closer to the election date.

Moreover, the Brazilian municipal election of 2020 featured in person voting, and the electoral authorities had banned the use of mass messaging on social media during the campaign, creating incentives for candidates to use in-person events instead, despite the social distancing regulations in place (Tarouco, 2021).

Electorally motivated male mayors might have been more likely to respond to such electoral incentives, thus imposing fewer restrictions closer to the election and organizing more gatherings during the electoral campaign than their female counterparts. This would be in line with Brollo and Troiano (2016), who show that male mayors are more likely to engage in corruption activities and to behave strategically closer to the election day, compared to female mayors. If male mayors' higher likelihood to open up the municipality

as "strong", "military type of leader" or "harsh, but successful" while female were criticized as "bully", "unprofessional", and "dictator" (Denise, 2020).

around election day explains the negative impact on deaths starting in November, we should find that these effects are driven by male mayors who could run in the 2020 election.

As shown in Table 9, the negative impact on deaths in the last period is indeed only driven by municipalities where the male mayor has electoral incentives (columns 2 and 4). When both male and female mayors are non-term-limited, the impact is significant at the 5 percent level and higher in magnitude than in the full sample (-1.7 vs. -1.0, columns 2 vs. 1). When only the female mayor is term-limited, the impact is similar as in the full sample and almost significant (-1.2, p-value 0.11, column 4). In contrast, when the male mayor is term-limited, the impact on deaths is ten times smaller, close to zero, and far from significant (column 3).

Table 9: Impact of having a female mayor on COVID-19 deaths in Period 4, by term limit status

	(1)	(2)	(3)	(4)
Outcome	Number of Covid-19 deaths in Period 4			
	Full sample	Both not limited	Male limited Female not	Female limited Male not
Treatment	-1.001**	-1.740**	-0.194	-1.228
	(0.405)	(0.669)	(0.605)	(0.750)
Robust p-value	0.016	0.011	0.659	0.108
Observations	514	258	172	142
Polyn. order	1	1	1	1
Bandwidth	0.118	0.116	0.151	0.142
Mean	2.434	3.044	1.891	2.425

Notes: The outcome is the total number of deaths per 10,000 inhabitants (using the 2010 census) during the last period (November 2020-January 2021). Other notes as in Table 8.

Turning to commerce restrictions in September and October, we find that the impact is the largest and significant at the 10 percent level when the male mayor is non-term-limited while the female mayor is. However, the effect remains positive even when the male mayor is term-limited, although the estimates are not significant (Appendix Table G6).

While the evidence is less conclusive for policies, the effects on isolation are consistent with those for deaths–even if, as in the case of policies, the samples are small and the effects imprecisely estimated. Appendix Table G7 shows that the increase in the share of people staying at home in female-led municipalities during the election week and the week after is only driven by municipalities were the male mayor has electoral incentives (columns 3 and 4, and 7 and 8). When the male mayor is not allowed to run again, the estimate becomes either negative or close to zero and non-significant (columns 5 and 6). These results are consistent with electorally motivated male mayors being more likely to organize in-person events during the campaign, leading to a spike in deaths after the election.[21]

6 Conclusion

This paper studies gender differences in crisis response, focusing on the behavior of Brazilian mayors during the COVID-19 pandemic. Using a close election design, we find that female mayors handled the crisis differently, leading to a different evolution in the number of death over time in female-led municipalities compared to male-led municipalities.

First, we find that having a female mayor led to more deaths at the beginning of the period – a two-fold increase in May 2020 – while it led to fewer deaths at the end of the period – a 41.1 percent reduction in November and December 2020, compared to the average male-led municipalities.

Consistent with the different evolution in deaths, we find that female mayors were less likely to impose commerce restrictions early on – in February and March – while they became more likely to do so later on – in September and October. Moreover, the negative impact on deaths in the last quarter is consistent with the lower share of people staying at home in male-led municipalities around election day (November 15).

Finally, we show that these results are only driven by mayors who were non-term-limited, and thus allowed to run for re-election in 2020. We conclude that the gender differences we observe are due to the fact that female and male mayors responded differently to electoral incentives. While electorally motivated female mayors were more likely to delay restrictive policies at the beginning, electorally motivated male mayors were more likely to open-up the municipality closer to the election.

The next iteration of the paper will build on the results discussed in the current version and include a conceptual framework to model the interaction between gender and electoral incentives. This framework will also be used to generate additional testable implications.

[21] In-person events during the campaign would explain well the increased share of people going out in the last two days of the campaign (Table 7). Instead, the impact on the days following the election could be driven by mayors organizing in-person events to celebrate, as suggested by news articles reporting celebration gatherings the week after the election.

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Appendix

Table of Contents

A Data appendix

A1 Variable definitions and sources

Table A1: Definition and sources of variables used in the analysis

Variables	Dataset	Date	Description / comments
			Panel A: City level socio-demographic characteristics
population	Census	2010	Total population of the municipality.
experienced density	GHSL	2015	Total population living within 10 km of the average inhabitant of the municipality. For each municipality, we count the total population living in a 10km radius (encompassing both areas inside and outside the municipality's perimeter) around each 1 square km pixel composing the area of the municipality. We then average this count using each pixel's population as weights.
average persons per room	Census	2010	Number of individuals living in the household, divided by the number of rooms in the dwelling.
commuting time	Census	2010	Averate time that the municipality's employed population usually spent in travel from home to work, in minutes. This variable is derived from a categorical variable that informs intervals of time, from which we use the mid-points. The values are top-coded to 2 hours (i.e. the last category that corresponds to "two hours or more").
65 years old	Census	2010	Share of the municipalitys population aged 65 or above.
nursing home residents per 10k pop	Census	2010	Number of individuals aged 65 or above living in nursings homes or asylums, per 10,000 working age individuals living in the municipality. Working age individuals idefined as 18 years old or above.
area	IBGE	2010	Area of the municipality in squared-kilometers.
distance sao paulo	IBGE	2010	Geographical distance, in kilometers, between each municipality and the city of So Paulo (i.e. straight line along earth's surface).
km to closest airport connecting to hot spots	ANAC	2010	Geographical distance, in kilometers, to nearest airport having at least a flight from USA, UK, France, Spain, Italy, Germany and China (i.e. straight line along earth's surface).
median household income p/c	Census	2010	Median per capita household income. "Per capita" means the household total divided by the total number of household members. Total household income includes income from main and other jobs, and income from other sources (e.g. social security pensions or retirement benefits, bolsa famlia program, program for erradication of child labor, other social transfers, interest on savings, securities, rental, pension, dan retirement of private pension funds).
informality rate	Census	2010	Share of the municipality's working age population (18 y.o. or above) that work as employees without a signed work card. Self-employed individuals are not considered informal.
unemployment rate	Census	2010	Share of the municipality's working age population (18 y.o. or above) that did not work for at least one hour, or was on leave from work, over the week of reference (last week of July 2010), but that took providence to find a job in the month of reference (July 2010).
college graduate employment share	Census	2010	The share of the municipality's population that had completed college education or a higher educational level among those who worked on the week of reference (last week of July 2010), among those that reported their educational status in the census.
black and mixed population share	Census	2010	Share of the municipality's population that declares to be black or mixed-race.

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Variables	Dataset	Date	Description / comments
			Panel B: City level electoral variables
Turnout	TSE	2016	Share of registered voters who cast a vote in the first round of the 2016 election.
Number of candidates	TSE	2016	Number of candidates running for mayor in the first round of the 2016 election.
Orientations' vote share	TSE	2016	Share of vote in the first round of the 2016 election that went to candidates belonging to each political orientation. We group the 32 parties into four orientations, that we labelled as: "Left", "center-left", "center-right & liberals", and "right & christians". See A5 for more details on the construction of the orientations.
			Panel C: Candidate-level electoral variables
Election winner	TSE	2016	Dummy variable that equals one if the candidate has the largest share of valid votes as registered by the electoral justice in the first round, in case there was not second round, or in the second round, in case there was one.
Gender of the candidates	TSE	2016	Dummy variable that equals one if the candidate is a female, as registered by the electoral justice (not self-declaration), and zero if male. This variable was verified using an algorithm that computes the probability of being a female according to the first a names dataset from IBGE. Only one correction was manually made after this check.
Incumbency status of the candidates	TSE	2016	Dummy variable that equals one if the candidate ran the election as the incumbent, i.e. ran for reelection, and zero otherwise. This variable was constructed by using the self-declaration of candidates and verified by matching the name of the candidate with the name of the winner of the 2012 election. More details in Appendix.
Age	TSE	2016	Age of the candidate, computed using the election's date and the candidate's date of birth as registered by the electoral justice.
Political Orientation (Coallition)	TSE	2016	Categorial variable with four possible values indicating to which one of the four political orientations the candidate's party belongs to. We group the 32 parties into four orientations, that we labelled as: "Left", "center-left", "center-right & liberals", and "right & christians". See A5 for more details on the construction of the orientations.
Education	TSE	2016	Dummy variable that equals one if the candidate has already completed tertiary-level education.

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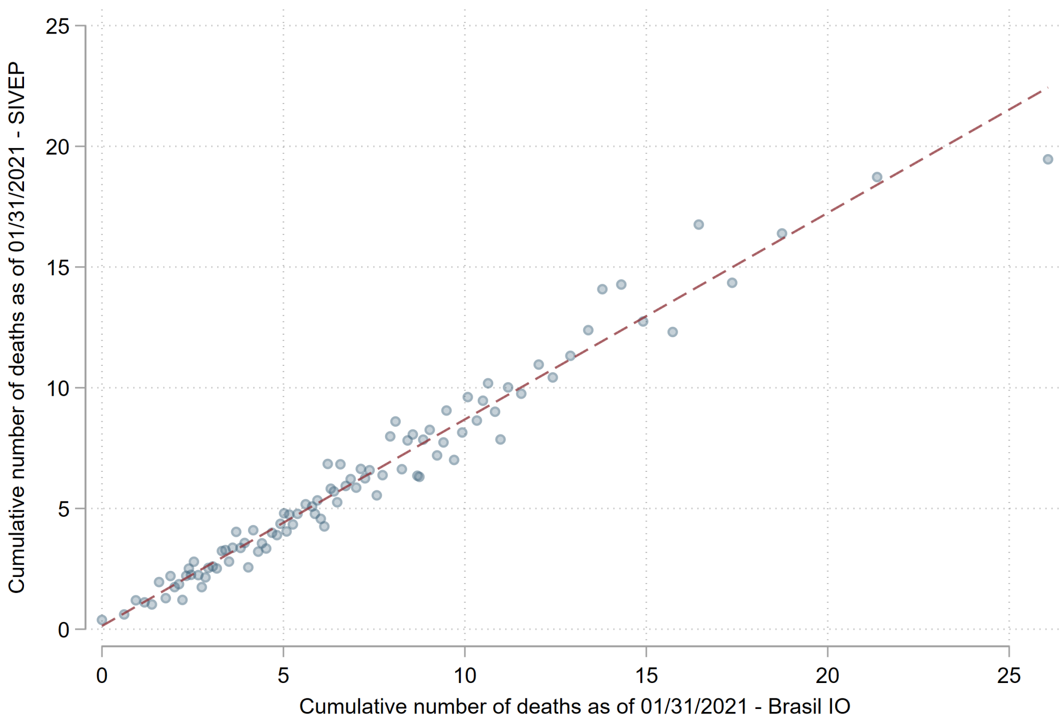
Variables	Dataset	Date	Description / comments
			Panel D: Pandemic Outcomes and Policies
State-fixed effects	IBGE	2020	27 dummy variables named after each one of the federal states and the Federal District that takes the value one if the city belongs to the corresponding state, and zero otherwise.
Deaths per day (6 countries comparison)	OWID	2020	Absolute numbers of confirmed COVID -19 deaths in each country, per day (seven-day rolling average).
Deaths per 10k	Brazil IO	2020 - 2021	Absolute numbers of confirmed COVID-19 deaths registered in the city, per day and per 10k inhabitants and normalized to the 2010 population. Brazil IO collected the data directly from state's secretaries.
Deaths per 10k	SIVEP	2020 - 2021	Absolute numbers of confirmed COVID-19 deaths registered in the city, per day and per 10k inhabitants and normalized to the 2010 population. SIVEP compiles the mandatory registries of all covid deaths notified to the Ministry of Health.
Timing of First Confirmed COVID-19 Death	Brazil IO	2020 - 2021	Number of days between 01/01/2021 and the first confirmed COVID-19 death registered in each city.
Daily Social Distancing Index	InLoco	2020 - 2021	Share of individuals staying at home at a given day at each city, as measured by anonymized geolocalization data from around 60 million cellphones in Brazil. The shares are computed by InLoco using all cellphones observed in each city.
Policy variables (commerce restrictions, curfew, lockdown, travel restrictions, public transport restrictions, workplace restrictions)	Own data collection	2020	Daily dummy variable valued as one if the city was adopting the given type of policy in that day, and zero otherwise. Also computed for different time frames, i.e. as a share of days of Implementation of Restrictions by month or week. Data was collected directly from the cities' own official diaries, where all decrees and policies must be formally published before being valid (Dirio Oficial do Municpio). Data collection follows Chauvin et al. (2021).

Notes: Census' period of reference is the last week of July of 2010, unless otherwise stated.

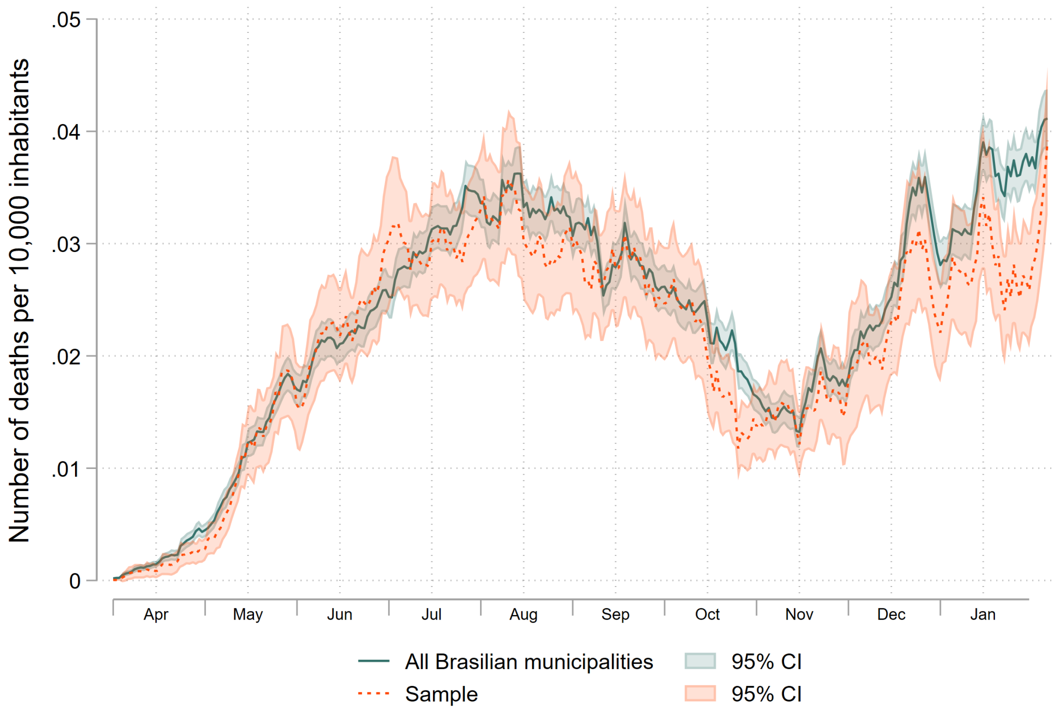
A2 COVID-19 data

Figure A1: Correlation of municipal COVID-19 deaths from Brasil.io and SIVEP-Gripe



Notes: This scatterplot reports the total number of deaths per 10,000 inhabitants accumulated as of January 31, 2021 in each municipality in the Brasil.io dataset (x-axis) and the SIVEP-Gripe dataset (y-axis).

Figure A2: Evolution of COVID-19 deaths across Brazilian municipalities



Notes: This graph plots the cross-municipality averages of the 7-day moving average of the number of deaths per 10,000 inhabitants (using the 2010 census) across Brazilian municipalities for each day from April 1st to January 31st. In blue, we consider all Brazilian municipalities, while in orange we consider only municipalities part of our sample of analysis. For both, we exclude municipalities in the state of Mato Grosso (3.3 percent), where some misreporting issues arose.

A3 Policies data

Table A2: Number and share of municipalities that implemented containment policies

Policy	Representative municipalities	Share of total (%)	Municipalities in sample	Share of total (%)
Commerce restrictions	353	70.46	315	66.18
Curfew	54	10.78	57	11.97
Events cancellations	474	94.61	453	95.17
Facemask mandatory	457	91.22	419	88.03
Gathering restrictions	453	90.42	428	89.92
Lockdown	40	7.98	38	7.98
School closure	461	92.02	447	93.91
Transport restrictions	200	39.92	144	30.25
Travel restrictions	199	39.72	202	42.44
Workplace restrictions	147	29.34	145	30.46
Total	501	100	476	100

Notes: This table gives the number and share of municipalities that implemented the policy at least once over March and October, 2020. The first two columns look at a random sample of representative Brazilian municipalities, taken from Chauvin et al. (2021). The last two columns look at the municipalities in our sample of analysis for which data on policies are available.

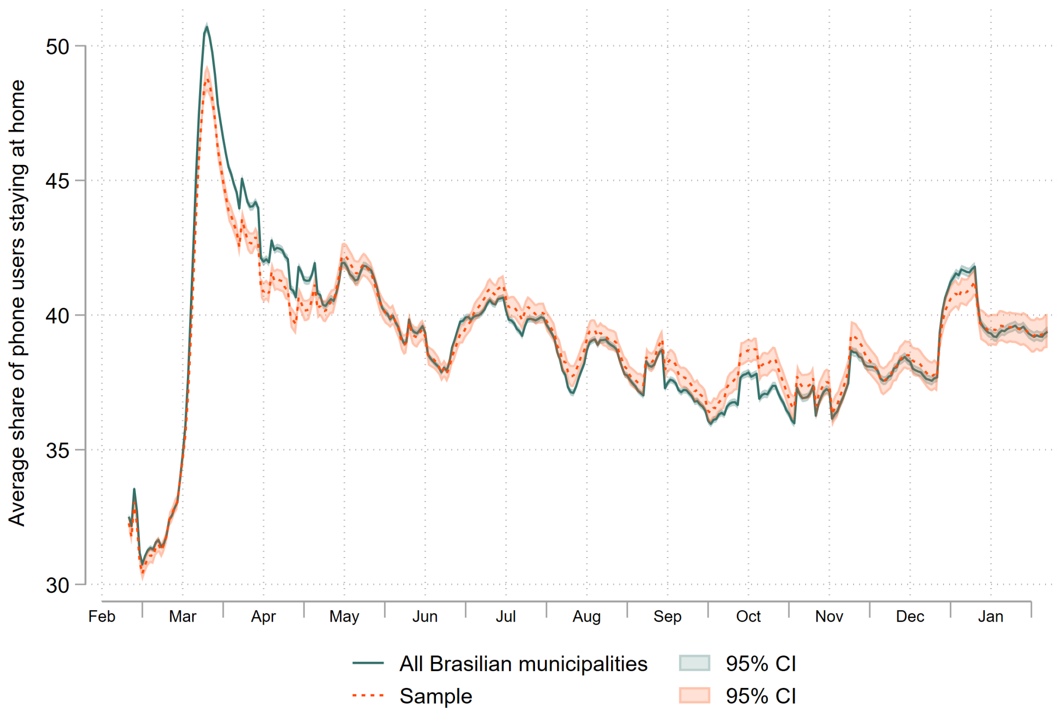
Table A3: Probability of implementing policy A (Row) given that policy B (Column) is in place the same day

	Commerce	Curfew	Events cancel	Face-masks	Gatherings	Lockdown	School	Transport	Travel	Workplace
Commerce	100	50.69	41.88	42.35	45.06	30.85	40.94	44.02	45.53	50.65
Curfew	11.43	100	9.17	11.57	9.7	18.15	9.14	10.87	12.52	14.1
Events cancel	96.19	93.38	100	93.19	95.47	95.15	93.63	94.58	94.86	95.79
Face-masks	76.87	93.15	73.65	100	75.5	100	75.25	83.73	81.77	84.23
Gatherings	88.71	84.72	81.82	81.88	100	77.89	80.13	84.25	85.89	85.21
Lockdown	3.83	10.01	5.15	6.85	4.92	100	5.17	5.36	6.37	4.33
School	93.33	92.46	92.93	94.51	92.79	94.81	100	92.07	94.58	94.48
Transport	26.92	29.49	25.19	28.21	26.18	26.35	24.7	100	36.76	29.72
Travel	42.57	51.93	38.62	42.13	40.8	47.93	38.79	56.19	100	52.2
Workplace	27.08	33.45	22.3	24.82	23.15	18.62	22.16	25.98	29.85	100

Notes: Each cell represent the share of days a policy in the row has been implemented during the days a policy in the column is in place over the period from March 1, 2020 through October 31, 2020. The figure is based on data from a random sample of representative Brazilian municipalities, taken from Chauvin et al. (2021).

A4 Mobility data

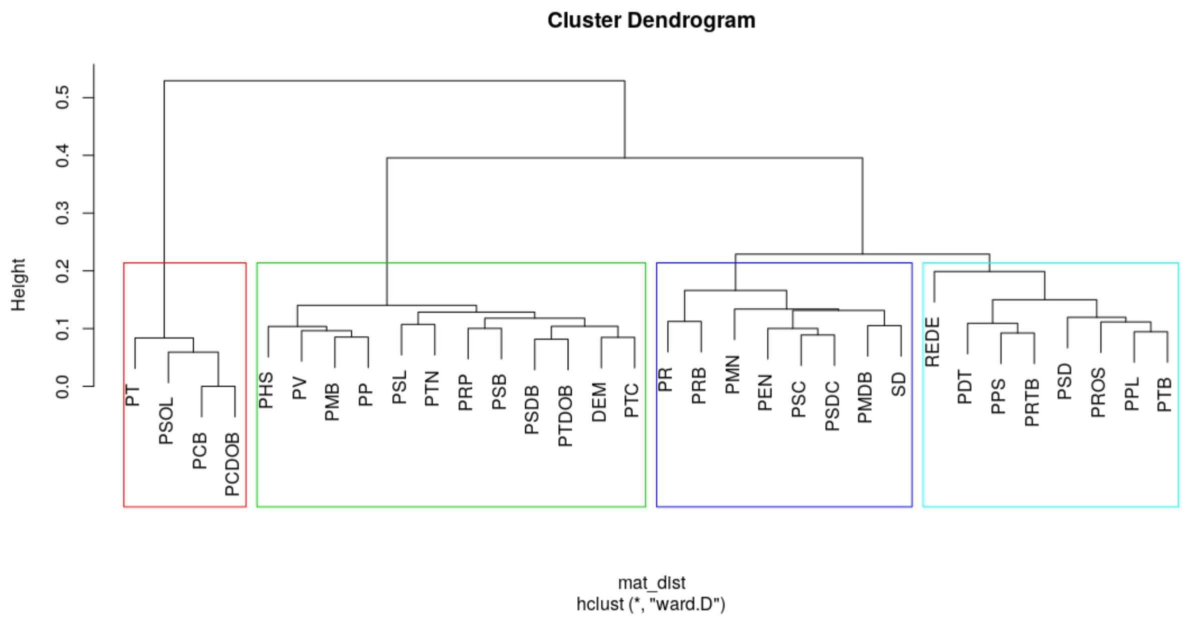
Figure A3: Evolution of the isolation index across Brazilian municipalities



Notes: This graph plots the average share of phone users staying at home across Brazilian municipalities for each day from February 25, 2020 to January 31, 2021. In blue, we consider all Brazilian municipalities, while in orange we consider only municipalities part of our sample of analysis. For both, we consider a balanced panel of municipalities, excluding those with missing values during the period of interest.

A5 Elections data

Figure A4: Data-driven classification of political orientations



Notes: This dendogram shows the results of a hierarchical cluster analysis exercise using data from the 2016 municipal election. The analysis uses as an input a measure of relative distance between each pairwise combination of political parties. For each pair, we fist compute, for the party with the smallest number of votes within each pair, the share of its total votes that came from coalitions that featured both parties (across all municipal elections in the country). In other words, this is the share of votes that the smallest party in the pair received that also went to the largest party in the pair. The absolute distance between the two parties is the inverse of this share, and the relative distance is the absolute distance divided by the maximum distance observed among all pairwise combination of parties. We obtain 4 political orientations, which we denote"Left" (red block), "Center-right and liberals" (green block), "Right and Christians" (blue block), and "Center left" (light blue box).

B Balance tests

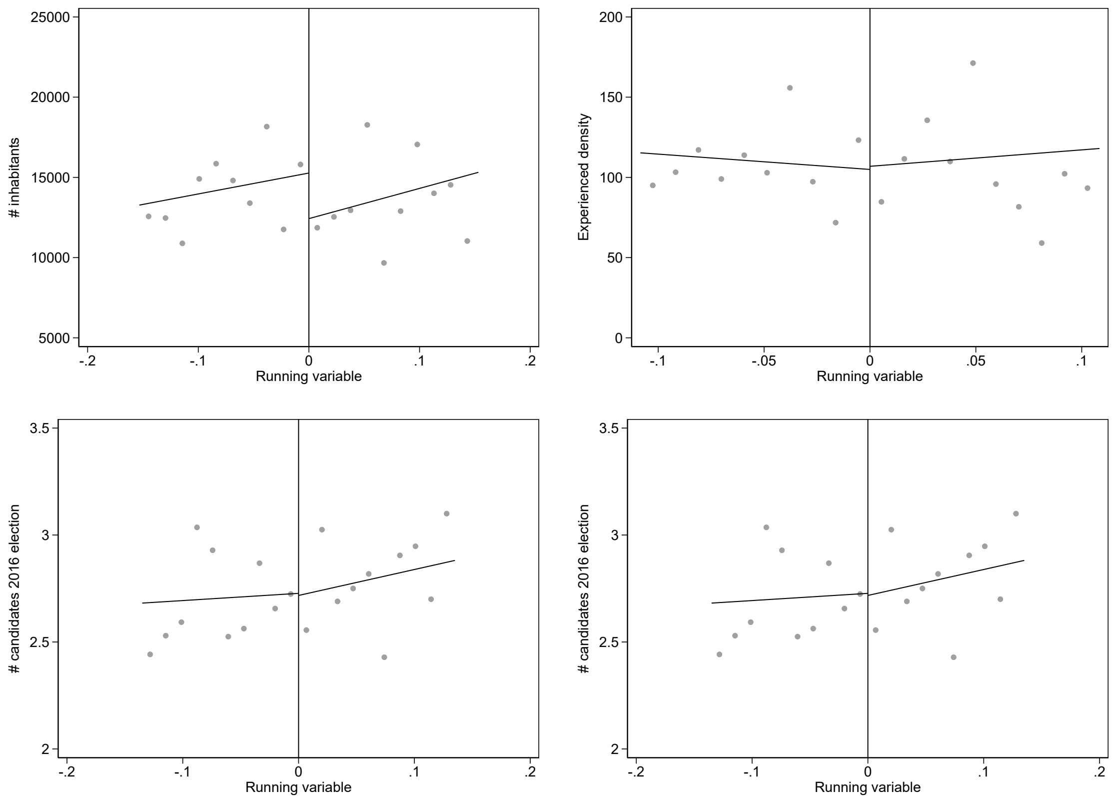
Table B1: Balance Test: Municipalities' characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Outc.	pop	density	persons /room	commuting	% above 65 y.old	nursing h. residents	area	distance to Sao Paulo	km to airport	median income
Treat.	-2,842	2.0	-0.032	0.284	0.003	-1.096	-1,795*	-107	-65.2	34.3
	(1,982)	(23.8)	(0.037)	(0.856)	(0.004)	(1.459)	(837.0)	(124)	(36.4)	(20.53)
P-value	0.200	0.785	0.465	0.731	0.358	0.611	0.0613	0.505	0.114	0.138
Obs	653	488	606	517	500	580	539	600	591	725
Polyn.	1	1	1	1	1	1	1	1	1	1
Bdw	0.153	0.108	0.141	0.120	0.114	0.134	0.126	0.139	0.137	0.187
Mean	15,272	105.0	0.731	21.296	0.078	4.008	2,924	1,551	345.0	293.2

	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Outc.	inform. rate	unemp. rate	% college employed	% black & mixed	turnout	number cand	orientation 1	orientation 2	orientation 3	orientation 4
Treat.	0.003	-0.004	-0.005	-0.045	0.019	-0.010	-0.008	-0.021	0.021	0.015
	(0.010)	(0.004)	(0.005)	(0.037)	(0.010)	(0.187)	(0.052)	(0.031)	(0.057)	(0.047)
P-value	0.779	0.490	0.440	0.311	0.137	0.820	0.994	0.658	0.688	0.961
Obs	570	617	585	570	579	585	555	498	527	613
Polyn.	1	1	1	1	1	1	1	1	1	1
Bdw	0.130	0.144	0.135	0.131	0.133	0.135	0.128	0.113	0.123	0.143
Mean	0.167	0.046	0.069	0.613	0.846	2.727	0.343	0.074	0.279	0.294

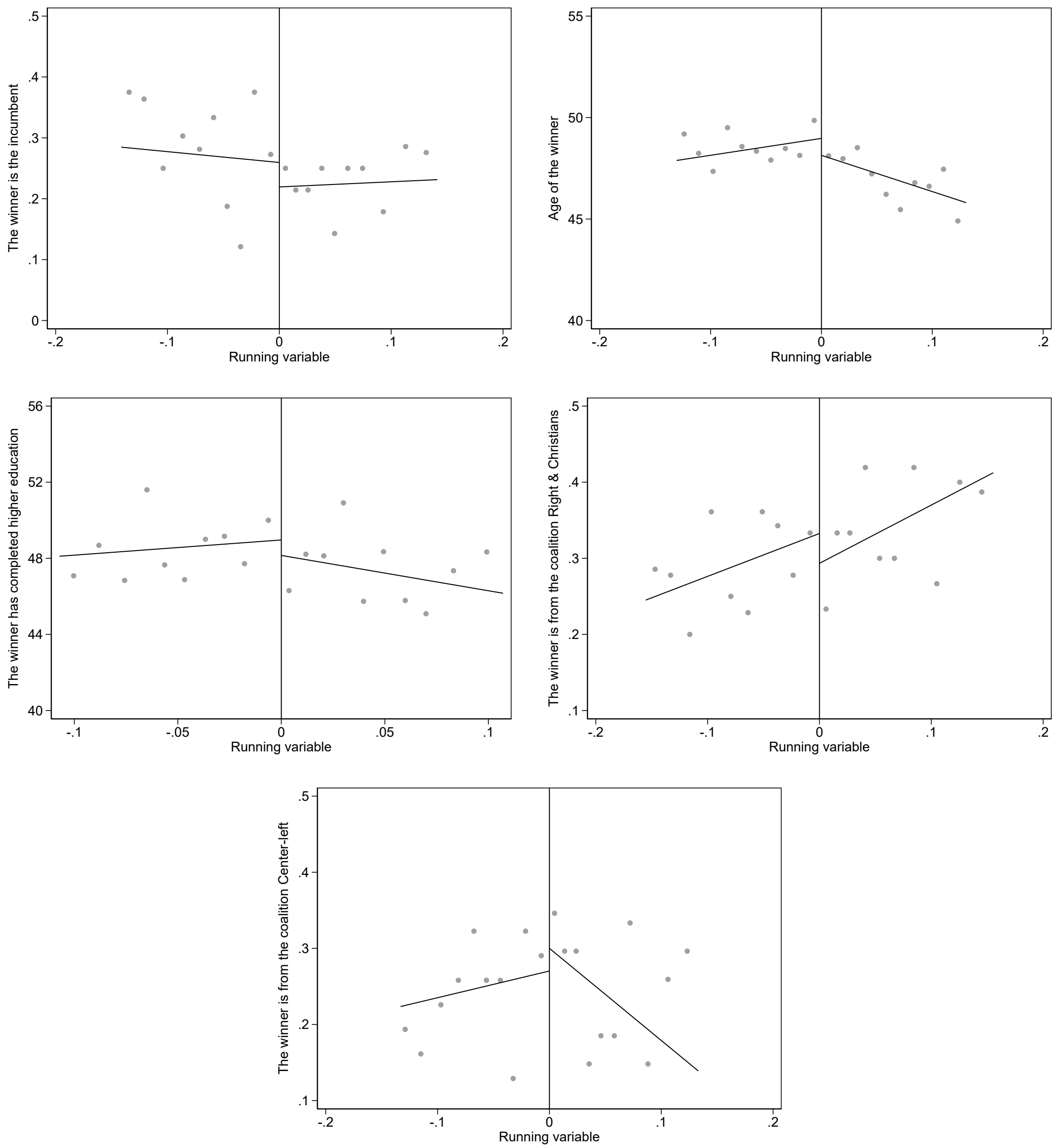
Notes: Each column considers a specific baseline characteristic, as defined in Table A1. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure B1: Balance Test: Population, density, share above 65 years old, and number of candidates



Notes: This figure is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the baseline characteristic. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

Figure B2: Balance test: Characteristics of the winner of the election



Notes: This figure is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the outcome variable. Averages are calculated within evenly-spaced (resp. quantile-spaced) bins of the running variable for continous (resp. binary) outcome variables. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

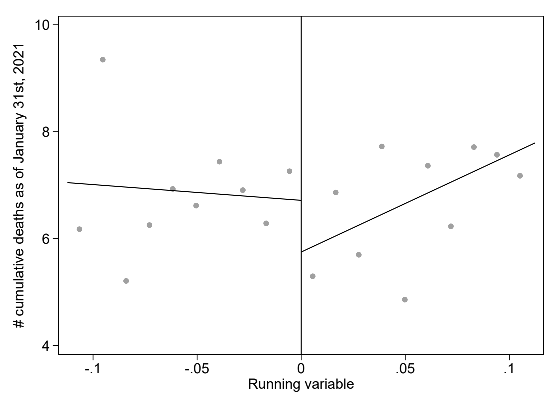
C Additional results on COVID-19 deaths

Table C1: Impact on the cumulative number of COVID-19 deaths as of January 31st, 2021

	(1)
Ouctome	Cumulative number of COVID-19 deaths As of 01/31/2021
Treatment	-0.967
	(0.789)
Robust p-value	0.228
Observations	498
Polyn. order	1
Bandwidth	0.112
Mean, left of threshold	6.717

Notes: The outcome is the cumulative number of deaths per 10,000 inhabitants (using the 2010 census) as of January 31st, 2021. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure C1: Impact on the cumulative number of COVID-19 deaths as of January 31st, 2021



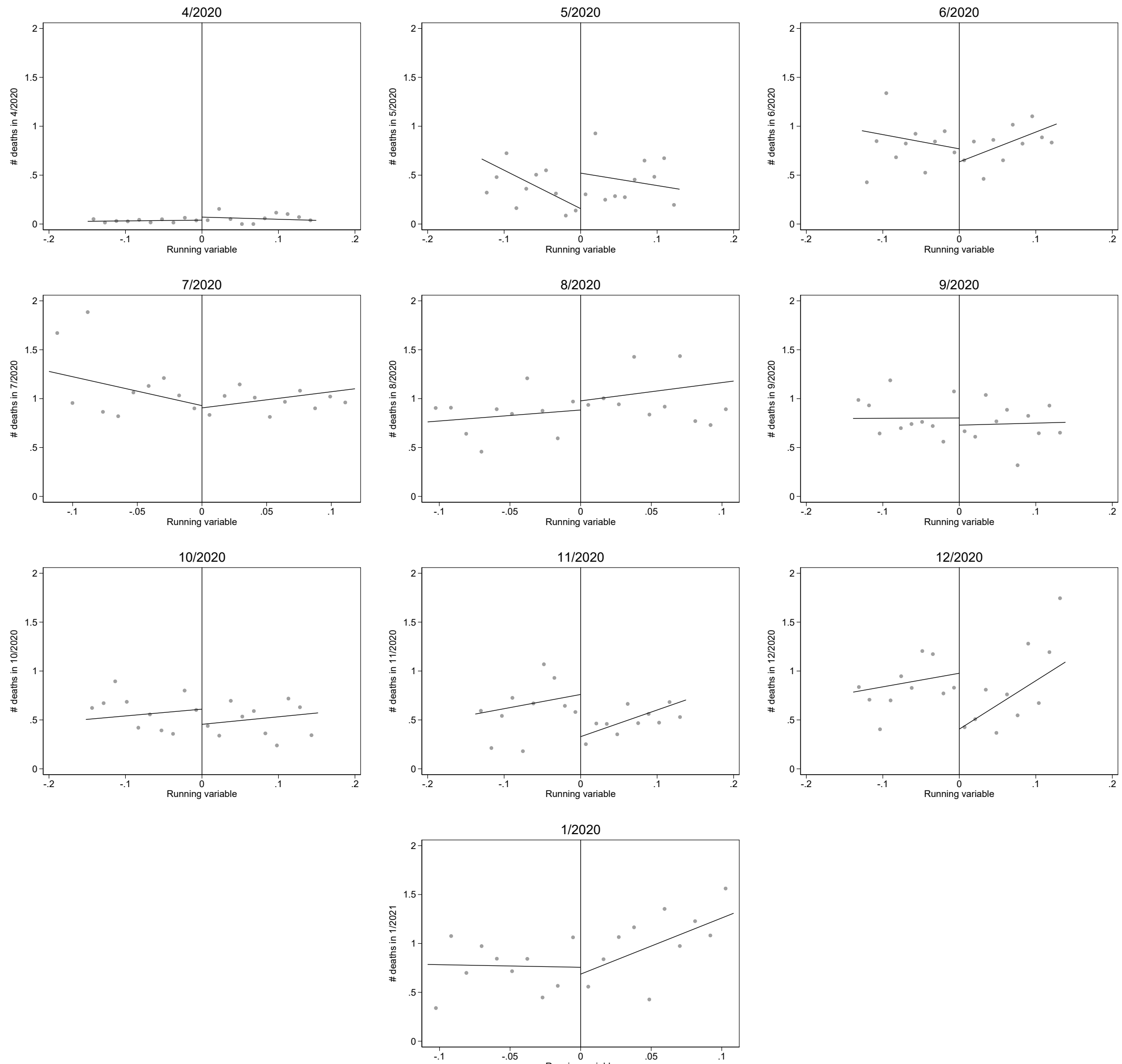
Notes: Each graph is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the cumulative number COVID-19 deaths per 10,000 inhabitants in the municipality as of January 31st, 2021. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

Table C2: Impact on monthly COVID-19 deaths

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ouctome	Number of COVID-19 deaths per 10,000 inhabitants									
	04/20	05/20	06/20	07/20	08/20	09/20	10/20	11/20	12/20	01/21
Treatment	0.031	0.363**	-0.133	-0.023	0.093	-0.073	-0.155	-0.431**	-0.571**	-0.070
	(0.037)	(0.173)	(0.256)	(0.232)	(0.287)	(0.193)	(0.192)	(0.186)	(0.218)	(0.267)
R. p-value	0.524	0.043	0.664	0.970	0.969	0.747	0.391	0.025	0.016	0.645
Obs.	638	561	548	514	488	597	648	592	596	488
Polyn.	1	1	1	1	1	1	1	1	1	1
Bandwidth	0.162	0.165	0.167	0.171	0.170	0.164	0.162	0.133	0.146	0.118
Mean	0.040	0.215	0.850	0.978	0.778	0.783	0.597	0.755	0.984	0.760

Notes: Each column takes as outcome the total number of deaths per 10,000 inhabitants (using the 2010 census) during the month of interest. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure C2: Impact on monthly COVID-19 deaths



Notes: Each graph is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the total number COVID-19 deaths per 10,000 inhabitants in the municipality during the month of interest. Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

D Additional results on policies

Table D1: Impact of having a female mayor on the timing of policies adoption

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome	Date at which the policy was first implemented						
	commerce	workplace	travel	transport	curfew	lockdown	any
Treatment	33.042**	20.152	-4.328	6.118	-23.749	-0.116	16.025
	(13.315)	(23.263)	(15.448)	(30.494)	(32.900)	(18.986)	(9.018)
Robust p-value	0.012	0.540	0.745	0.833	0.568	0.862	0.105
Observations	175	85	127	83	27	24	280
Polyn. order	1	1	1	1	1	1	1
Bandwidth	0.128	0.129	0.137	0.141	0.114	0.140	0.163
Mean, left of threshold	101.515	115.539	107.515	113.924	140.019	141.196	97.770

Notes: The sample varies by policies, and is restricted to municipalities that implemented the policy at some point during the period of analysis. The outcome is the number of days between December 31, 2019 and the first day in which the municipality implemented the corresponding policy (columns 1 through 6) or any of the six policies considered (column 7). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table D2: Impact of having a female mayor on workplace restrictions by month

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with workplace restrictions in place							
	03/20	04/20	05/20	06/20	07/20	08/20	09/20	10/20
Treatment	-0.680	-2.179	-0.233	3.674	1.344	0.694	1.476	1.843
	(0.847)	(2.508)	(3.202)	(3.908)	(3.898)	(3.788)	(3.744)	(3.798)
Robust p-value	0.614	0.579	0.834	0.241	0.576	0.692	0.549	0.487
Observations	256	269	256	227	249	255	250	249
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.119	0.127	0.118	0.096	0.110	0.116	0.113	0.111
Mean, left of threshold	1.398	4.925	5.616	4.742	6.216	6.730	6.918	7.020

Notes: The sample is restricted to municipalities for which data on policies are available. The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table D3: Impact of having a female mayor on travel restrictions by month

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with travel restrictions in place							
	03/20	04/20	05/20	06/20	07/20	08/20	09/20	10/20
Treatment	-1.352	-3.576	-4.349	-3.366	-2.571	-4.899	-6.232	-6.604
	(1.522)	(3.796)	(3.922)	(4.006)	(4.002)	(4.077)	(4.151)	(4.213)
Robust p-value	0.367	0.315	0.239	0.377	0.495	0.215	0.129	0.111
Observations	255	249	249	250	250	245	243	237
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.115	0.110	0.111	0.112	0.113	0.108	0.107	0.104
Mean, left of threshold	3.267	8.453	11.005	11.888	11.713	12.702	13.301	13.413

Notes: The sample is restricted to municipalities for which data on policies are available. The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table D4: Impact of having a female mayor on transport restrictions by month

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with transport restrictions in place							
	03/20	04/20	05/20	06/20	07/20	08/20	09/20	10/20
Treatment	0.309	0.949	0.919	2.719	2.696	0.979	0.641	1.293
	(1.196)	(3.063)	(3.110)	(3.087)	(3.123)	(3.262)	(3.432)	(3.649)
Robust p-value	0.846	0.640	0.624	0.308	0.323	0.647	0.699	0.564
Observations	280	257	255	256	256	252	249	237
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.132	0.120	0.115	0.118	0.118	0.114	0.110	0.104
Mean, left of threshold	2.028	5.071	5.064	4.546	4.731	6.114	6.724	6.875

Notes: The sample is restricted to municipalities for which data on policies are available. The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table D5: Impact of having a female mayor on curfew by month

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome	Number of days with a curfew in place						
	04/20	05/20	06/20	07/20	08/20	09/20	10/20
Treatment	0.898	1.558	2.415	2.354	2.562	2.789	2.789
	(1.780)	(2.246)	(2.557)	(2.686)	(2.655)	(2.674)	(2.674)
Robust p-value	0.663	0.575	0.431	0.486	0.365	0.304	0.304
Observations	277	266	259	256	259	257	257
Polyn. order	1	1	1	1	1	1	1
Bandwidth	0.130	0.125	0.122	0.118	0.121	0.119	0.119
Mean, left of threshold	1.418	1.810	1.987	2.517	2.450	2.423	2.423

Notes: The sample is restricted to municipalities for which data on policies are available. The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table D6: Impact of having a female mayor on lockdown by month

	(1)	(2)	(3)	(4)	(5)	(6)
Outcome	Number of days with a lockdown in place					
	05/20	06/20	07/20	08/20	09/20	10/20
Treatment	0.061	-2.696	-2.380	-2.396	-2.364	-2.329
	(1.363)	(2.330)	(2.540)	(2.491)	(2.494)	(2.484)
Robust p-value	0.875	0.212	0.270	0.274	0.281	0.289
Observations	270	270	245	242	250	250
Polyn. order	1	1	1	1	1	1
Bandwidth	0.128	0.109	0.106	0.111	0.111	0.112
Mean, left of threshold	1.076	3.768	4.001	3.896	3.867	3.813

Notes: The sample is restricted to municipalities for which data on policies are available. The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure D1: Impact of having a female mayor on policies: Daily estimates

Notes: The sample is restricted to municipalities for which data on policies are available. This figure plots the estimated daily coefficients of the effect of having a female mayor on an indicator equal to 1 if the policy was implemented on that day.

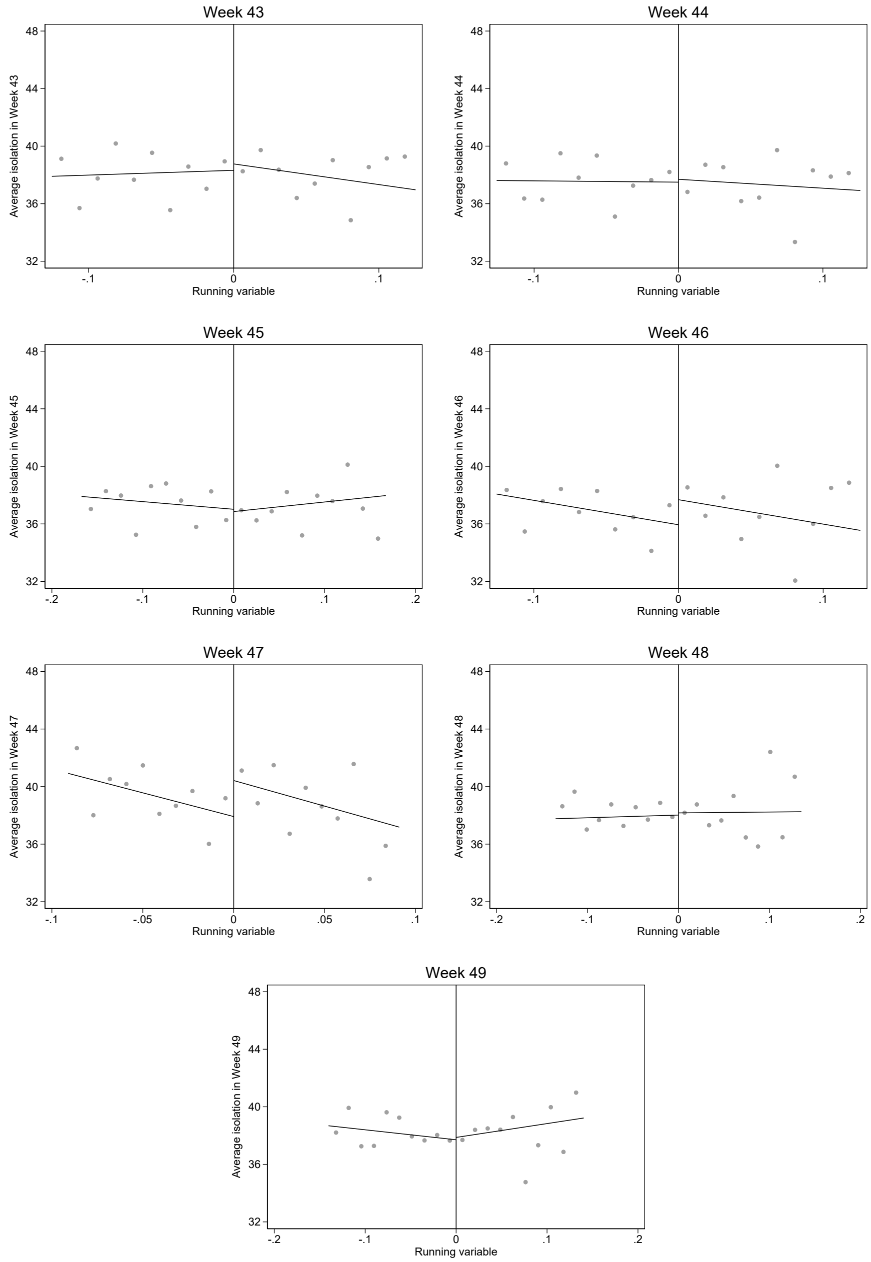
E Additional results on isolation

Table E1: Impact of having a female mayor on the weekly average of the isolation index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome	Weekly average share of phone users staying at home						
	Week 43	Week 44	Week 45	Week 46 (election)	Week 47	Week 48	Week 49
Treatment	0.443	0.198	-0.158	1.741	2.504**	0.149	0.164
	(1.058)	(1.051)	(1.096)	(1.175)	(1.308)	(1.110)	(1.387)
R. p-value	0.660	0.863	0.997	0.127	0.049	0.880	0.934
Obs.	159	160	196	159	119	170	174
Polyn. order	1	1	1	1	1	1	1
Bandwidth	0.125	0.126	0.167	0.126	0.091	0.135	0.140
Mean	38.321	37.498	37.017	35.942	37.916	38.021	37.707

Notes: We restrict the sample to a balanced panel of municipalities, excluding those with missing values between Feb-25-2020 and Jan-31-2020. The outcome is the weekly average of the isolation index, which measures the share of phone users staying at home on a given day day. The week numbers refer to the number of weeks since January 1st. Week 46 corresponds to the week of the election (first round). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure E1: Impact of having a female mayor on the weekly average of the isolation index



Notes: We restrict the sample to a balanced panel of municipalities, excluding those with missing values between Feb-25-2020 and Feb-25-2021. This figure is constructed by restricting the support to observations in the estimation bandwidths and by setting the fit to match the local polynomial point estimator (polynomial order 1 and triangular kernel). Dots represent the local averages of the weekly average of the isolation index, which measures the share of phone users staying at home on a given day day. The week numbers refer to the number of weeks since January 1st. Week 46 corresponds to the week of the election (first round). Averages are calculated within evenly-spaced bins of the running variable. The running variable is the margin of victory of the female candidate in the 2016 election (percentage point difference between the vote share of the female and the male candidates). Positive values denote that the female candidate won the election, and negative values that the male candidate prevailed.

F Robustness tests

Alternative death measure. To make sure that our results are not affected by misreporting issues, we generate daily RD estimates on the cumulative number of deaths using the SIVEP data presented in Section 2.3. While the data we use in the rest of the paper come from state health secretaries, this alternative measure comes from hospital records collected by the Ministry of Health. As shown in Appendix Figure F4, the two data sources provide very close estimated effects across the whole period.

Controls. We test the robustness of our results to adding a wide range of controls. In Panel A of Appendix Tables F1, F2, and F3, we include the 20 municipal-level characteristics presented in Table 1, while in Panel B we include the 7 mayor's characteristics presented in Table 3. All estimates are very close in magnitude when including either sets of controls, and they all remain significant.

State fixed effects. Given that state governments also have jurisdiction over municipalities territory, the policies implemented at the state level are likely to influence mayors' decisions and COVID-19 outcomes. However, variations in state policies are unlikely to explain our results. First, Figure 2 shows that female- and male-led municipalities are evenly distributed over the territory. Second, municipalities are balanced on a wide range of characteristics at the threshold, including distance to Sao Paulo, suggesting that female-led municipalities do not systematically belong to different states at the threshold (Appendix B). Third, Panel C of Appendix Tables F1, F2, and F3 shows that our results are robust to exploiting within state variation only. The results remain virtually unchanged in both significance and magnitude when including state fixed effects.[22]

Sample selection. We test the robustness of the results to excluding some unusual observations from the sample: municipalities in the state of Mato Grosso, for which we observed some irregularities in the deaths data (3.0 percent of the sample) and municipalities that held supplementary elections (2.5 percent). As shown in Panel D of Appendix Tables F1, F2, and F3, the magnitude of the results is not affected by this restriction. The only coefficient losing statistical significance is the one associated to the impact on commerce restrictions in September. However, the magnitude remains high, and the coefficient associated to October remains significant.

Bandwidths and polynomial order. Figures F1, F2, and F3 plot the point estimates for each outcome using a wide range of different bandwidths, and using either a first or a second order polynomial. Overall, the effect is of similar magnitude across polynomial orders, and most coefficients are stable in a large window around the optimal bandwidths. The only exceptions are the impact on commerce restrictions in the late period and the impact on the weekly isolation index: when using a polynomial order 1, the effects tend to decrease as we go away from the discontinuity, but they remain high if we move closer, and when using a second order polynomial.

[22]In order to include state fixed effects, we removed states containing only a few municipalities that are part of our sample. More precisely, we removed 9 states containing fewer than 20 municipalities, accounting for 8.0 percent of our sample

Table F1: Impact on COVID-19 deaths: Robustness tests

Panel A: Controlling for municipality characteristics

	(1)	(2)	(3)	(4)
Outcome	Number of Covid-19 deaths			
	No control		With controls	
	Period 1	Period 4	Period 1	Period 4
Treatment	0.387**	-1.001**	0.397**	-0.980**
	(0.175)	(0.405)	(0.159)	(0.388)
Robust p-value	0.037	0.016	0.022	0.025
Observations	580	514	515	492
Polyn. order	1	1	1	1
Bandwidth	0.134	0.118	0.119	0.109
Mean	0.206	2.434	0.179	2.391

Panel B: Controlling for the mayor's characteristics

	(1)	(2)	(3)	(4)
Outcome	Number of Covid-19 deaths			
	No control		With controls	
	Period 1	Period 4	Period 1	Period 4
Treatment	0.387**	-1.001**	0.438**	-0.913**
	(0.175)	(0.405)	(0.179)	(0.403)
Robust p-value	0.037	0.016	0.021	0.027
Observations	580	514	527	501
Polyn. order	1	1	1	1
Bandwidth	0.134	0.118	0.122	0.114
Mean	0.206	2.434	0.184	2.414

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Panel C: State fixed effects

	(1)	(2)	(3)	(4)
Outcome	Number of Covid-19 deaths			
	Full sample		Restricted + State FE	
	Period 1	Period 4	Period 1	Period 4
Treatment	0.387**	-1.001**	0.416**	-1.044**
	(0.175)	(0.405)	(0.159)	(0.410)
Robust p-value	0.037	0.016	0.015	0.013
Observations	580	514	560	471
Polyn. order	1	1	1	1
Bandwidth	0.134	0.118	0.141	0.117
Mean	0.206	2.434	0.205	2.422

Panel D: Excluding unusual observations

	(1)	(2)	(3)	(4)
Outcome	Number of Covid-19 deaths			
	Full sample		Robustness sample	
	Period 1	Period 4	Period 1	Period 4
Treatment	0.387**	-1.001**	0.392**	-0.881**
	(0.175)	(0.405)	(0.178)	(0.414)
Robust p-value	0.037	0.016	0.035	0.040
Observations	580	514	564	486
Polyn. order	1	1	1	1
Bandwidth	0.134	0.118	0.139	0.117
Mean	0.206	2.434	0.218	2.309

Notes: In Panel A (resp., B), columns 3 and 4, we include as controls all the municipal (resp., winner's) characteristics presented in Table 1 (resp., Table 3). In Panel C, columns 3 and 4, we include state fixed effects and remove municipalities part of states with fewer than 20 municipalities in our sample (8.0 percent). In Panel D, columns 3 and 4, we remove municipalities part of Mato Grosso state (3.0 percent) and municipalities that held a supplementary election (2.5 percent). The outcome is the total number of deaths per 10,000 inhabitants (using the 2010 census) during the period of interest. Period 1 (resp., 4) corresponds to April-May 2020 (resp., November 2020-January 2021). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robustp-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table F2: Impact on commerce restrictions: Robustness tests

Panel A: Controlling for municipality characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with commerce restrictions in place							
	No control				With controls			
	03/20	04/20	09/20	10/20	03/20	04/20	09/20	10/20
Treatment	-2.495**	-6.506**	7.252*	7.539*	-2.228*	-6.355**	7.997*	8.280**
	(0.977)	(2.836)	(4.337)	(4.297)	(1.026)	(2.635)	(4.096)	(4.094)
Robust p-value	0.018	0.037	0.067	0.056	0.052	0.038	0.065	0.043
Observations	243	250	232	232	232	243	201	201
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.108	0.112	0.099	0.099	0.099	0.107	0.084	0.084
Mean, left of threshold	3.182	10.624	7.861	6.582	3.198	10.626	8.112	6.760

Panel B: Controlling for the mayor's characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with commerce restrictions in place							
	No control				With controls			
	03/20	04/20	09/20	10/20	03/20	04/20	09/20	10/20
Treatment	-2.495**	-6.506**	7.252*	7.539*	-2.452**	-6.759**	6.460*	6.852*
	(0.977)	(2.836)	(4.337)	(4.297)	(1.000)	(2.858)	(4.212)	(4.240)
Robust p-value	0.018	0.037	0.067	0.056	0.018	0.029	0.092	0.077
Observations	243	250	232	232	246	243	232	232
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.108	0.112	0.099	0.099	0.109	0.107	0.099	0.098
Mean, left of threshold	3.182	10.624	7.861	6.582	3.187	10.626	7.859	6.581

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Panel C: State fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with commerce restrictions in place							
	Full sample				Restricted + State FE			
	03/20	04/20	09/20	10/20	03/20	04/20	09/20	10/20
Treatment	-2.495**	-6.506**	7.252*	7.539*	-2.574**	-5.414*	6.851*	7.088*
	(0.977)	(2.836)	(4.337)	(4.297)	(0.922)	(2.604)	(4.131)	(4.088)
Robust p-value	0.018	0.037	0.067	0.056	0.014	0.074	0.067	0.056
Observations	243	250	232	232	231	217	180	183
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.108	0.112	0.099	0.099	0.124	0.109	0.086	0.088
Mean, left of threshold	3.182	10.624	7.861	6.582	3.661	11.894	9.341	7.859

Panel D: Excluding unusual observations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with commerce restrictions in place							
	Full sample				Robustness sample			
	03/20	04/20	09/20	10/20	03/20	04/20	09/20	10/20
Treatment	-2.495**	-6.506**	7.252*	7.539*	-2.250**	-6.460*	6.009	7.085*
	(0.977)	(2.836)	(4.337)	(4.297)	(0.970)	(2.942)	(4.390)	(4.367)
Robust p-value	0.018	0.037	0.067	0.056	0.037	0.049	0.128	0.078
Observations	243	250	232	232	242	240	221	219
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.108	0.112	0.099	0.099	0.120	0.115	0.102	0.098
Mean, left of threshold	3.182	10.624	7.861	6.582	3.118	10.949	8.884	7.528

Notes: The sample is restricted to municipalities for which data on policies are available. In Panel A (resp., B), columns 3 and 4, we include as controls all the municipal (resp., winner's) characteristics presented in Table 1 (resp., Table 3). In Panel C, columns 3 and 4, we include state fixed effects and remove municipalities part of states with fewer than 20 municipalities in our sample (8.0 percent). In Panel D, columns 3 and 4, we remove municipalities part of Mato Grosso state (3.0 percent) and municipalities that held a supplementary election (2.5 percent). The outcome is the number of days during which the policy was in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robustp-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table F3: Impact of the isolation index: Robustness tests

Panel A: Controlling for municipality characteristics

	(1)	(2)	(3)	(4)
Outcome	Weekly average share of phone users staying at home			
	No control		With controls	
	Week 46	Week 47	Week 46	Week 47
Treatment	1.741	2.504**	1.332	1.887*
	(1.175)	(1.308)	(1.127)	(1.202)
Robust p-value	0.127	0.049	0.174	0.100
Observations	159	119	143	129
Polyn. order	1	1	1	1
Bandwidth	0.126	0.091	0.108	0.097
Mean, left of threshold	35.942	37.916	35.845	37.990

Panel B: Controlling for the mayor's characteristics

	(1)	(2)	(3)	(4)
Outcome	Weekly average share of phone users staying at home			
	No control		With controls	
	Week 46	Week 47	Week 46	Week 47
Treatment	1.741	2.504**	1.842*	2.317**
	(1.175)	(1.308)	(1.136)	(1.262)
Robust p-value	0.127	0.049	0.088	0.049
Observations	159	119	148	116
Polyn. order	1	1	1	1
Bandwidth	0.126	0.091	0.112	0.088
Mean, left of threshold	35.942	37.916	35.865	37.922

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Panel C: State fixed effects

	(1)	(2)	(3)	(4)
Outcome	Weekly average share of phone users staying at home			
	Full sample		Restricted + State FE	
	Week 46	Week 47	Week 46	Week 47
Treatment	1.741	2.504**	1.837	2.740***
	(1.175)	(1.308)	(1.283)	(1.043)
Robust p-value	0.127	0.049	0.187	0.009
Observations	159	119	109	92
Polyn. order	1	1	1	1
Bandwidth	0.126	0.091	0.095	0.077
Mean, left of threshold	35.942	37.916	35.436	37.648

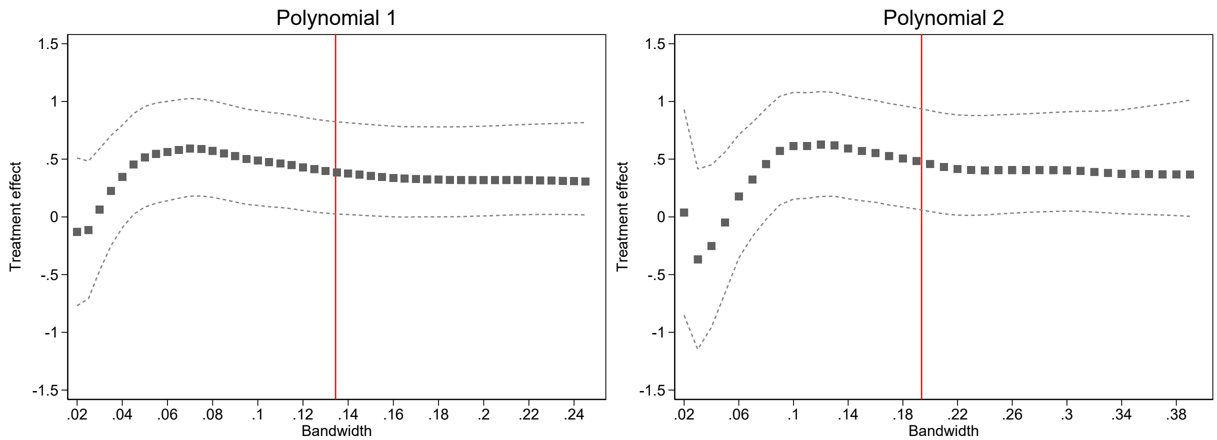
Panel D: Excluding unusual observations

	(1)	(2)	(3)	(4)
Outcome	Weekly average share of phone users staying at home			
	Full sample		Robustness sample	
	Week 46	Week 47	Week 46	Week 47
Treatment	1.741	2.504**	2.116*	2.701**
	(1.175)	(1.308)	(1.265)	(1.378)
Robust p-value	0.127	0.049	0.099	0.042
Observations	159	119	144	113
Polyn. order	1	1	1	1
Bandwidth	0.126	0.091	0.115	0.088
Mean, left of threshold	35.942	37.916	35.820	37.545

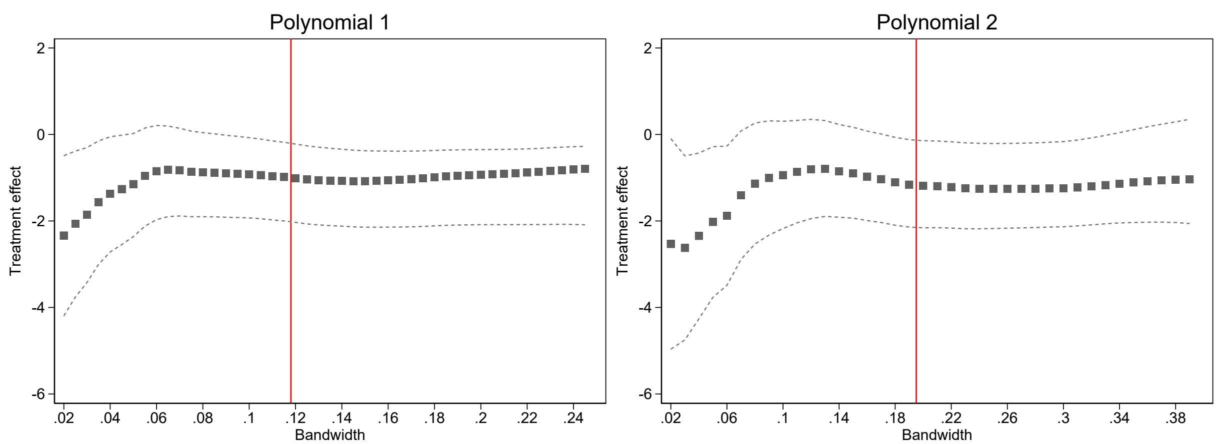
Notes: We restrict the sample to a balanced panel of municipalities, excluding those with missing values between Feb-25-2020 and Jan-31-2020. In Panel A (resp., B), columns 3 and 4, we include as controls all the municipal (resp., winner's) characteristics presented in Table 1 (resp., Table 3). In Panel C, columns 3 and 4, we include state fixed effects and remove municipalities part of states with fewer than 20 municipalities in our sample (8.0 percent). In Panel D, columns 3 and 4, we remove municipalities part of Mato Grosso state (3.0 percent) and municipalities that held a supplementary election (2.5 percent). The outcome is the weekly average of the isolation index, which measures the share of phone users staying at home each day. The week numbers refer to the number of weeks since January 1st. Week 46 corresponds to the week of the election (first round). The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robustp-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Figure F1: Impact on COVID-19 deaths: Robustness to bandwidths and polynomial order

Period 1

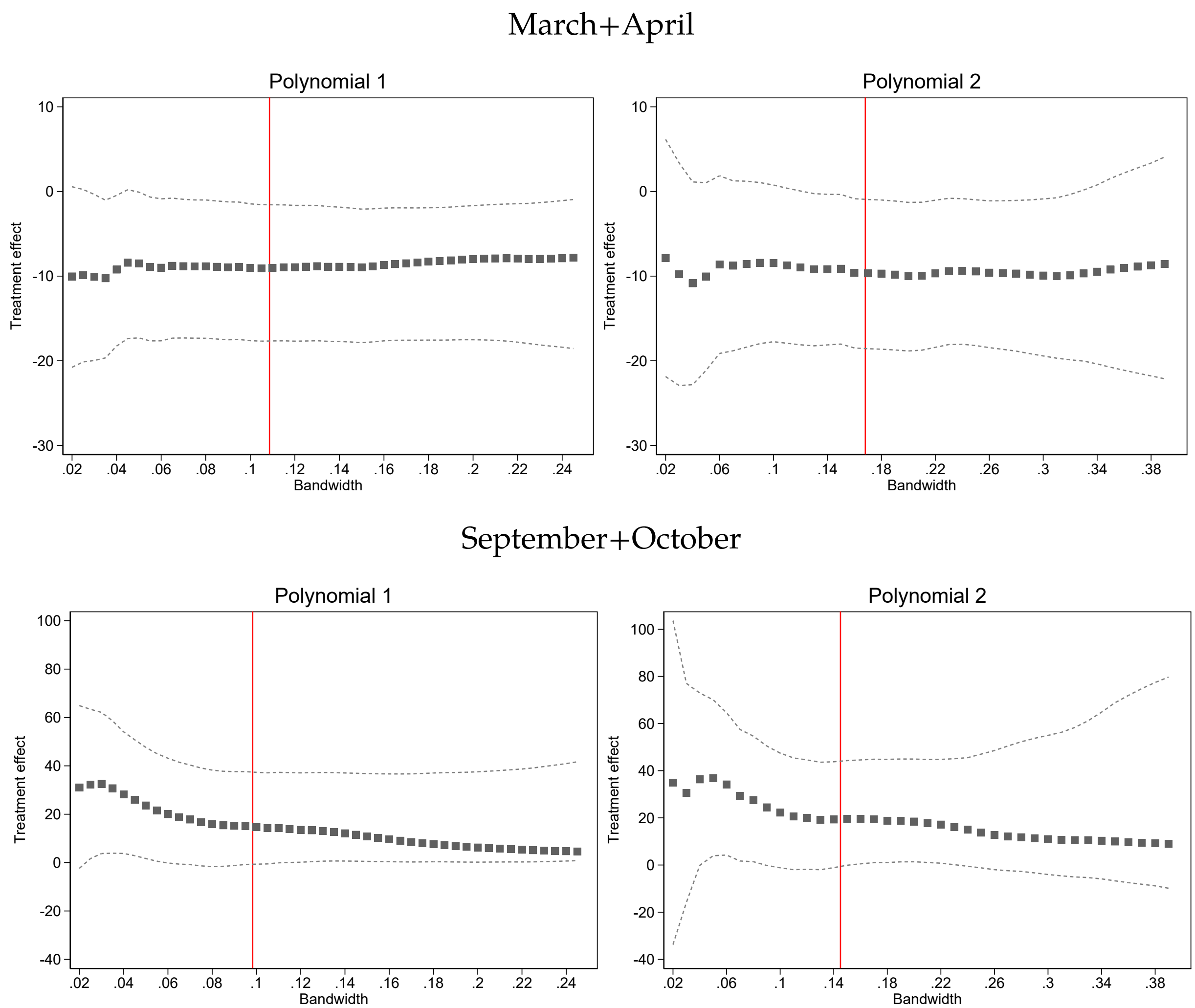


Period 4



Notes: These figures show the sensitivity of the point estimate to bandwidth choice, using a linear (polynomial 1) or quadratic specification (polynomial 2). Dots represent the estimated treatment effect using different bandwidths (horizontal axis). Dotted lines represent the 95% robust confidence interval. When using a polynomial order 1 (resp. 2), the estimates are reported for values of the bandwidth from 2 to 25 percentage points (resp. 40pp), in steps of 0.2 percentage points (resp. 0.4pp). The vertical red line gives the value of the MSERD optimal bandwidth used in the main estimation.

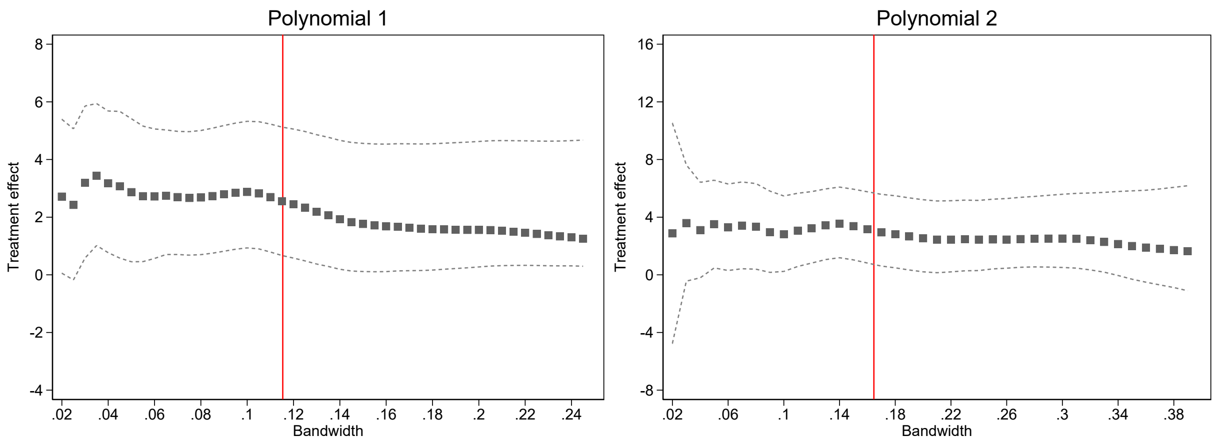
Figure F2: Impact on commerce restrictions: Robustness to bandwidths and polynomial order



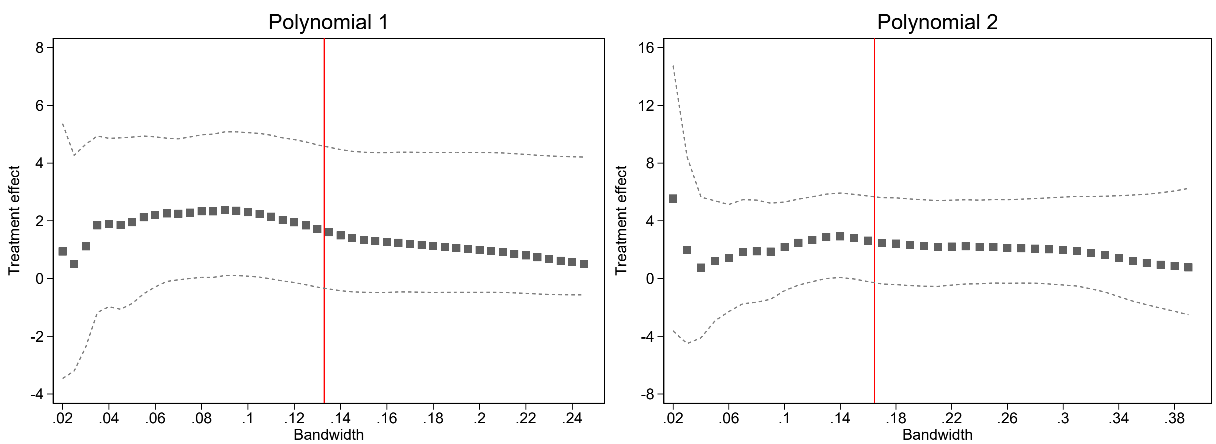
Notes: These figures show the sensitivity of the point estimate to bandwidth choice, using a linear (polynomial 1) or quadratic specification (polynomial 2). Dots represent the estimated treatment effect using different bandwidths (horizontal axis). Dotted lines represent the 95% robust confidence interval. When using a polynomial order 1 (resp. 2), the estimates are reported for values of the bandwidth from 2 to 25 percentage points (resp. 40pp), in steps of 0.2 percentage points (resp. 0.4pp). The vertical red line gives the value of the MSERD optimal bandwidth used in the main estimation.

Figure F3: Impact on the Isolation index: Robustness to bandwidths and polynomial order

Election week (Week 46)

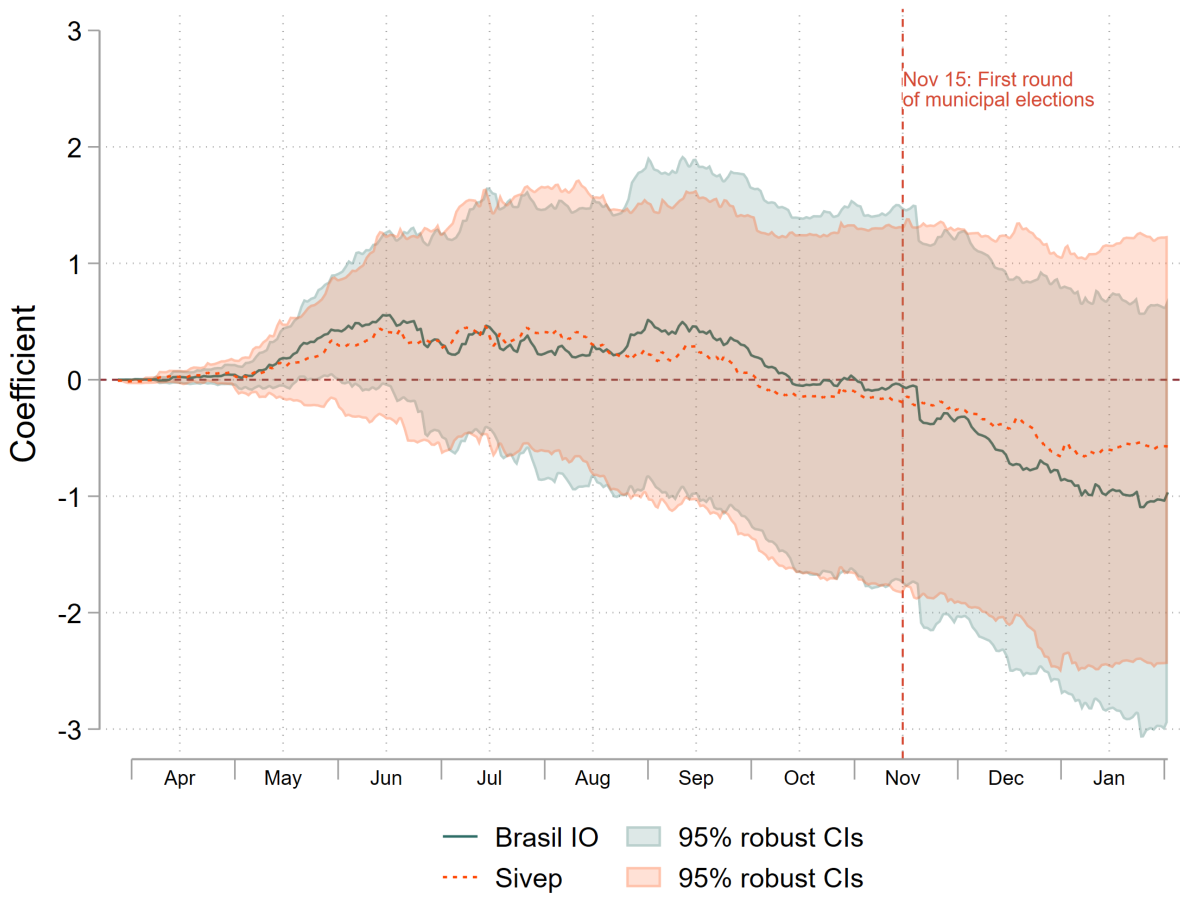


Week following the election (Week 47)



Notes: These figures show the sensitivity of the point estimate to bandwidth choice, using a linear (polynomial 1) or quadratic specification (polynomial 2). Dots represent the estimated treatment effect using different bandwidths (horizontal axis). Dotted lines represent the 95% robust confidence interval. When using a polynomial order 1 (resp. 2), the estimates are reported for values of the bandwidth from 2 to 25 percentage points (resp. 40pp), in steps of 0.2 percentage points (resp. 0.4pp). The vertical red line gives the value of the MSERD optimal bandwidth used in the main estimation.

Figure F4: Impact on the cumulative number of COVID-19 deaths using SIVEP data



Notes: This figure plots the RD estimates obtained by taking as outcome the cumulative number of Covid-19 deaths per10,000 inhabitants, for each day from April 1st to January 31st, 2020. In blue (resp. orange) are the point estimates and 95 percent robust intervals using Brasil.io (resp. SIVEP) data.

G Additional tables and figures

G1 Additional tables

Table G1: Descriptive statistics by gender of the mayor

	Female (N=422)		Male (N=561)	
	Mean	Sd	**Mean**	Sd
Panel A	*Socio-demographic characteristics*			
population	**13,879**	13,124	**13,971**	12,409
experienced density	**118.1**	219.0	**120.8**	157.3
average persons per room	**0.698**	0.216	**0.708**	0.262
commuting time	**21.6**	4.61	**21.5**	4.55
$\geq$65 years old	**0.083**	0.022	**0.082**	0.024
nursing home residents per 10k pop	**3.128**	8.829	**4.191**	13.111
area	**1,689**	5,830	**1,819**	5,190
distance sao paulo	**1,453**	739.8	**1,441**	740.5
km to closest airport connecting to hot spots	**289.0**	198.3	**309.9**	225.9
median household income p/c	**318.3**	138.4	**320.6**	148.4
informality rate	**0.169**	0.054	**0.169**	0.055
unemployment rate	**0.044**	0.022	**0.044**	0.021
college graduate employment share	**0.064**	0.029	**0.069**	0.030
black and mixed population share	**0.590**	0.214	**0.591**	0.215
Panel B	*Political characteristics*			
turnout	**0.858**	0.060	**0.853**	0.059
number candidates	**2.730**	0.979	**2.642**	0.934
center-right & liberal	**0.375**	0.306	**0.389**	0.311
left	**0.064**	0.160	**0.075**	0.175
center-left	**0.245**	0.271	**0.255**	0.284
right & Christian	**0.316**	0.292	**0.280**	0.282

Notes: The sample includes only municipalities outside of any *arranjos populacionais*, where one man and one woman were the two front runners in the 2016 election. The first (resp. last) two columns include only municipalities where a female (resp. male) candidate won the 2016 election. Socio-demographic variables come from the 2010 census, except for the experienced density that is defined as the total population living within 10 km of the average inhabitant of the municipality and which is computed using the 2015 data from the Global Human Settlement Layer. The political variables refer to the first round of the 2016 municipal election. The last four variables denote the vote share of each of the four main political orientations.

Table G2: Descriptive statistics: Broader samples of municipalities

	All (N=5,556)		Outside AP (N=4,424)	
	Mean	Sd	**Mean**	Sd
Panel A	*Socio-demographic characteristics*			
population	**33,706**	199,763	**13,615**	12,434
experienced density	**501.2**	1,667.8	**124.9**	167.2
average persons per room	**0.664**	0.213	**0.670**	0.226
commuting time	**22.2**	5.98	**21.2**	4.54
$\geq$65 years old	**0.084**	0.025	**0.086**	0.024
nursing home residents per 10k pop	**5.876**	12.832	**5.475**	13.103
area	**1,525**	5,645	**1,563**	5,433
distance sao paulo	**1,168**	754.3	**1,241**	742.3
km to closest airport connecting to hot spots	**272.7**	205.6	**290.1**	203.1
median household income p/c	**388.3**	165.6	**359.7**	154.0
informality rate	**0.158**	0.055	**0.166**	0.055
unemployment rate	**0.043**	0.022	**0.041**	0.021
college graduate employment share	**0.076**	0.036	**0.070**	0.029
black and mixed population share	**0.516**	0.237	**0.533**	0.236
Panel B	*Political characteristics*			
turnout	**0.855**	0.060	**0.858**	0.061
number candidates	**2.832**	1.212	**2.646**	0.986
center-right & liberal	**0.391**	0.319	**0.383**	0.322
left	**0.070**	0.164	**0.071**	0.171
center-left	**0.247**	0.283	**0.250**	0.287
right & Christian	**0.292**	0.294	**0.296**	0.300

Notes: The sample includes either all Brazilian municipalities (first two columns), or only municipalities outside of any *arranjos populacionais* (last two columns). We exclude municipalities that experienced a redistricting between 2010 (census year) and today (12 municipalities). Socio-demographic variables come from the 2010 census, except for the experienced density that is defined as the total population living within 10 km of the average inhabitant of the municipality and which is computed using the 2015 data from the Global Human Settlement Layer. The political variables refer to the first round of the 2016 municipal election. The last four variables denote the vote share of each of the four main political orientations. The area, distance to Sao Paulo and number of kilometers to the closest airport are missing for 5 municipalities in the full sample.

Table G3: Descriptive statistics: Municipalities close to the threshold

	Full sample (N=983)		Close (N=202)	
	Mean	Sd	**Mean**	Sd
Panel A	*Socio-demographic characteristics*			
population	**13,879**	13,124	**13,880**	11,254
experienced density	**118.1**	219.0	**109.8**	117.9
average persons per room	**0.698**	0.216	**0.708**	0.209
commuting time	**21.6**	4.61	**21.6**	4.70
$\geq$65 years old	**0.083**	0.022	**0.081**	0.023
nursing home residents per 10k pop	**3.128**	8.829	**3.215**	7.650
area	**1,689**	5,830	**1,682**	4,634
distance sao paulo	**1,453**	739.8	**1,492**	730.3
km to closest airport connecting to hot spots	**289.0**	198.3	**294.3**	202.7
median household income p/c	**318.3**	138.4	**314.4**	148.6
informality rate	**0.169**	0.054	**0.167**	0.057
unemployment rate	**0.044**	0.022	**0.044**	0.023
college graduate employment share	**0.064**	0.029	**0.066**	0.031
black and mixed population share	**0.590**	0.214	**0.586**	0.225
Panel B	*Political characteristics*			
turnout	**0.858**	0.060	**0.858**	0.057
number candidates	**2.730**	0.979	**2.767**	1.137
center-right & liberal	**0.375**	0.306	**0.359**	0.299
left	**0.064**	0.160	**0.068**	0.161
center-left	**0.245**	0.271	**0.271**	0.291
right & Christian	**0.316**	0.292	**0.302**	0.261

Notes: The sample includes either all municipalities in our analysis sample (first two columns), or only municipalities close to the discontinuity, defined as municipalities where the victory margin is lower than 4 percentage points (last two columns). Socio-demographic variables come from the 2010 census, except for the experienced density that is defined as the total population living within 1 km of the average inhabitant of the municipality and which is computed using the 2015 data from the Global Human Settlement Layer. The political variables refer to the first round of the 2016 municipal election. The last four variables denote the vote share of each of the four main political orientations.

Table G4: Descriptive statistics: 2016 Candidates

Panel A	*All candidates (N=16,617)*							
	Female candidates (N=2,164)				Male candidates (N=14,453)			
	mean	sd	min	max	**mean**	sd	min	max
Incumbency	**0.166**	0.166	0	1	**0.177**	0.381	0	1
Age	**47.6**	10.2	19	90	**49.1**	10.9	19	89
Tertiary education	**72.4**	44.7	0	1	**49.3**	50.0	0	1
Center-right & liberal	**0.371**	0.483	0	1	**0.370**	0.482	0	1
Left	**0.114**	0.318	0	1	**0.105**	0.307	0	1
Center-left	**0.238**	0.426	0	1	**0.244**	0.430	0	1
Right & Christian	**0.277**	0.448	0	1	**0.281**	0.449	0	1
Wins	**0.304**	0.460	0	1	**0.347**	0.476	0	1
Panel B	*Winners (N=5,568)*							
	Female candidates (N=627)				Male candidates (N=4,941)			
	mean	sd	min	max	**mean**	sd	min	max
Incumbency	**0.225**	0.418	0	1	**0.239**	0.427	0	1
Age	**47.2**	10.3	19	82	**48.8**	10.8	21	88
Tertiary education	**71.5**	45.2	0	1	**50.1**	50.0	0	1
Center-right & liberal	**0.381**	0.486	0	1	**0.404**	0.491	0	1
Left	**0.065**	0.247	0	1	**0.059**	0.236	0	1
Center-left	**0.238**	0.426	0	1	**0.241**	0.428	0	1
Right & Christian	**0.316**	0.465	0	1	**0.296**	0.456	0	1

Notes: The sample includes all Brazilian municipalities (except Brasilia and Fernando de Noronha). The level of observation is the candidate. In panel A, we consider all candidates running in the first round (considering candidates running in both supplementary and ordinary elections), whereas in panel B we consider only the ultimate winner (the winner of the supplementary election if one took place). The age of the candidate (resp., education level) is missing for 12 (resp. 5) candidates.

Table G5: Impact of having a female mayor on commerce restrictions in March and April, by term limit status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome	Number of days with commerce restrictions in place							
	Full sample		Both not limited		Male limited Female not		Female limited Male not	
	March	April	March	April	March	April	March	April
Treatment	-2.495**	-6.506**	-2.820	-11.618**	-1.673	-1.864	-2.104	-2.273
	(0.977)	(2.836)	(2.415)	(5.552)	(1.864)	(4.737)	(1.292)	(4.945)
Robust p-value	0.018	0.037	0.200	0.038	0.456	0.911	0.327	0.862
Observations	243	250	106	103	74	95	53	53
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.108	0.112	0.101	0.097	0.112	0.149	0.086	0.086
Mean	3.182	10.624	3.637	11.726	3.159	11.025	1.704	6.871

Notes: The sample is restricted to municipalities for which data on policies are available. In column 2, the sample is restricted to elections where neither of the two front runners ran as incumbent. In column 3 (resp., 4), the sample is restricted to elections where only the male (resp. female) candidate among the top two ran as incumbent. The outcome is the number of days during which commerce restrictions were in place, separately for each month. The independent variable is an indicator equal to one if the female candidate won in 2016. We use a non-parametric estimation procedure (fitting two linear regressions separately on each side of the threshold) and we use MSERD data-driven bandwidths. We assess statistical significance based on the robust p-value. ***, **, and * indicate significance at 1, 5, and 10 percent, respectively. The mean gives the average value of the outcome for male-led municipalities at the threshold.

Table G6: Impact of having a female mayor on commerce restrictions in September and October, by term limit status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of days with commerce restrictions in place							
	Full sample		Both not limited		Male limited Female not		Female limited Male not	
Outcome	Sep.	Oct.	Sep.	Oct.	Sep.	Oct.	Sep.	Oct.
Treatment	7.252*	7.539*	2.664	3.210	8.789	10.046	10.892*	10.083*
	(4.337)	(4.297)	(6.607)	(6.645)	(6.099)	(6.364)	(6.515)	(6.417)
Robust p-value	0.067	0.056	0.552	0.541	0.213	0.144	0.067	0.075
Observations	232	232	116	116	72	66	57	58
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.099	0.099	0.111	0.113	0.109	0.092	0.099	0.104
Mean	7.861	6.582	8.985	6.700	4.518	3.501	10.480	11.622

Notes: Same notes as in Appendix Table G5.

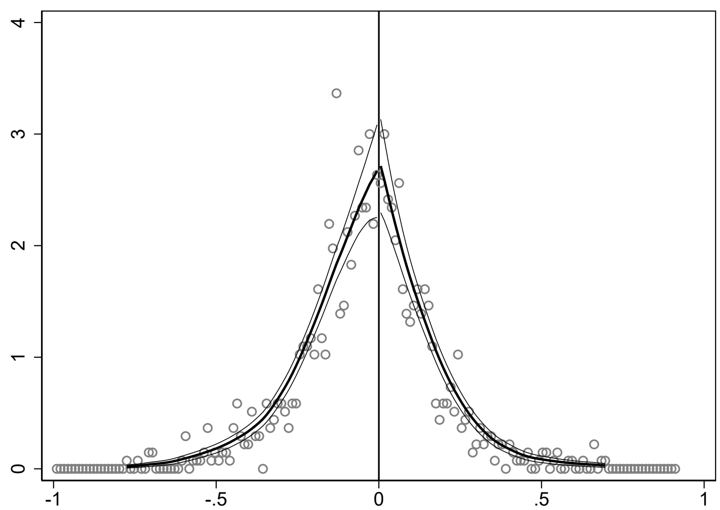
Table G7: Impact of having a female mayor on the weekly average of the isolation index, by term limit status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weekly average share of phone users staying at home							
	Full sample		Both not limited		Male limited Female not		Female limited Male not	
Outcome	W46	W47	W46	W47	W46	W47	W46	W47
Treatment	1.741	2.504*	1.862	3.265	-1.299	0.320	7.919***	2.937
	(1.175)	(1.308)	(1.989)	(2.112)	(2.139)	(1.667)	(2.380)	(3.219)
Robust p-value	0.127	0.049	0.414	0.134	0.514	0.780	0.002	0.400
Observations	159	119	78	69	41	39	33	38
Polyn. order	1	1	1	1	1	1	1	1
Bandwidth	0.126	0.091	0.130	0.110	0.118	0.106	0.087	0.109
Mean	35.942	37.916	36.604	38.497	36.645	38.566	34.256	37.067

Notes: We restrict the sample to a balanced panel of municipalities, excluding those with missing values between Feb-25-2020 and Jan-31-2020. The outcome is the weekly average of the isolation index, which measures the share of phone users staying at home each day. Week 46 corresponds to the week of the election (first round), while week 47 corresponds to the following one. Other notes as in Appendix Table G5.

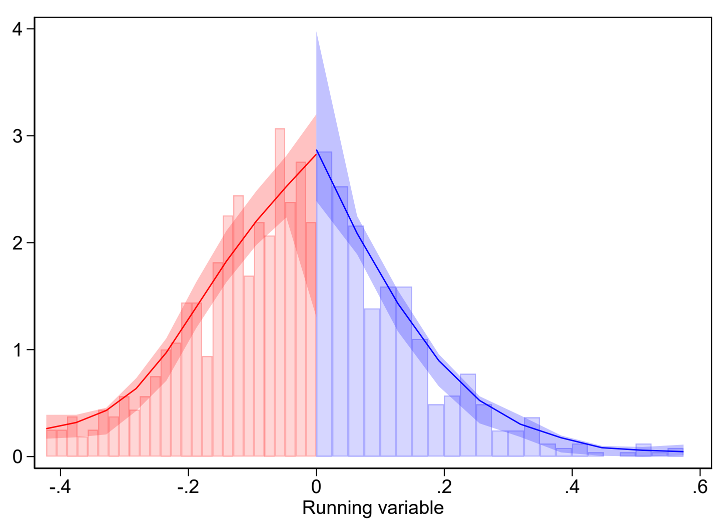
G2 Additional Figures

Figure G1: McCrary (2008)'s density test



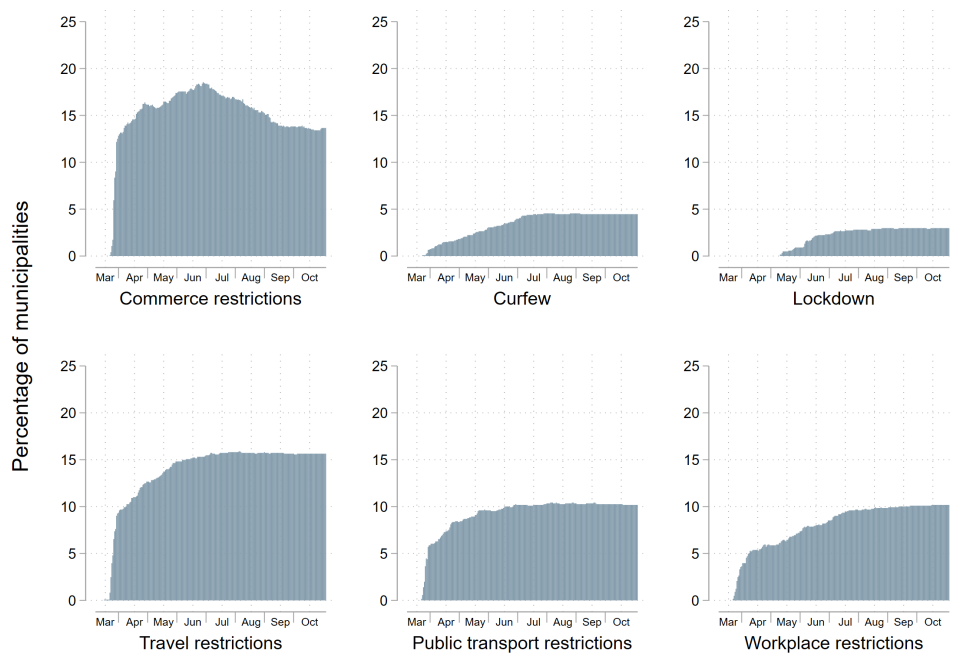
Notes: This Figure tests for a jump in the density of the running variable (the victory margin of the female candidate) at the threshold using the method developed by McCrary (2008). The solid line represents the density of the running variable. Thin lines represent the confidence intervals.

Figure G2: Cattaneo et al. (2018)'s density test



Notes: This Figure tests for a jump in the density of the running variable (the victory margin of the female candidate) at the threshold using the method developed by Cattaneo et al. (2018). The solid line represents the density of the running variable. Thin lines represent the confidence intervals.

Figure G3: Frequency of use of individual containment policies over time



Notes: Each graph plots the share of municipalities adopting the policy on a given date, from March 1st to October 31st.