Women Politicians and Violence Against Women: Evidence from Mexico
ONLINE APPENDIX

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Appendix

A Continuity of Observations

Regression Discontinuity Designs (RDD) rely on the assumption that potential outcomes are continuously distributed at the treatment cutoff, with treatment assignment relying only on the running variable – in this case the winning margin for women candidates. That is, treatment assignment should be orthogonal to any confounding variable that may affect violence against women (VAW). The RDD assumption could be violated if treatment assignment is not orthogonal to any variable that may affect the outcome or if mayoral candidates can influence their assignment-to-treatment (the margin of victory) and sort nonrandomly around the threshold. We employ three sets of tests to provide evidence that the continuity assumption is met: formal tests of sorting, balance tests for the continuity of covariates around the threshold, and a placebo test with past VAW outcomes, specifically homicides of women and young women in 2010 and 2017. We select 2010 because it is the same year as the sociodemographic data we use in our analysis and 2017 because potential candidates for the 2018 election had to register their candidacy in late 2017. Null results found in each of the robustness checks indicate the continuous potential outcomes assumption is met and that treatment assignment is orthogonal to other variables that could affect VAW.

A.1 Sorting Tests

A.1.1 McCrary Test

The RDD assumption would be violated if mayoral candidates can influence their assignment-to-treatment (the margin of victory) and sort nonrandomly around the threshold. In order to formally verify that there is no candidate sorting around the treatment cutoff, we conduct a standard McCrary test (McCrary 2008) and present the results here. This test uses the same RDD framework to explore outcomes around the cutoff but uses the density of observations

as the outcome rather than the primary VAW outcomes of interest used for the main analysis. If the density of observations is discontinuous around the threshold, 0% margin of victory, then the assumption of continuous potential outcomes is violated. Figure A1 shows the binned number of observations below and above the 0% margin of victory threshold, where observations above the threshold indicate municipalities where a woman candidate beat a man, with the density of observations on either side of the threshold overlaid (and 95% confidence intervals). Although there is a small "jump" with a lower density of observations located above the threshold, this discontinuity is not statistically significant. There does not appear to be any identifiable sorting below or above the threshold. According to the formal test (conducted using the R package rdd (Dimmery 2016)), the log difference in density height is -0.1744 (binwidth 0.01529) with a p-value of 0.31. This null result suggests that the continuity assumption is likely to hold in our research context.

A.1.2 Nonparametric Test

To provide further evidence, we also validate the continuity of observations using a non-parametric test from Cattaneo et al. (2020) (using the R package rddensity) that does not require binning. The nonparametric test (using jackknife standard errors) also indicates no evidence of sorting around the cutoff ($t = -0.52$; $p = 0.60$; effective $n = 415$).

A.2 Covariate Balance

The RDD assumption could be violated if the treatment assignment is not orthogonal to a variable that may affect VAW, and thus, confounding variables should be continuous around the cutoff. Using data from the 2010 Census on municipality-specific sociodemographic factors, including gender-specific variables such as number of women, women-run households, economically active women, and the average education of women, we conduct balance tests by estimating the RDD with these sociodemographic variables as outcomes.

The plots in Figure A2 show the regression discontinuity for the sociodemographic out-
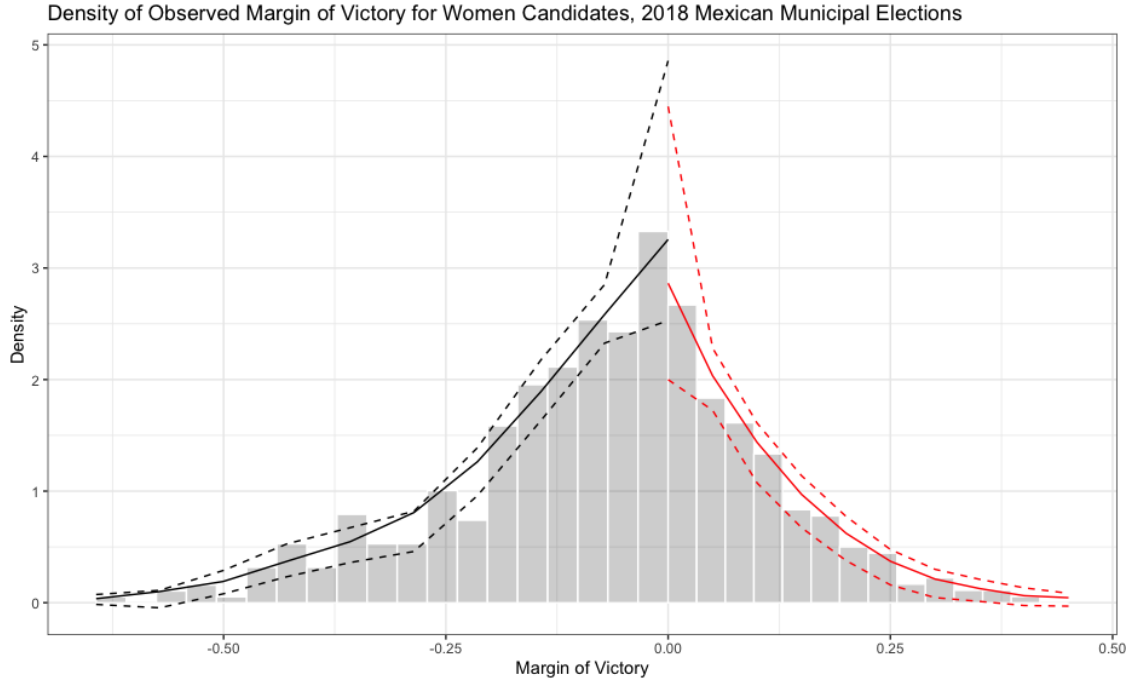
Figure A1: Distribution of Margin of Victory Around the Threshold (Calonico et al. 2015)

comes. In all plots, observations to the left of the cutoff represent municipalities where men politicians defeated women politicians, while observations to the right of the cutoff represent municipalities where women politicians defeated men politicians. The y-axis in all plots is a different sociodemographic measure, while the x-axis represents the margin of victory in the 2018 election, where negative values represent losing margins for women politicians. For visual simplicity, the data is binned using spacing estimators, as is recommended by the literature.

We estimate the RDD following the same procedure as the main RDD results (using the R package `rddensity`). Table A1 shows the results. We find no discontinuity at the threshold for any of the sociodemographic variables. The findings support the assumption that treatment assignment is orthogonal to other confounding characteristics of municipalities that may influence VAW.
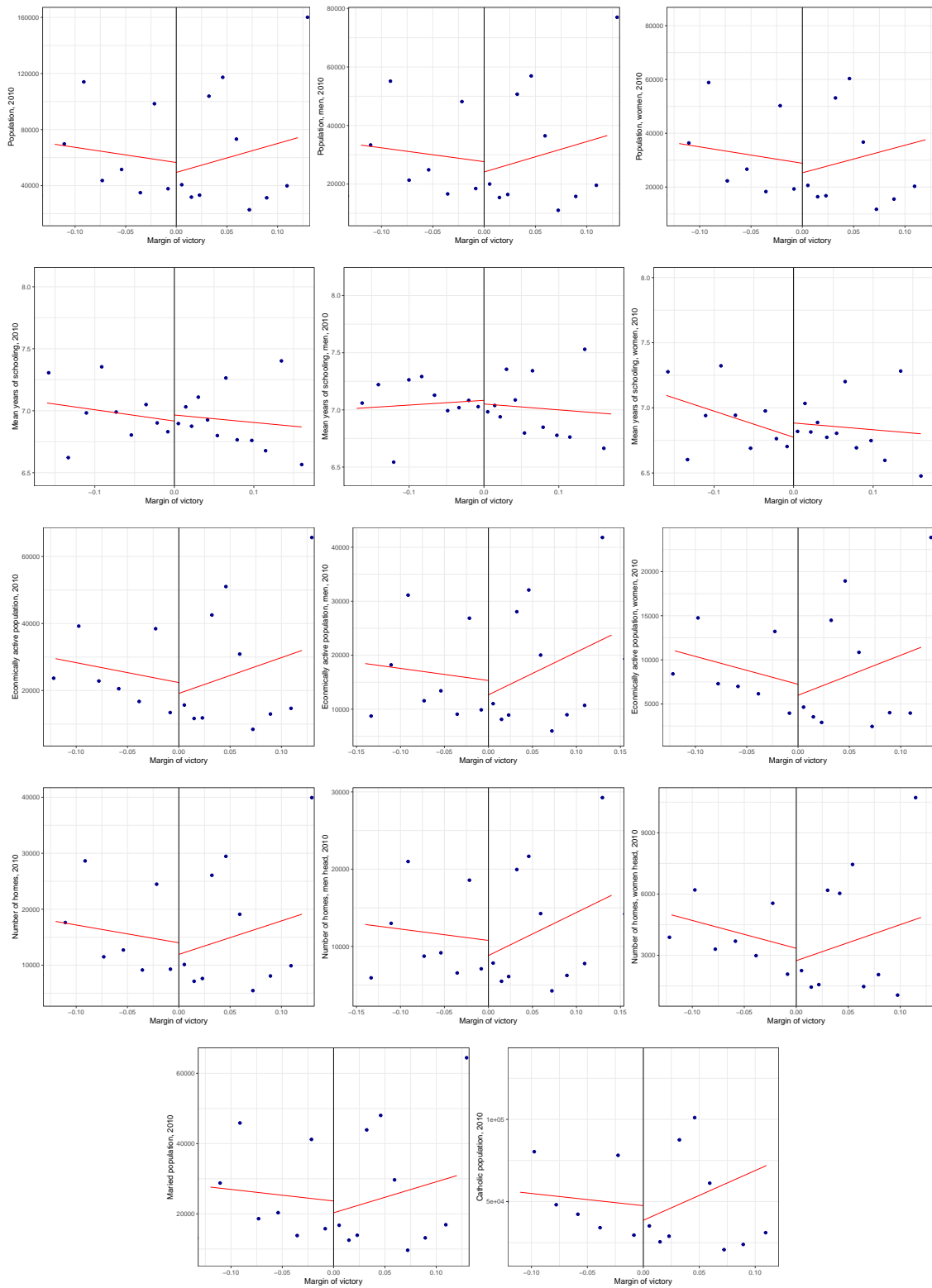
Figure A2: Regression discontinuity plots for sociodemographic covariates. Running variable is winning margin. Data is binned using spacing estimators.

Table A1: Covariate balance: Women politicians and demographic variables, RDD estimates.

Outcome	Estimate	SE	p	Bandwidth	Polynomial	Obs
Population	-6,810.04	27,134.60	0.80	0.12	1	309
Population, men	-3,421.54	13,238.52	0.80	0.12	1	307
Population, women	-6,810.04	27,134.60	0.80	0.12	1	309
Mean years of schooling	0.04	0.29	0.88	0.16	1	378
Mean years of schooling, men	-0.03	0.30	0.93	0.17	1	378
Mean years of schooling, women	0.04	0.29	0.88	0.16	1	378
Economically active population	-3,182.29	11,839.26	0.79	0.12	1	307
Economically active population, men	-2,565.61	7,369.73	0.73	0.14	1	334
Economically active population, women	-3,182.29	11,839.26	0.79	0.12	1	307
Number of homes	-2,019.94	6,855.12	0.77	0.12	1	309
Number of homes, men head	-1,978.70	5,048.20	0.70	0.14	1	338
Number of homes, women head	-2,019.94	6,855.12	0.77	0.12	1	309
Married pop, 12 y/o and older	-3,212.20	11,151.17	0.77	0.12	1	309
Catholic population	-7,580.90	22,826.68	0.74	0.11	1	294

A.3   Placebo Test with Past VAW Outcomes

We also use a placebo test to provide further evidence addressing two concerns: (1) that women politicians are self-selecting and winning close elections in municipalities with high VAW levels and (2) that a spurious correlation due to some third confounder is driving both VAW and the electoral success of women politicians in close elections.

We use homicides of women and young women in two separate years: 2010 (same year as the census that we use for the covariate balance tests, used for consistency) and 2017 (year before the elections when politicians are required to register as candidates). Data from both years would tell us whether women politicians are self-selecting and winning close elections in municipalities with high VAW levels. However, the placebo test using data from 2017 is most relevant because potential 2018 election candidates must register themselves at the end of 2017.

The plots in Figure A3 show the regression discontinuity for the placebo outcomes. In all plots, observations to the left of the cutoff represent municipalities where men politicians defeated women politicians, while observations to the right of the cutoff represent municipalities where women politicians defeated men politicians. The y-axis in all plots is a different placebo measure, while the x-axis represents the margin of victory in the 2018 election, where

negative values represent losing margins for women politicians. The top row shows results for placebo measures from 2010 and the bottom row shows results for placebo measures from 2017. For visual simplicity, the data is binned using spacing estimators, as is recommended by the literature.
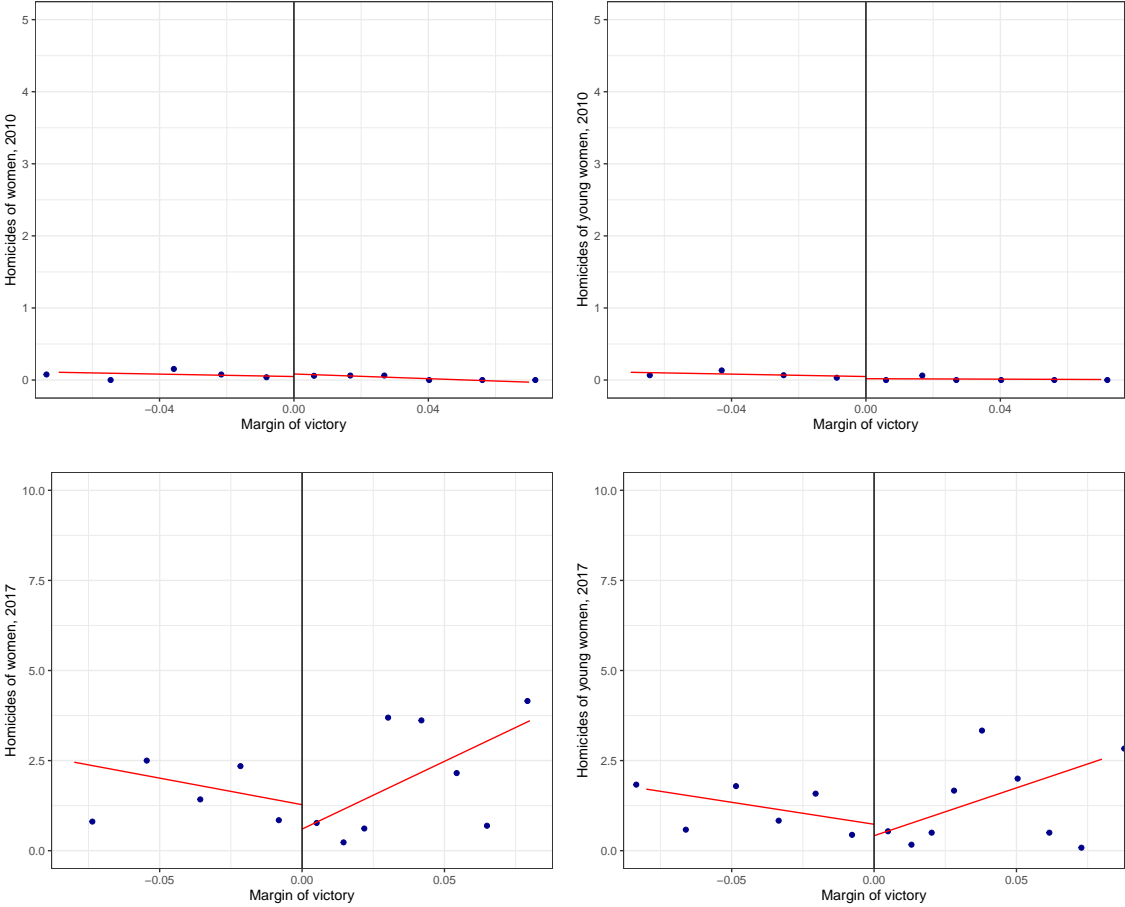

Figure A3: Placebo regression discontinuity plots for homicides of women and young women. Top row uses data from 2010, bottom row uses data from 2017. Running variable is winning margin. Data is binned using spacing estimators.

We estimate the RDD with these measures as outcomes and using the same specification as the main results (using the `R` package `rddensity`). Results are shown in Tables A2 and A3. We find that that electing a woman candidate in 2018 has no effect on these *past* VAW outcomes. This provides compelling additional evidence that women are not self-selecting into electoral races in municipalities that are particularly dangerous (or safe) for women or electorally beneficial for women, and lends support to the as-if-random assumption.

Table A2: Women politicians and homicides of women in 2010, placebo test, RDD estimates.

Outcome	Estimate	SE	p	Bandwidth	Polynomial	Obs
Homicides of women	0.03	0.08	0.66	0.07	1	206
Homicides of women	0.04	0.12	0.74	0.09	2	255
Homicides of young women	-0.03	0.06	0.60	0.07	1	207
Homicides of young women	-0.03	0.07	0.70	0.11	2	280

Table A3: Women politicians and homicides of women in 2017, placebo test, RDD estimates.

Outcome	Estimate	SE	p	Bandwidth	Polynomial	Obs
Homicides of women	-0.65	0.69	0.35	0.08	1	238
Homicides of women	-1.29	0.99	0.19	0.09	2	255
Homicides of young women	-0.32	0.45	0.48	0.08	1	225
Homicides of young women	-0.73	0.63	0.25	0.09	2	248

B   Spatial Distribution of Treated and Control Units

A related but different concern may be spatial sorting, i.e. that women politicians only win close elections in certain regions. In order to demonstrate that there is no spatial sorting of treated versus untreated municipalities, Figure B1 shows the geographic distribution of our sample. Of the 1,324 municipalities we collected data on, 559 (42%) held elections where a woman and a man were the top two vote-receiving candidates. Municipalities where elections took place in which a woman candidate defeated a man are shown in light blue and where a man candidate defeated a woman are shown in green. Municipalities where both candidates
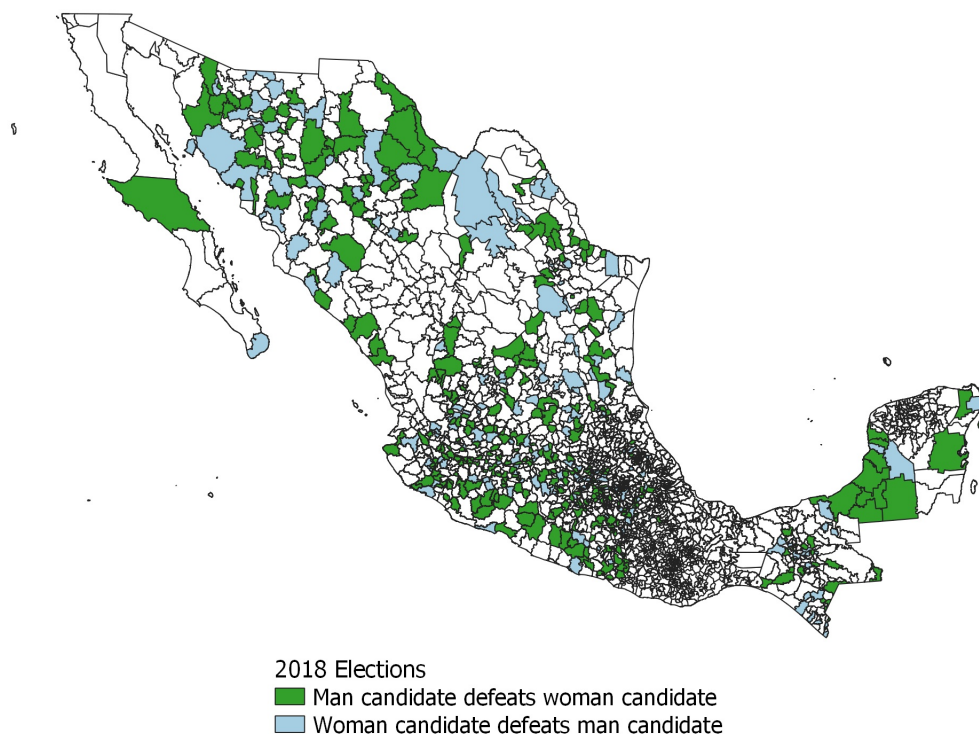
Figure B1: Geographic distribution of municipalities with elections in 2018 where either a woman candidate defeated a man candidate (show in light blue) or a man candidate defeated a woman candidate (shown in green). Source: data collected by authors and RAs from state electoral agency websites, map produced by Marco Alcocer.

were the same gender are white and not included in the RDD estimations[1]. The map reveals that municipalities with a woman mayor are not spatially clustered in any particular region of Mexico.

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[1]Municipalities in the state of Oaxaca are also excluded, as is standard in the literature, because hundreds of municipalities follow indigenous self-governance that uses different electoral rules. We also exclude municipalities in the states of Tabasco and Yucatán due to lack of data on the gender of candidates. Any states that did not hold elections in 2018 are similarly not included in the estimations.

C   Coding Candidate Gender

The Mexican government provides the gender of the winning candidate that becomes mayor but the gender of candidates that do not win is not systematically collected or reported.[2] This information is crucial for our study because the identification strategy relies on comparing municipalities where a woman candidate barely defeats a man candidate and municipalities where a man candidate barely defeats a woman candidate. We thus hand-code the gender of the first and second place candidates in each election using information from each state's electoral agency. Here we describe the data collection procedure for this information.

We recruited two undergraduate research assistants (RAs) and provided them with the political party and number of votes for each first and second place candidate for all municipal elections in 2018 from Magar (2018). This information also included the gender of the winning candidate. To identify the gender of the second place candidate, the RAs were instructed to search for the electoral results of each municipality in each state's electoral agency. This is because municipal election data is stored by each state's electoral agency, not the federal electoral agency. For each state, the RAs searched for the list of candidates that included their political party and electoral results and matched the official state election results to Magar's data. For each election, the RAs (1) identified the candidate that received the second most electoral votes and coded whether that candidate was a woman or a man based on their name, (2) verified that the first and second place candidates and their parties were accurate, and (3) verified that the number of votes for the first and second place candidates were accurate. The principal investigators (PIs), two of whom are of Mexican origin, trained the RAs and verified their work.

In Mexico, the vast majority of names are easily attributable to a gender. For names that are not gender-specific, that the RAs could not code, or that the RAs were unsure about, they were instructed to leave blank spaces and highlight them for further review by the PIs. The PIs then went through the names the RAs could not identify and made coding

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[2]Some states do report this information, though rarely in a systematic manner, while others do not.

decisions based on the name, and if the name was still unclear, determined their gender based on background research on each one of these unknown candidates. For example, the PIs routinely verified a candidate's gender through the candidate's personal campaign website or news stories covering the candidates.

D   VAW Summary Statistics

Table D1 shows the summary statistics for the VAW outcomes in our sample across time and pooled.

E   Main RDD Results: Alternative Estimation

In the paper, we report conventional RDD estimates with robust standard errors. In this section we report the results of the RDD when using an alternative estimation method: robust bias-corrected estimates and standard errors. We report the conventional RDD estimates in the main body because they are more conservative and the robust-bias corrected estimates here for robustness and transparency. We estimate the RDD using the same procedure as the main results: we estimate first and second-order polynomials (Calonico et al. 2014; Gelman and Imbens 2019) using optimal bandwidths that minimize the mean-squared error (Calonico et al. 2014), but rely on the robust bias-corrected estimates and standard errors. We use the `rdrobust` package in `R` to estimate the RDD (Calonico et al. 2015). Table E1 shows the RDD results.

F   Probing Mechanisms

Women politicians may affect the prevalence of VAW through various mechanisms, some that are observable and measurable (e.g., the number of women staffers), some that are qualitative or hard to measure (e.g., workshops organized for for women, collaboration with

Table D1: Full sample summary statistics of VAW outcomes at the municipality level.

Statistic	Mean	St. Dev.	N
2019			
Homicides of women	2.08	6.85	559
Homicides of young women	1.43	4.90	559
Rape	7.05	22.46	559
Domestic violence (in tens)	11.08	385.82	559
Sexual abuse	14.44	50.85	559
Sexual harassment	3.40	13.70	559
2020			
Homicides of women	2.10	6.84	559
Homicides of young women	1.49	5.38	559
Rape	6.76	23.36	559
Domestic violence (in tens)	12.07	404.38	559
Sexual abuse	13.67	44.76	559
Sexual harassment	4.15	13.63	559
2021			
Homicides of women	2.13	6.76	559
Homicides of young women	1.48	5.09	559
Rape	8.14	27.34	559
Domestic violence (in tens)	13.88	451.53	559
Sexual abuse	17.12	56.97	559
Sexual harassment	5.17	16.86	559
Pooled			
Homicides of women	6.30	19.87	559
Homicides of young women	4.40	14.77	559
Rape	21.95	71.08	559
Domestic violence (in tens)	37.03	1,231.07	559
Sexual abuse	45.23	151.57	559
Sexual harassment	12.71	43.12	559

Table E1: Alternative Estimation: Robust bias-corrected regression discontinuity results: Effect of women politicians on VAW.

	Linear RDD				Quadratic RDD			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
Homicides of women	−1.384	−2.011**	−1.257	−5.365**	−3.542**	−3.741**	−3.874**	−10.759***
	(0.939)	(0.838)	(0.997)	(2.538)	(1.570)	(1.509)	(1.591)	(4.025)
n	370	370	408	373	374	368	381	373
Bandwidth	0.156	0.155	0.180	0.158	0.161	0.154	0.167	0.158
Homicides of young women	−0.721	−1.929**	−0.223	−3.220*	−2.390**	−2.784**	−2.283*	−7.168**
	(0.681)	(0.823)	(0.720)	(1.831)	(1.169)	(1.232)	(1.189)	(3.027)
n	381	346	439	374	382	372	374	373
Bandwidth	0.165	0.143	0.215	0.161	0.167	0.157	0.159	0.159
Rape	−2.854	−5.789*	−8.302*	−18.146	−7.403*	−7.276*	−11.053**	−25.831**
	(3.148)	(3.495)	(4.307)	(11.080)	(4.426)	(3.983)	(4.878)	(12.985)
n	391	324	333	335	377	388	396	385
Bandwidth	0.090	0.067	0.067	0.070	0.095	0.100	0.099	0.097
Domestic violence (in tens)	−7.655	−6.679	−8.142	−24.555	−12.479	−16.633*	−18.320**	−47.431*
	(6.613)	(6.239)	(6.814)	(19.537)	(7.641)	(8.503)	(9.095)	(25.009)
n	357	433	408	395	391	399	399	396
Bandwidth	0.076	0.100	0.092	0.087	0.104	0.105	0.101	0.103
Sex abuse	−4.786	−3.705	−8.953	−14.120	−16.417	−17.334*	−22.606**	−56.383*
	(6.041)	(6.432)	(8.279)	(20.471)	(10.218)	(9.022)	(10.961)	(29.746)
n	440	440	381	426	388	399	393	393
Bandwidth	0.099	0.104	0.085	0.098	0.097	0.101	0.096	0.097
Sexual harassment	−1.829	−0.830	−2.840	−5.308	−3.305	−3.663	−6.563*	−13.985*
	(1.703)	(2.362)	(2.865)	(6.819)	(2.236)	(2.605)	(3.433)	(8.066)
n	369	430	405	403	426	437	421	423
Bandwidth	0.077	0.113	0.100	0.098	0.108	0.122	0.113	0.112

Coefficients are robust bias-corrected RDD estimates. The bandwidth represents the optimal bandwidth that minimizes mean-squared errors.

Robust standard errors shown in parentheses.

* p < 0.1, ** p < 0.05, *** p < 0.01

women's organizations to promote women's safety, events and services provided by Municipal Women Institutes), and others than may be more indirect and difficult to identify (e.g., providing better lighting in public spaces, supporting extracurricular activities in public schools, raising awareness by speaking more about women's topics at events, providing food baskets to struggling families, implementing job programs for men).

We undertake two complementary strategies to probe possible mechanisms through which women politicians may influence the prevalence of VAW within their jurisdictions. First, we leverage quantitative data from the 2020 Census of Municipal Governments to measure clearly gendered administrative factors that may be affected. Second, we conduct qualitative research on women mayors that won very close elections to illustrate some real world actions taken by these women mayors that are explicitly gendered.

First, women politicians may influence the way that local administrations look and function in ways that are observable. To investigate this possibility, we leverage the Census of Municipal Governments conducted every two years. During our period of analysis (2019-2021) only one census was conducted, and it collected information on municipal governments at the end of 2020. Using this data, we narrow in on gendered-outcomes that may measure pathways through which women politicians affect VAW. We discard gendered characteristics that are hard to affect in the short-term (e.g., how many buildings Municipal Women's Institutes own, how many institutions exist that address women's issues, and how many institutionalized gender units exist within government agencies, among others), and instead focus on factors that could be possibly affected within the three-year mayoral terms. We thus focus on the percent of support staff in the municipal government that are women, the percent of women who lead municipal government institutions (mayors have power over their appointment), the percent of the budget designated to municipal government institutions that address gender and women issues, and whether the municipal government had implemented formal channels for citizens participation. We then estimated the RDD using these variables as outcome measures.

Table F1: Women politicians and administrative outcomes. RDD estimates, linear (top) and quadratic (bottom).

	Support staff (% of total)	Institution leaders women (% of total)	Budget for women institutions (% of total)	Formal channel for Citizen participation
Woman mayor	14.793*	7.393***	0.427	0.132
	(7.986)	(2.575)	(0.270)	(0.116)
p	1	1	1	1
n	322	293	313	310
Bandwidth	0.127	0.111	0.125	0.121
Woman mayor	15.325	6.162*	0.462	0.159
	(10.024)	(3.330)	(0.318)	(0.157)
p	2	2	2	2
n	404	345	379	358
Bandwidth	0.180	0.142	0.170	0.150

Conventional RDD estimates with robust standard errors and optimal bandwidth that minimizes mean-squared errors.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table F1 shows the results. We find that women politicians increased the percent of women support staff and the percent of women leading municipal government institutions. These findings suggest that women politicians impact the gendered composition of local leaders and administrative staff. Results also show that women politicians increase the percent of budget designated to institutions that address women and gender issues and whether municipal government established formal channels for citizen participation, though these results are not statistically significant.

Second, we conduct qualitative research into a subset of the women politicians in our sample that won very close elections. Specifically, we search all women mayors that won with under 2% of the vote, which provided 33 woman mayors. We found publicly available online news and government reports for 18 of these mayors taking at least one action to address VAW, which corresponds to 55% of the subsample. Table F2 provides a list of actions taken by women mayors during the term we analyze that are explicitly gendered. While we do not claim that these actions alone account for the effects we find, we find them incredibly insightful as they provide real-world examples of actions taken by women politicians. Through this exercise, we found the common trend that many of these women are

celebrated as the first woman mayor in their municipality. This provides suggestive evidence that women's representation is public and celebrated in some instances. More concretely, we find evidence of a wide variety of actions taken by these women to bring awareness to and address VAW. A common trend appears to be the use of Municipal Women's Institutes as avenues through which mayors implement programs, workshops, events, and provide services.

G RDD Results: Homicides of Men and Non-VAW Crimes

To investigate whether the effect of women politicians on VAW is a general effect on violence and crime or specifically about VAW, we also estimate the main RDD specification using non-VAW outcomes. Specifically, we estimate the RDD using outcome measures of other types of violence and crime: the homicides of men, homicides of young men, and four of the most prevalent crimes in Mexico (extortion, home burglary and vehicle theft, kidnapping, and drug dealing). We note that these outcomes and analyses were not pre-registered and should thus be seen as exploratory. Data on homicides comes from death certificate data from 2019 and 2020 and is collected from Mexico's National Institute of Statistics and Geography (INEGI) (INEGI 2021). Data on crimes is from the Executive Secretariat of the National Public Security System SESNSP) (SESNSP 2022), and measures reported crimes from 2019 - 2021. Descriptive statistics of these outcomes are shown in Table G1.

The plots in Figure G1 show the regression discontinuity for the non-VAW outcomes. In all plots, observations to the left of the cutoff represent municipalities where men politicians defeated women politicians, while observations to the right of the cutoff represent municipalities where women politicians defeated men politicians. The y-axis in all plots is a different placebo measure, while the x-axis represents the margin of victory in the 2018 election, where negative values represent losing margins for women politicians. For visual simplicity, the data is binned using spacing estimators, as is recommended by the literature.
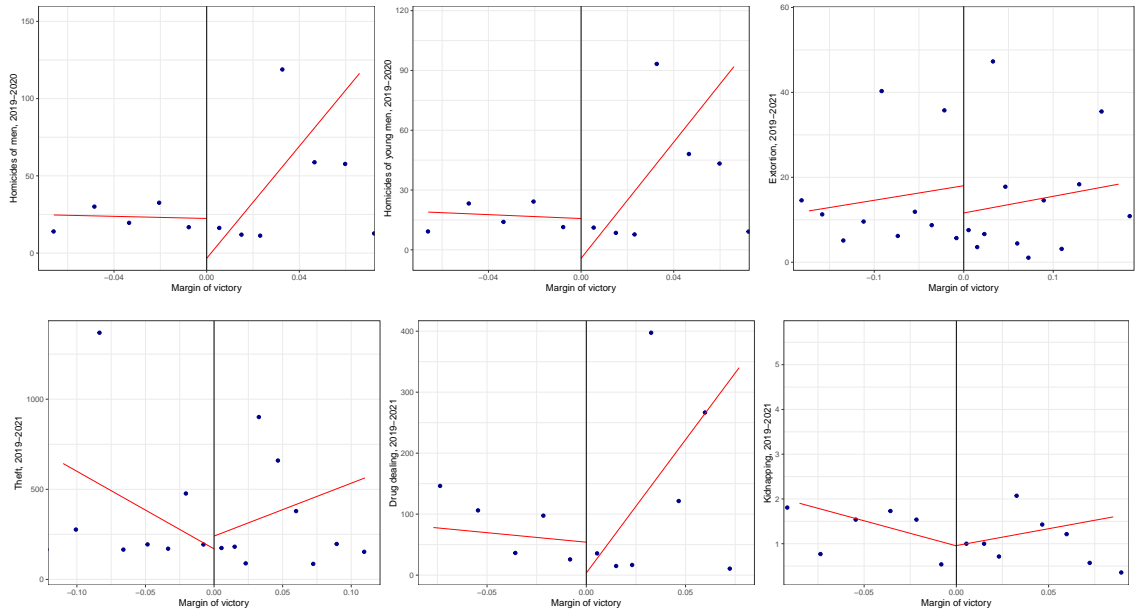
Figure G1: Regression discontinuity plots for homicides of men and young men, and non-VAW crimes, including extortion, theft, drug dealing and kidnapping. Running variable is winning margin. Data is binned using spacing estimators.

Table F2: Women mayors who won close elections (winning margin ¡2%) and actions to address VAW.

Woman Mayors	Actions
Marlit Moreno Alvarez	Held events and workshops on the empowerment of women.
Mireya Gonzalez Perez	
Miriam Caballero Arras	Inaugurated and participated in the Race to Commemorate Women's Day.
Maria Elena De Anda Gutierrez	
Esmeralda Sanchez Gonzalez	Implemented programs that provided food baskets and basic services for women.
Maria Itze Camacho Zapiain	
Eva Patricia Salazar Marroquín	Participated in annual March for the International Women's Day alongside head of the Municipal Women's Institute.
Sara Eugenia Castillon Ochoa	
Karla Erika Valdenegro Gamboa	
Araceli Solorzano Solorzano	Created shelter for vulnerable persons via the Municipal Women's Institute.
Jeronima Toledo Villalobos	
Flora Lina Garibay	Created System Against Violence Against Women via the Municipal Women's Institute.
Nora Francisca Medina Campa	
Dolores Lopez De La Cruz	Carried out advertising campaigns supporting women to prevent and eradicate VAW.
María Cristina Díaz Salazar	
Marisol Gonzalez Torres	Invested and distributed sowing machines to women to support self-employment.
Marisol Cruz Garcia	
	Acquired contract from state government to employ women in municipality to make school uniforms.
	Supported psychological services via the Municipal Women's Institute and the Youth Institute.
	Created programs to raise awareness about respecting women.
	Inaugurated exposition of women entrepreneurs.
	Promoted therapy through the Municipal Women's Institute.
	Attended International Women's Day events and promoted various programs ran by the Municipal Women's Institute and the Network for Assistance to Women Victims of Violence.
	Spread awareness against VAW through videos on social media.
	Spread awareness against VAW and women's empowerment and labor challenges through social media.
	Participated in the Regional Security Board on the International Day to Eliminate Violence Against Women and spoke about protecting women and eradicating VAW.
	Spoke alongside public security agents about preventive actions to reduce VAW.
	Signed agreement to support pregnant women who need access to hospitals.

Table F2: (Continued) Women mayors who won close elections (winning margin ¡2%) and actions to address VAW.

Woman Mayors	Actions
	Held various women-related activities and events: March Against Violence Against Women, public informative talks about VAW, public talks to women about self-esteem and crime prevention, and workshop of self-defense techniques for women.
	Held exposition to promote women-crafted products.
	Held workshops through the Center for Women's Development to promote and provide attention and services to women about a host of issues.
	Attended event by the Mexican Association of Women Entrepreneurs.
	Held event commemorating International Women's Day.
	Advanced the representation of women public servants in local government.
	Coordinated with governor to support small businesses, including women-owned businesses.
	Inaugurated municipal market, which supports local businesses, including women making and selling artisanal product.
	Held public conferences about municipal government advances in addressing VAW.
	Publicly promoted and highlighted bravery of women who denounce VAW.
	Implemented "Safe Woman" App that functions as a mobile alert with geolocation and direct link to municipal police.
	Created public agenda to protect women.
	Publicly promoted the municipality's women shelters.
	Promoted women businesses in collaboration with the Mexican Association of Women Business Owners.
	Held seminar on policies to address VAW at local university.
	Created Municipal Women's Institute and promoted institute's programs.
	Inaugurated Center for Women's Development through which various programs for women are ran.
	Held talks on VAW, gender equality, women's rights, and other related topics at various public schools.
	Held conference for 200 women on the International Women's Day.

Table F2: (Continued) Women mayors who won close elections (winning margin ¡2%) and actions to address VAW.

Woman Mayors	Actions
	Participated in "A Day Without a Woman" protest and encouraged citizens and business to do so as well.
	Provided monthly informational meetings with citizens about eradicating VAW.
	Held workshops for women small business-owners.
	Acted as ambassador for the "Women and Peace" campaign.
	Publicly celebrated women in public health and advocated for victims of VAW at event held for International Women's Day.
	Held public event celebrating the 65th anniversary of women's suffrage and honored powerful women who fought for gender equality.

Table G1: Summary statistics: Homicides of men and non-VAW crimes (2019-2021)

Statistic	Mean	St. Dev.	N
Homicides of men	17.10	51.53	559
Homicides of young men	12.72	39.72	559
Extortion	4.89	17.70	559
Theft	124.18	477.16	559
Drug dealing	29.16	122.00	559
Kidnapping	0.46	1.33	559

Interpretation of the plots should be undertaken with caution.

RDD results are shown in Table G2. First, we find that women politicians that win narrow elections have a short-term (first year in office) negative effect on homicides of men and young men, but that these effects become smaller and lose their statistical significance at the 5% level during a woman politician's second year in office. The effect sizes for the first year of a woman's administration are similar in size across homicides of women and men. That is, the point estimates are all close to the mean number of homicides of their respective measures. This tells us that the effects are substantively large the first year for homicides of both men and women, but become larger during the second year for homicides of women and remain statistically significant, while the effects on homicides for men get smaller and lose their statistical significance at the 5% level during a woman politician's second year in office. This suggests that women have an overall effect on reducing homicides, but this effect is short-lived for homicides of men and not only persistent for homicides of women but even more pronounced in subsequent years.

Second, we also find that women politicians have no effect on the prevalence of reported non-VAW crimes for any year (no results are statistically significant at either $p < 0.05$ or $p < 0.1$). Interestingly, though not statistically significant, some point estimates for kidnapping, theft, and extortion are positive, suggesting that the consistent negative effects on VAW crimes are not due to some phenomenon wherein all crimes and forms of violence are lower in municipalities with women mayors. This provides strong evidence that women politicians are having an effect on VAW outcomes specifically.

Together, these results suggest that women politicians reduce VAW crimes – particularly severe forms of VAW – and not crimes in general, though they do have some short-term effect on homicides of men as well.

Table G2: Women politicians and Non-Vaw Outcomes, RDD estimates.

Outcome	Year	Estimate	SE	p	Bandwidth	Polynomial	Obs
Homicides, men	2019	-15.53	6.44	0.02	0.06	1	176
Homicides, men	2020	-10.52	5.60	0.06	0.07	1	206
Homicides, men	2021	-16.30	7.56	0.03	0.07	1	198
Homicides, young men	2019	-11.60	4.95	0.02	0.06	1	182
Homicides, young men	2020	-8.53	4.50	0.06	0.07	1	199
Homicides, young men	2021	-12.12	5.90	0.04	0.07	1	203
Extortion	2019	-0.27	2.98	0.93	0.10	1	274
Extortion	2020	-2.27	3.94	0.56	0.18	1	404
Extortion	2021	-2.07	4.74	0.66	0.14	1	339
Theft	2019	-13.08	57.29	0.91	0.10	1	264
Theft	2020	6.83	57.29	0.91	0.10	1	264
Theft	2021	5.03	55.77	0.93	0.10	1	266
Drug dealing	2019	-4.09	14.67	0.78	0.08	1	225
Drug dealing	2020	-19.20	20.08	0.34	0.08	1	220
Drug dealing	2021	-31.04	22.34	0.16	0.07	1	210
Kidnapping	2019	-0.02	0.33	0.95	0.10	1	264
Kidnapping	2020	0.08	0.20	0.68	0.09	1	248
Kidnapping	2021	0.02	0.20	0.93	0.08	1	218

H   Multi-Cutoff RDD

Since our RDD design is based on winning margins from a plurality electoral system, we are estimating a multi-cutoff RDD (Cattaneo et al. 2016). In other words, unlike a single-cutoff RDD where the cutoff is the same for all units, the cutoff in plurality elections depends on the vote share of each candidate. For example, one candidate could win with 34% of the vote to an opponent with 30% of the vote, while another candidate could win with 59% of the vote to an opponent with 40% of the vote. By using the margin of victory as our running variable, we are normalizing the running variable and pooling our units. By doing so, our RDD is estimating the weighted average of the local average treatment effect across vote shares (Cattaneo et al. 2016). Our coefficient of interest is this pooled estimand. We thus focus on estimating the pooled estimand and leave heterogeneity unexplored. We also do not explore heterogeneity due to our relatively small sample size.[3]

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[3]Although we discussed heterogeneity we hoped to explore in our pre-analysis plan (including the effect of organized crime and the effect of gender-based civil unrest), we were unable to tackle these additional

However, if we assume constant treatment effects, our RDD estimate can be interpreted like a single-cutoff RDD design: the overall average of the average treatment effects (Cattaneo et al. 2016). To assess this assumption, Cattaneo et al. (2016) recommended plotting the vote share of the second place candidate ("the strongest opponent"). As noted by these scholars, "if most of the mass in the distribution is near the same cutoff value, then the analyst can treat the design as equivalent to a single-cutoff RD design" (Cattaneo et al. 2016, p. 1246). Figures H1 and H2 plot these distributions for the full sample and for close elections (winning margin < 10%). The figures show a unimodal distribution centering around 30%. This makes intuitive sense in the Mexican case, as Mexico had three major parties in 2018: Morena, PAN, and PRI. We take this as suggestive evidence that we may be able to treat our design as equivalent to a single-cutoff RD design and interpret the RDD coefficients as the local average treatment effects.

I Deviations from Pre-Analysis Plan

In this section we explicitly identify and explain deviations we took from the pre-analysis plan (PAP) we registered prior to data collection and that is available at the Open Science Foundation Registry: –.

First, we only specified that we would use covariate balance tests to check the RDD continuity assumption. In addition to the covariate balance tests we registered, we chose to also use formal sorting tests. We chose to do this because it has become standard practice and to provide even more robustness than the original PAP anticipated. An additional robustness check we run is a placebo test using past outcomes as the dependent variable. We did not register this test in the PAP. Again, this is an additional robustness check that provides further credibility to the main results.

Second, in our pre-registered research design, we noted that we planned to estimate the

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tests in this paper. However, thinking about these mediating factors in future work will be important in elucidating the mechanism through which women politicians reduce VAW.
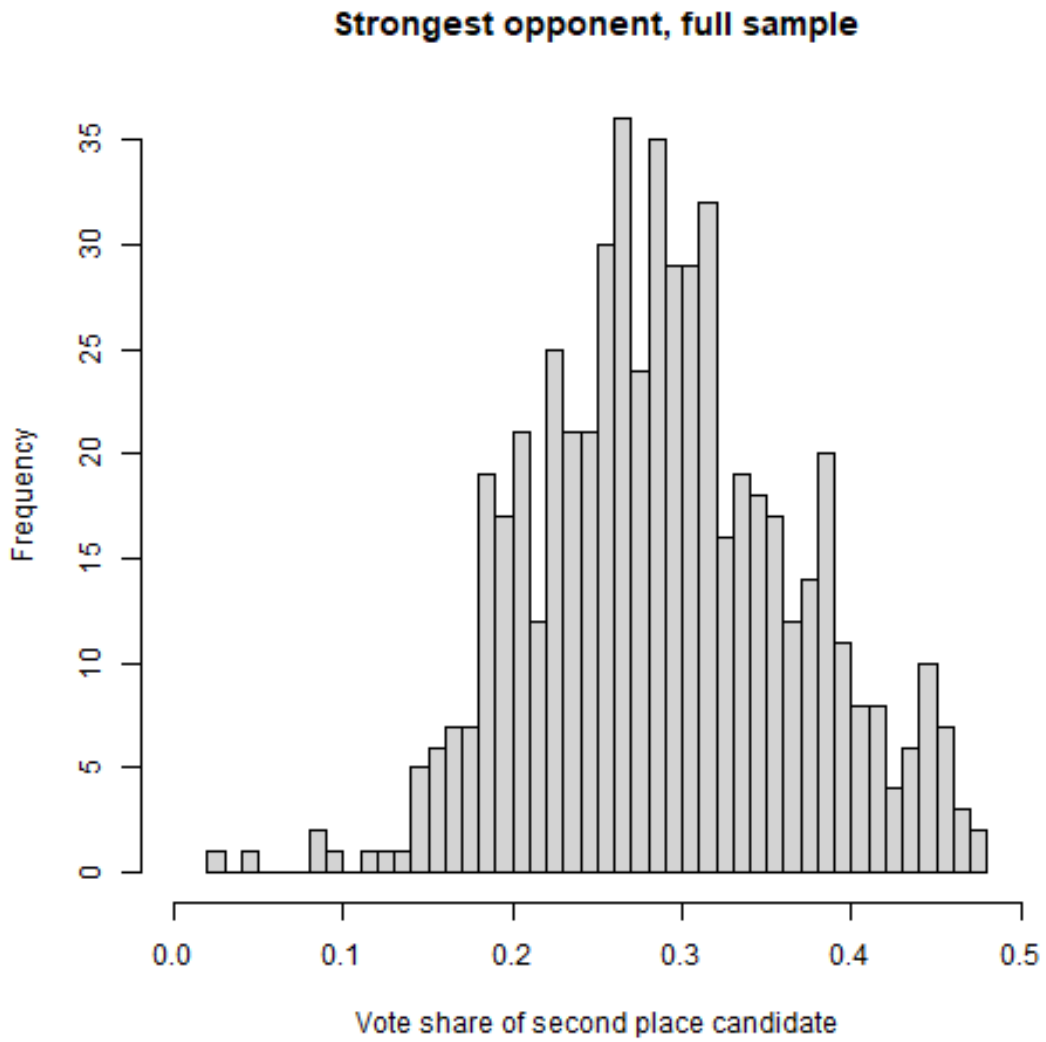
Strongest opponent, full sample

Frequency (y-axis)

Vote share of second place candidate (x-axis)

Figure H1: Histogram of vote share of second place candidate in the 2018 local elections in Mexico.
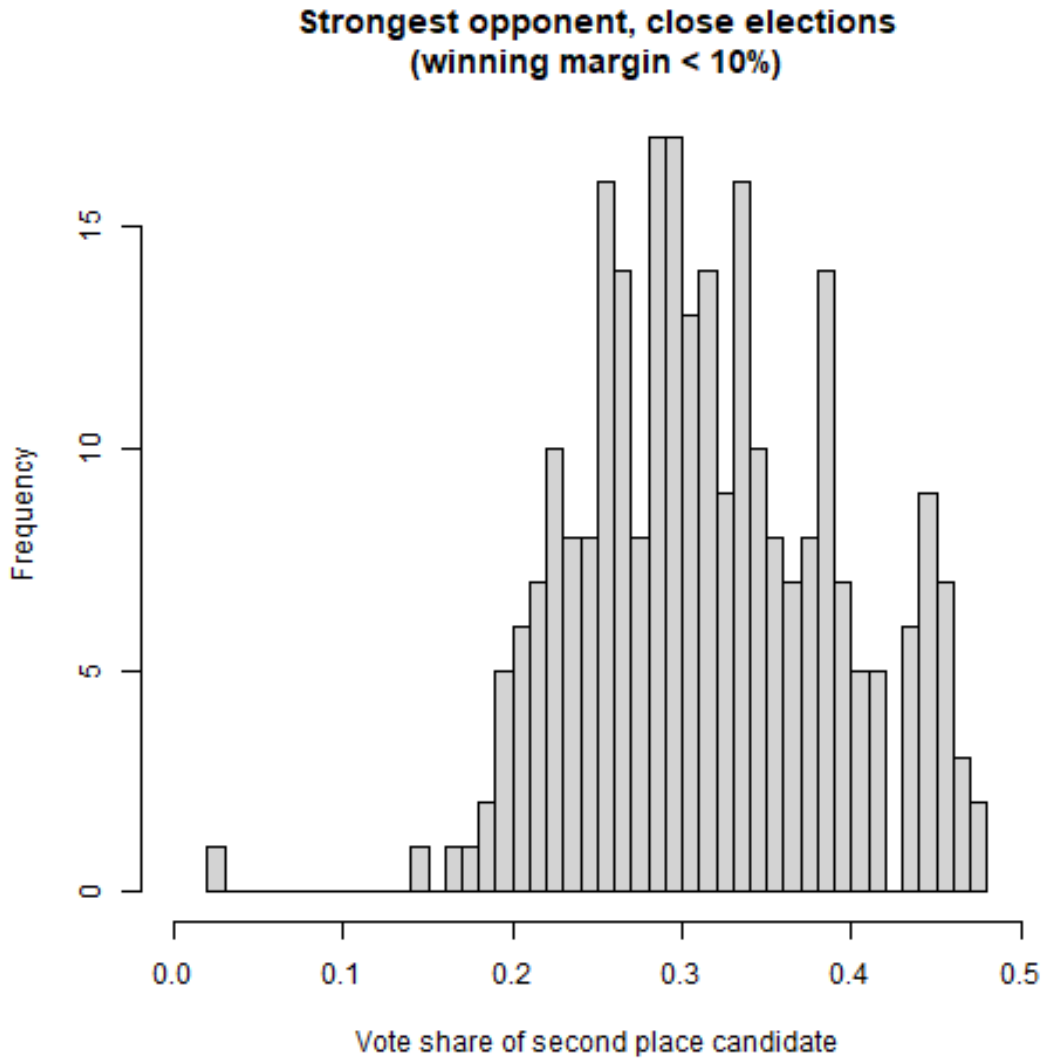
24

Figure H2: Histogram of vote share of second place candidate in close elections during the 2018 local elections in Mexico.

RDD using two procedures to calculate optimal bandwidths: Imbens and Kalyanaraman (2012) (herein IK) and Calonico et al. (2020) (herein CCF). However, CCF improves upon the MSE-optimal bandwidth selectors from IK, as discussed in Calonico et al. (2014), and we therefore only calculate bandwidths using this method.

Third, in the PAP we specified that data on local elections would come from a third-party repository. However, after beginning the data collection on the gender of candidates we noticed that some of the election results were not completely accurate. This is likely because election results take time to verify. We therefore collected and verified each election result directly from each state's electoral agency.

Fourth, we did not register how we would probe mechanisms. After concerns over possible mechanisms arose, we began to consider how we could address those. Given the lack of data on the topic, we turned to the 2021 Census of Municipal Governments that measures various administrative characteristics at the end of 2020 and found some relevant variables. We also decided that qualitative information could complement the quantitative evidence given the limitations of the latter.

Fifth, we only planned to run the RDD using VAW measures as outcomes. When the question arose as to whether women politicians affect other forms of violence and crimes that are not gendered, we decided to run additional analyses using homicides of men and non-VAW crimes (extortion, theft, kidnapping, and drug dealing). These tests were not included in the PAP. Nevertheless, we decided to estimate the RDD using these outcomes following the research design we *had* registered so as to not deviate from the original plan. It should also be noted that these are additional tests and not main results.

Finally, the PAP included a preliminary plan to explore heterogeneous effects. However, after collecting election and gender data we decided that the sample size was likely not large enough to give us the power to conduct these tests. We therefore decided against collecting additional data. We believe that assessing the mediating effect of organized crime and gender-based civil unrest, as we suggested in the PAP, may be important for understanding

the mechanisms through which women politicians can reduce VAW, and we hope to explore these factors in future work.

J   Pre-Analysis Plan

The PAP was registered prior to data collection and is available at the Open Science Foundation Registry at the following link: -. However, we provide the PAP here in full for transparency.

Women Politicians and Violence Against Women in Mexico Pre-Analysis Plan
Anonymized author(s)
February 10, 2022

1 Pre-analysis plan

In this pre-analysis plan we pre-register a set of primary analyses for our paper tentatively titled "Women Politicians and Violence Against Women in Mexico." This is an observational study exploiting a Regression Discontinuity Design (RDD) to explore the outcome of local elections in Mexico for the 2018 election cycle.

While pre-registration of observational studies is becoming more common, not all researchers are engaging with this practice. We have decided to do so because we have a straightforward and intuitive research design that approximates the random assignment of treatment and control groups in experimental research and because our study relies on data which requires subjective coding decisions made by the researchers. By reporting our design, coding choices and expectations before seeing the results, we hope to mitigate concerns about these subjective coding decisions and potential "p-hacking", and therefore enhance the causal credibility of the study's findings.

We note that we are only pre-registering the paper's main hypotheses, which we commit to reporting in the paper. Any deviations from the pre-analysis plan will be noted and explained in the paper. Additionally, we plan on conducting additional tests to explore heterogeneous effects, and we commit to clearly communicating this in the paper. In this pre-analysis plan, we are focusing on the 2018 local elections, but given time and resource availability we might seek to extend the coverage to include additional elections between 2015 and 2017. If we do, the data collection will be identical to the collection of the 2018 data.

This pre-analysis plan outlines the project's motivation, the main hypotheses, the data collection procedures, data sources, and the research design to perform the statistical analysis. We attest that at the time this document was registered we have not had access to the main independent variable (we are still in the process of collecting the data) and thus have not conducted any of the statistical analyses

1.1 Motivation

The objective of this study is to investigate whether the presence of women politicians has an effect on the incidence and severity of violence against women (VAW). In short, we ask whether the presence of women politicians leads to better outcomes regarding VAW.

To answer this question, we focus on the Mexican case. Mexico offers an excellent and intriguing case for three reasons: (1) VAW is a major problem in Mexico, like in most countries, with 2 in 3 women experiencing some sort of violence against them (ENDIREH 2017; UN 2021); (2) gender-based policies, including VAW, are a salient political issue; and (3) Mexico has a notably high gender parity in politics with established gender quotas (Baldez

2004; Piscopo 2016; Htun and Weldon 2018), anti-violence legislation (Htun and Jensenius 2022; Htun and Weldon 2018), and is ranked fourth worldwide in women's representation (Inter-Parliamentary Union 2022). The high levels of women's representation in politics *and* high levels of VAW present a suitable case for disentangling the effects of women in power.

This topic is substantively important in political science because studying whether women politicians can affect VAW has important implications for not only democratic representation and participatory processes, but also for potentially reducing VAW. When women candidates become visible players in the political system, their presence and subsequent policy and practices are likely to empower and benefit other women (Desposato and Norrander 2008; Burns, Schlozman, and Verba 2001; Hansen 1997; Kock 1997; Verba, Burns, and Schlozman 1997). However, despite being such a fundamental public policy concern, little is known about the effectiveness of visible women candidates on other societal outcomes such as VAW.

1.2 Theory and hypotheses
Existing research and deductive theorizing about the Mexican case suggest several possible ways in which the election of women politicians could impact VAW and gender-based violence more generally. We focus on two main relationships: women politicians affecting (i) the actual prevalence of VAW and (ii) the probability that citizens report VAW.

H1: Municipalities that elect a woman politician will experience a reduction in overall VAW.

Scholarship has shown that women's representation matters for a number of reasons and issues. Given that VAW is, by definition, an issue which victimizes women, and thus that women are more aware of, it is reasonable to believe that women politicians are more likely to create policies meant to address VAW and to reduce its prevalence.

At the same time, there are many other institutional and bureaucratic factors that likely condition the occurrence of gendered violence (e.g. resource availability, characteristics of the justice system and law enforcement agencies and civil society engagement). There are also political self-selection dynamics, socialization effects, and norms that may shape how women politicians behave. Because we are not able to account for all of these determinants, we may find that women politicians have a null effect on VAW. In the event of null results, we plan to explicitly theorize about what conclusions we can draw from the lack of effect. A key part of this theory-building exercise will involve interviews of women politicians in Mexico to assess what barriers might prevent them from impacting VAW.

H2: Municipalities that elect a woman politician will experience an increase in reports by individuals of crimes related to VAW.

Beyond having or not having direct effects on the actual prevalence of VAW, women politicians may have an effect on how likely it is that VAW is reported by individuals. The

effect could be driven by various mechanisms, including by actions that women politicians may take, such as being more vocal about VAW or directing authorities to prioritize VAW, or people's perception of women politicians, such as believing that women politicians take VAW more seriously.

H3: Municipalities that elect a woman politician will experience more reports of less severe forms of VAW than more severe forms.

In addition to women politicians making it more likely that people report VAW incidents to authorities, there could be differential effects within this behavior if women politicians make it more likely that individuals report certain types of VAW more than others depending on the severity of that crime, e.g. sexual assault versus rape. This effect could be driven by the presence of women candidates driving individuals to report VAW, thus breaking the cycle of tolerating more extreme forms of VAW.

1.3 Identification strategy and right-hand-side variables

We exploit a natural experiment to infer the causal effect of women being elected to local office on VAW. We use a close-elections regression discontinuity design to estimate how electing a woman for mayor is related to the number and severity of instances of VAW in Mexican municipalities.

1.3.1 Unit on analysis

Our unit of analysis is the Mexican municipality.

1.3.2 Description of the voting system and municipal governments

Municipalities are headed by a municipal president (mayor) elected through plurality rule. Municipal elections occur every three years, and up until 2018 municipal presidents could not be reelected.

Mexico is a federal system where municipalities have constitutional powers over various duties, including public security, certain public spending, public works, social programs, and education, among others. By law, municipal governments are run by the municipal president along with the municipal council, though in practice there often exist few limits on the power of the municipal president. The municipal president, for example, has the power to appoint the heads of all municipal government agencies. Thus, municipal presidents have the power to set policy agendas and the means to pursue them.

1.3.3 Source of plausibly exogenous variation

We use a regression discontinuity design of close elections, as is now standard in the literature. Specifically, our research design exploits close races for the municipal president office. We restrict the estimation sample to the following cases:

1. A female candidate narrowly loses to a male candidate.

2. A male candidate narrowly loses to a female candidate.

The identification assumption is that, for this set of cases, whether or not a woman won or lost an election is as good as random. We find this highly plausible.

13.4 Election Data

Election data comes from Magar (2021).[1] This dataset contains the electoral results for all municipal elections in Mexico. We use municipal election data from 2018. The data includes the number of candidates, the votes that each candidate received, the total number of votes, and political party of the candidates, and the gender of the winning candidate.

While we plan on using the 2018 elections, given time and resources, we would like to extend this data to include all local elections between 2015 and 2017 as well.

1.3.5 Classifying candidates as women

While the data on elections includes the gender of the winning candidate that becomes municipal president, the gender of the candidates that do not win is not collected. This information is crucial for this study because the identification strategy relies on comparing municipalities where a woman candidate barely defeated a male candidate and municipalities where a male candidate barely defeated a woman candidate.

We thus plan on collecting the gender of the second place candidate for all local elections in 2018. At the time that this PAP is being registered, we are in the process of collecting this data.

Here we describe the data collection procedure for this information.

We have recruited two undergraduate research assistants (RAs) and provided them the political party and number of votes for each first and second place candidate for all municipal elections in 2018. This information also includes the gender of the winning candidate. To identify the gender of the second place candidate, the RAs have been instructed to search for the electoral results of each municipality in each state's electoral agency. This is because municipal election data is stored by each state's electoral agency, not the federal electoral agency. For each state, the RAs are searching for the list of candidates that includes their political party and electoral results. When the RAs identify the candidate that received the second most electoral votes, they code whether this candidate is male or female based on their name.

In Mexico, the vast majority of names are easily attributable to a gender. Thus, the RAs code whether the name of the second place candidate is of a male or of a female. For names that are not gender specific, that the RAs could not code, or that the RAs are unsure about, they

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[1] Magar, Eric (2018) Recent Mexican election vote returns repository, https://github.com/emagar/elecRetrns

have been instructed to leave it blank and highlight it. The researchers, two of which are of Mexican origin, will then go through the names the RAs could not identify and make coding decisions based on the name, and if the name is still unclear, determine their gender based on background research on each one of these unknown candidates. In case this process still leaves names unclassified, we will use pre-existing R packages that predict the gender of an individual based on their name. Any name that cannot be clearly identified by this process will be left blank and excluded from the analysis.

This procedure has certain limitations, though we do not believe them to be prevalent or leading to bias. For transparency, we discuss these limitations here. This method bases the gender of individuals on their names, which may result in incorrect coding for a number of reasons. First, an individual may have a name that is traditionally associated with the other gender. Second, it may miscode individuals who use their birth name but who have transitioned genders. While we acknowledge that these may be issues present in our data, we do not believe that they are commonplace in this case nor that they introduce bias, for example, by being correlated to our outcomes of interest.

1.3.6 Bandwidth for narrow victory/loss

Regression discontinuity designs rely on close elections – in our case, on small margins of victory/loss for a woman candidate in mayoral races. Rather than selecting an arbitrary threshold to define "close elections," we rely on the growing literature which identifies the optimal bandwidth through a data-driven approach.

Specifically, we commit to estimating and reporting the two most prominent procedures to estimate optimal bandwidths: (1) Imbens and Kalyanaraman (2012)[2] and (3) Calonico, Cattaneo, and Farrell (2020).[3]

1.4 Outcome measures

VAW is an umbrella term that captures different forms of gender-based violence, from femicides (killing a woman due to their gender), to rape, to sexual harrassment, to emotional abuse, among others. In many cases, instances of VAW remain unreported, and therefore the prevalence of VAW and prevalence of reports of VAW are interrelated but may differ across time and space for various reasons. We use various sources of data to measure these two interrelated but distinct concepts.

To measure actual instances of VAW we use:

1. Official femicide instances as defined by the Mexican government.

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[2] Imbens G, Kalyanaraman K. 2012. Optimal bandwidth choice for the regression discontinuity estimator. Rev. Econ. Stud. 79(3): 933–59.

[3] Calonico, S., M. D. Cattaneo, and M. H. Farrell. 2020. Optimal Bandwidth Choice for Robust Bias Corrected Inference in Regression Discontinuity Designs. Econometrics Journal, 23(2): 192-210.

a. In 2015 the Mexican government began collecting data on femicides. The government classifies intentional homicides as femicides if they are deemed to meet at least one of nine criteria (SESNSP, 3).[4]
2. The number of intentional homicides of women.
a. We also plan to use the total number of intentional homicides of women to measure VAW. This is for robustness and because the femicide measure provided by the government is a conservative count. [5]
3. The number of intentional homicides of young women (15-45 years old).
a. To more precisely measure intentional homicides of women that may be the result of gender-based violence, we create a new measure of intentional homicides of young women. The age range is chosen because sources have found that the majority of femicide victims in Mexico[6] and Latin America[7] fall within this age range.

The mortality data reporting intentional homicides of women comes from Mexico's National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía or INEGI) and the femicide data from the crime registry of the Executive Secretariat of the National Public Security System (Secretariado Ejecutivo del Sistema Nacional de Seguridad Pública or SESNSP).

To measure the prevalence of reporting VAW incidents, we use the following:

1. Incidents of VAW crimes reported to authorities, which include:
a. Sexual harrassment
b. Sexual abuse
c. Rape
d. Domestic violence

This data comes from the crime registry of the Executive Secretariat of the National Public Security System, which includes instances of reported crimes. One limitation is that these reported crimes are not disaggregated by the gender of the victim. However, since the vast majority of sexual crimes and domestic violence crimes are perpetrated against women, we believe that this data provides a valid measure of our proposed concept.

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[4] SESNSP. 2018. "Lineamientos para el registro y clasificación de los presuntos delitos de feminicidio para fines estadísticos"
[5] This is also becoming a standard practice of various human rights organizations in Mexico to account for the severe underreporting and lack of accurate data on femicides in Mexico.
[6] SEGOB, INMUJERES, ONU Mujeres. 2017. "La violencia feminicida en México, aproximaciones y tendencias 1985-2016."
[7] ECLAC. 2021. "At Least 4,091 Women Were Victims of Femicide in 2020 in Latin America and the Caribbean, Despite Greater Visibility and Social Condemnation." https://www.cepal.org/en/pressreleases/eclac-least-4091-women-were-victims-femicide-2020-latin-america-and-caribbean-despite

Any additional data sources we use for VAW-related outcomes that are not specified in this section will be clearly noted in the paper to clarify that they were not pre-registered.

All measures are available by municipality and year. We plan to use these outcomes by year of municipal administration (each year of the three-year terms) to see whether there are temporal effects as well as pooled (the three years of the administration combined) to see whether there are overall effects. We also plan on using both the rate of incidents per 100 thousand people and raw count.

1.5 Analysis

To estimate the regression discontinuity, we rely on procedures developed in the literature. Specifically, we utilize the rdrobust package in R for the main analysis (Calonico, Cattaneo, Farrell, and Titiunik 2017).[8] We estimate both linear and quadratic polynomial models.

Because the outcome measures are count variables, we also use a negative binomial regression to estimate the regression discontinuity for robustness.

1.6 Balance checks

As is standard in regression discontinuity designs, we will use pre-treatment variables to help validate the as-if random assumption. These tests are designed to assess balance between the treatment (woman candidate barely defeats male candidate) and control (male candidate barely defeats woman candidate) groups.

Specifically, we will use the 2010 census that provides information about each municipality, including population, economically active individuals, number of male/female residents, education levels, access to health care, marriage rates, religious affiliation, and number of homes, among others. We also use official data on each municipality's 2010 Gini and poverty levels from Mexico's National Council for the Evaluation of Social Development Policy.

We find it important to note, however, that due to chance, it should be expected that approximately 1 in 20 variables will lead to statistically significant differences with the significance level set at 0.05.

1.7 Heterogeneous effects

We plan on exploring some important heterogeneous effects. Here we register three heterogeneous effects. Any test that we end up conducting that is not registered will be noted as exploratory to make it clear that it was not pre-registered.

First, we plan on testing whether effects differ depending on whether organized crime was present in a municipality. Organized crime is a major issue in Mexico that is sometimes tied to VAW, and especially to instances of femicides. Organized crime is also often associated

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[8] Calonico, S., M. D. Cattaneo, M. H. Farrell, and R. Titiunik. 2017. rdrobust: Software for Regression Discontinuity Designs. Stata Journal, 17(2): 372-404.

with corruption in law enforcement agencies and local politics, perhaps making it more difficult to address VAW. We will use municipality-level data on the presence of organized crime in Mexico provided by the Mapping Criminal Organizations in Mexico project (Sobrino, Alcocer, Farfan Mendez, and Signoret 2022). This data covers up to 2018, so we will use the 2018 data to test whether municipalities with and without organized crime are affected differently by women politicians.

Second, we plan on testing whether there are differential effects based on pre-existing levels of violence. There may be reasons to believe that women politicians can address VAW differently in contexts of high versus low violence. This is especially salient in Mexico where some municipalities experience very high levels of violence while others do not. We will use data on intentional homicides to code municipalities as highly violent or not. While this threshold is arbitrary, for transparency, we plan on coding municipalities with homicide rates per capita greater than the third quartile of all municipalities in 2018 as highly violent municipalities.

Third, women's movements have become prevalent in Mexico, with many centering specifically on protesting against VAW. There is reason to believe that in municipalities where protests have taken place, politicians are more responsive to these issues—particularly women politicians—and therefore more likely to address them. To test for this, we use event data from the Armed Conflict Location & Event Data Project (ACLED) on protests, attempting to narrow in on protests dealing with women issues or VAW if possible, in order to code municipalities as having experienced these protests or not.

1.8 Standard errors

We will estimate heteroskedasticity-robust standard errors. In the case that we are able to collect data from years beyond 2018, we will cluster our standard errors to the municipality level.

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