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Polluting Politics

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Abstract: This paper estimates the causal impact of Democratic vs Republican governors on pollution. Using a regression discontinuity design, gubernatorial election data, and air quality data from U.S. Environmental Protection Agency (EPA), we find that air pollution is lower under Democratic governors.

JEL Classification: Q53, Q58, D72

Keywords: Political Parties, Pollution, Regression Discontinuity

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1. Introduction

It is estimated that more than 25 million Americans, including 7 million children, suffer from asthma, a number which has been steadily increasing since 2000 (Akinbami et al., 2012). One important contributor to this increase is exposure to air pollution. There is indeed a large body of literature on the negative impacts of air pollution on health (e.g. Greenstone (2004), Chay and Greenstone (2005), Dominici et al. (2014)). Although air pollution is strictly regulated in the United States[1] we observe substantial variability across states. Such variation is likely influenced by the states' political environment. In particular, the identity of the party in power is likely to have a significant influence, as it has been shown to affect economic activity, policies, spending, and the labor market (e.g. Besley and Case (1995, 2003), Leigh (2008), Beland (2015) and Beland and Oloomi (2015)). Party affiliation is then likely to contribute to the realized levels of air pollution.

In this paper, we estimate the causal impact of Democratic vs Republican governors on the states' levels of five major air pollutants: carbon monoxide (CO), ground-level ozone (Ozone), nitrogen dioxide (NO2), particulate matter (Particulates) and sulfur dioxide (SO2).[2] We find that the concentrations of NO2, Ozone and Particulates are significantly lower under Democratic governors. Interestingly, we find that changes in the levels mostly happen *below* EPA standards. Our analysis suggests that party affiliation has a significant impact on air pollution. Our results support political difference betwen political parties and reject median voter theorem.

[1] For instance, under the Clean Air Act, see `http://www2.epa.gov/clean-air-act-overview` for details.

[2] Our paper is contributing to the literature linking politics and the environmental policies. Fredriksson and Wollscheid (2010) find that party discipline, strength, and political instability are strong determinants of policy outcomes, while List and Sturm (2006) argues that policies are largely influenced by lobbying and finds a strong link between electoral incentives and environmental policies. Innes and Mitra (2015) find that new Republican representatives significantly depress inspection rates in the year following their election.

2. Data

The main data on air pollution come from the U.S. EPA AirData from 1975 to 2013. We use information on yearly average concentrations in a given state for five major pollutants: CO, Ozone, NO2, Particulates, and SO2. The five pollutants are covered by the Clean Air Act and are targeted by the EPA for their negative impacts on health, on the environment, as well as on properties. Of those pollutants, Ozone and Particulates have the strongest impacts on health and can lead to, or exacerbate respiratory problems, especially for people with asthma.[3] NO2 contributes to the formation of Ozone and Particulates. SO2 also contributes to the formation of Particulates.[4] Concentration levels represent averages across the states' monitoring stations. Using the National Ambient Air Quality Standards, we also report the yearly exceedance levels.[5] We use two main sources for the election data: ICPSR 7757 (before 1990) and *Atlas of U.S. Presidential Elections* (for 1990 to 2013).

3. Methodology

We capture the causal impact of the party allegiance of governors on air quality using a regression discontinuity design (RDD), following Lee (2001, 2008). The RDD allows us to remove potential endogeneity of elections resulting from unmeasured characteristics of states and candidates. Our main specification uses parametric regression discontinuity. We estimate:

$$Y_{st} = \beta_0 + \beta_1 D_{st} + F(MDV_{st}) + X_{st} + \gamma_s + \nu_t + \epsilon_{st} \tag{1}$$

[3] See `www.epa.gov/air/urbanair/` for details.

[4] See `http://www2.epa.gov/clean-air-act-overview` and Lippmann (2000), chapters 2 and 20, for details. We consider particulate matter from 0 to 10um (PM10 Total 0-10um STP).

[5] We use primary standards, see `http://www.epa.gov/air/criteria.html` for a precise description of those standards. Table A.1 and A.2 presents summary statistics.

Y_{st} represents the air quality measure of interest mentioned above. The main coefficient of interest is β_1. D_{st} is a dummy variable that takes a value of one if a Democratic governor is in power in state s during year t. Following Gelman and Imbens (2014), the party effect, β_1, is estimated by controlling for the margin of victory using a second-order polynomial of the margin of victory: $F(MDV_{st})$. We also present alternate polynomials and local-linear regression, using optimal bandwidth choice by Imbens and Kalyanaraman (2012). MDV_{st} refers to the margin of victory in the most recent gubernatorial election prior to year t in state s. The margin of victory is defined as the proportion of votes cast for the winner minus the proportion of votes cast for the candidate who finished second. The value is positive if the Democratic candidate won and negative otherwise. γ_s and ν_t capture state and year fixed effects, respectively. X_{st} refers to time-varying state characteristics. Standard errors are clustered at the state level to account for potential serial correlation.

4. Results

4.1. Main Results

As it is customary in RDD analysis, Figure 1 explores the discontinuity at 0% when a Democratic governor barely wins over a Republican. Figure 1 suggests that concentration levels are lower under Democratic governors. Table 1 presents RDD estimates for outcome variables: concentrations of CO, Ozone, NO2, Particulates, and SO2 using different polynomials. Our favorite specification is row 2: second-order polynomials. The tables report only the coefficient of interest: β_1, which captures the impact of the Democratic governor. Row 2 of Table 1 shows that Democratic governors significantly reduce concentrations for NO2, Ozone and Particulates. Coefficients for CO and SO2 also suggest that Democratic governors reduce concentrations, although the results are not statistically significant.[6] Table 1 also shows that results are robust regardless of the

[6] Recall that Ozone and Particulates are considered to have the most harmful impact on health. Yet, another feature of those pollutants is that they are not directly emitted as a

order of the polynomials used and to using local linear RDD. Appendix Table A.3 investigates whether the concentrations of the substances are higher than recommended by the EPA. Table A.3 shows that under Democratic governors, it is less likely that ozone emission will exceed the limits. There is no significant difference for CO and particulate; and NO2 and SO2 never goes above the recommended limit.

4.2. Robustness and Heterogeneity

Panel A of Table 2 investigates the heterogeneity of the impact and robustness of the results. Table 2 shows results are qualitatively the same if we control for several characteristics of states and governors. Table 2 also presents a specification excluding southern states (where Democrats and Republicans political views are similar) and yields qualitatively the same conclusion. Table 2 also presents results when governors and state legislatures are of the same party (united government) and results are qualitatively the same. Table 2 also shows that results for reelectable governors are stronger than lame-duck governors. We also test for the appropriateness of the RDD. Table 2 presents a placebo RDD to remove concern that the decrease in concentrations found above could result from long term trends. Using concentration data in the previous term as an outcome, we find that there is no discontinuity in concentration outcomes in the year prior to the election (T-1). Table 2 explores the impact of Democratic governors on the number of air quality monitoring sites in the state. Democrats could plausibly increase funding to state environmental agencies, which then increase investment in pollution monitoring. This could increase or decrease recorded pollution levels in the data without changing true air quality. Table 2 finds no significant impact on the number of monitoring sites. Figure A.1 shows the distribution of the margin of victory (MDV) for Democrats across all elections in our sample and Figure A.2 presents the McCrary test (2008). Those figures show no unusual jumps around the cutoff, which give confidence

result of human activities, but are the result of the interactions between many pollutants and chemicals (including NO2 and SO2).

in the RDD design. Table A.4 shows that characteristics of states are similar when Democrats barely win than when Republicans barely win. Finally, Figure A.4 presents event study graphs for NO2, Particulates and Ozone (i.e. the pollutants for which we find significant influence of Democratic governors). The effect in years before the election is not statistically different than zero, then the effect starts gradually after the election.

4.3. Possible mechanisms

The impact of states' policies on air quality can go through the adoption of more stringent air quality *standards*, better *monitoring* or stronger *enforcement* programs. Indeed states often adopt standards exceeding the EPA minimal standards. (Potoski and Woods, 2002). This is coherent with our findings that the political game does not affect the compliance with EPA's standards (see Table A.3).

Better monitoring is in line with Innes and Mitra (2015) who find that inspection rates in the first year after the election is lower under a Republican governor. In this paper, we use aggregate data across multiple monitoring stations. We do not find any substantial change in the number of monitoring stations resulting from the election of a Democrat or a Republican governor (see Table 2).

Finally, some states have better enforcement programs. Indeed, an important contributor to air quality is the elaboration of trading markets for SO2 and NOX. (Burtraw and Szambelan, 2009; Hansjürgens, 2011). Participation to those programs, as well as the negotiation of their effective regulations is likely to be influenced by the election of a Democrat (vs a Republican).[7]

[7] As an exploration, Panel B of Table 2 replicates the results of Table 1 while including additional controls for the change in policies. The coefficient for Democratic governors is no longer significant, which suggests that policies are a main channel through which we observe the decrease in pollution under Democratic governors.

5. Conclusion

In this paper, we found a significant causal impact of Democratic governors on the realized levels of air pollution. This is an important issue because of the well documented link between air pollution and health. An interesting finding is that the effect mostly happens below the national standards. This suggests that national regulations, such as the EPA standards, are effective in reducing pollution and tempering the political power play between Republican and Democratic governors.

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We would like to thank Nick Mangus from the EPA (AQS Team) for his precious help with the data. We would like to thank Costas Meghir as well as one anonymous referee for their helpful comments and suggestions. We would also like to thank Daniel Brent, Briggs Depew and Naci Mocan for their comments and suggestions. Vincent Boucher gratefully acknowledges financial support from FRQ-SC.

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Table 1: RDD estimates: several specifications

		(1)	(2)	(3)	(4)	(5)
Model	Concentration of	CO	NO2	Ozone	Particulates	SO2
1rst Order	Dem. Gov	-0.0057	-0.1367***	-0.0014***	-0.0394*	-0.0604
		(0.0211)	(0.0522)	(0.0005)	(0.0231)	(0.0479)
2nd Order	Dem. Gov	-0.0315	-0.1359**	-0.0022***	-0.0715**	-0.0952
		(0.0268)	(0.0664)	(0.0006)	(0.0283)	(0.0624)
3rd Order	Dem. Gov	-0.0224	-0.2663***	-0.0023***	-0.1026***	-0.0952
		(0.0308)	(0.0762)	(0.0007)	(0.0366)	(0.0624)
Local-Linear	Dem. Gov	-0.1358**	-0.2269***	-0.0022**	-0.0664*	-0.2368*
-IK Bandwith		(0.0547)	(0.0660)	(0.0010)	(0.0394)	(0.1380)

Notes: State average concentrations for each year: CO2 (ppm), NO2 (ppb), Ozone (ppm), Particulates ($\mu g/m^3$), SO2 (ppb). Standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1 Source: Airdata (EPA)

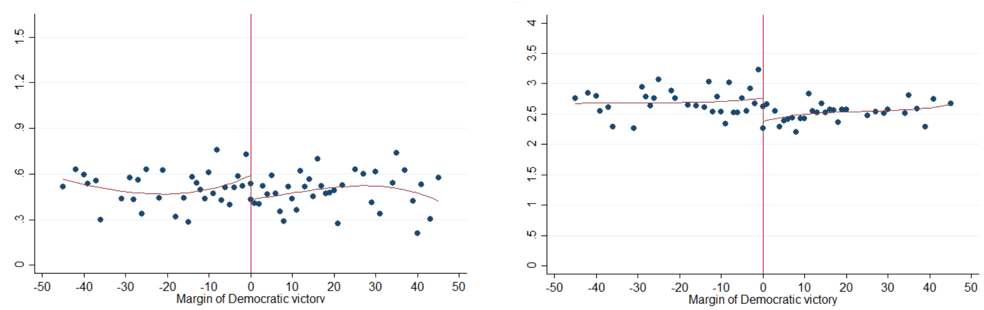
Table 2: RDD estimates for concentration using 2nd order polynomials: Heterogeneity, Robustness & Exploring mechanisms

		(1)	(2)	(3)	(4)	(5)
Model	Concentration of	CO	NO2	Ozone	Particulates	SO2
Panel A:						
Non-Southern States	Dem. Gov	0.0036	-0.2883***	-0.0035***	-0.0918**	-0.1837**
		(0.0360)	(0.0942)	(0.0009)	(0.0425)	(0.0842)
Same party Gov & Legis	Dem. Gov	-0.0480	-0.1192*	-0.0023***	-0.0830**	-0.1232*
		(0.0304)	(0.0713)	(0.0007)	(0.0330)	(0.0689)
Reelectable Gov.	Dem. Gov	-0.0275	-0.1986**	-0.0024***	-0.0684**	-0.0985
		(0.0303)	(0.0786)	(0.0007)	(0.0330)	(0.0728)
Lame-Duck Gov.	Dem. Gov	-0.0403	-0.0693	-0.0029**	-0.0003	-0.1172
		(0.0610)	(0.1228)	(0.0014)	(0.0729)	(0.1343)
Additional Controls	Dem. Gov	-0.0019	-0.1272*	-0.0022***	-0.0489*	-0.0755
		(0.0200)	(0.0752)	(0.0008)	(0.0255)	(0.0608)
Placebo RD at T-1	Dem. Gov	-0.0156	0.0711	-0.0003	-0.0253	0.1040
		(0.0301)	(0.0623)	(0.0009)	(0.0407)	(0.0754)
Number of Monitoring sites	Dem. Gov	0.0301	-0.0622	-0.0266	0.0151	-0.0479
		(0.0399)	(0.0670)	(0.0396)	(0.0621)	(0.0599)
Panel B:						
Control for policies	Dem. Gov	0.0124	-0.0092	0.0001	-0.0085	0.0388
		(0.0105)	(0.0312)	(0.0004)	(0.0163)	(0.0341)

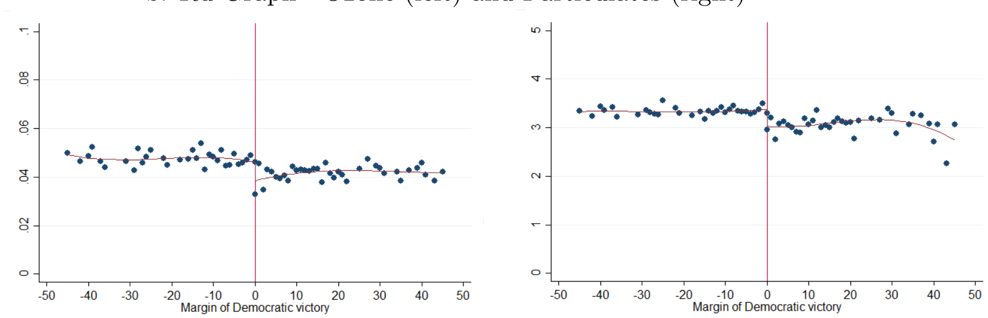
Notes: State average concentrations for each year: CO2 (ppm), NO2 (ppb), Ozone (ppm), Particulates ($\mu g/m^3$), SO2 (ppb). Standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1 Source: Airdata (EPA)

Figure 1: The Impact of Democratic Governors on Air Quality

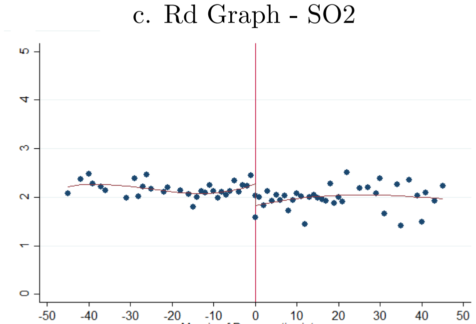
a. Rd Graph - CO (left) and NO2 (right)



b. Rd Graph - Ozone (left) and Particulates (right)



c. Rd Graph - SO2



Sources: Airdata (EPA) and Election Data

Appendix

Figure A.1: Distribution of the Margin of Democratic Victory

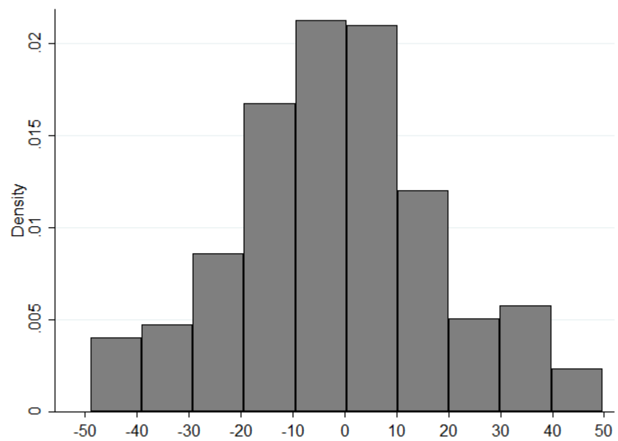


Figure A.2: McCrary test

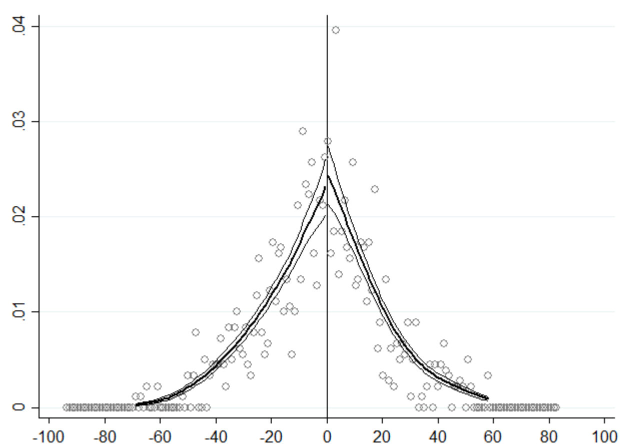
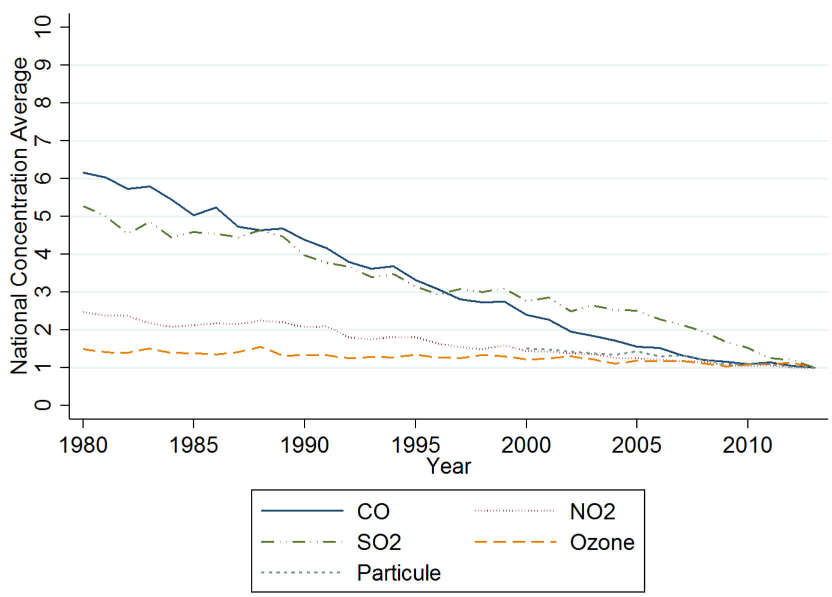


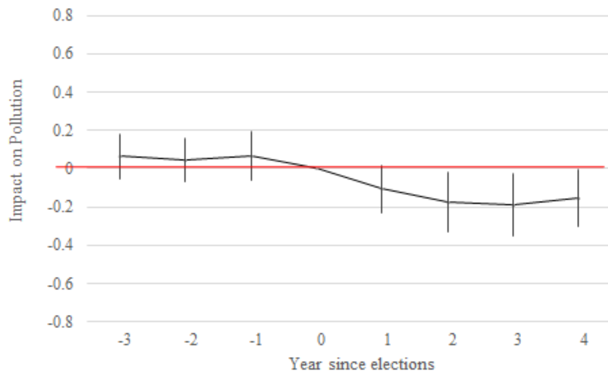
Figure A.3: Historic National Trends (Concentration Levels, 2013=1)



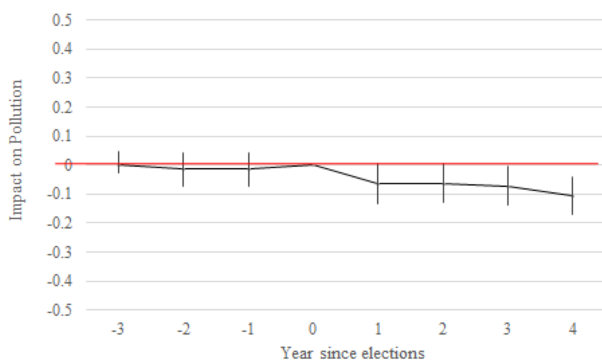
Source: EPA

Figure A.4: Event Study Graphs

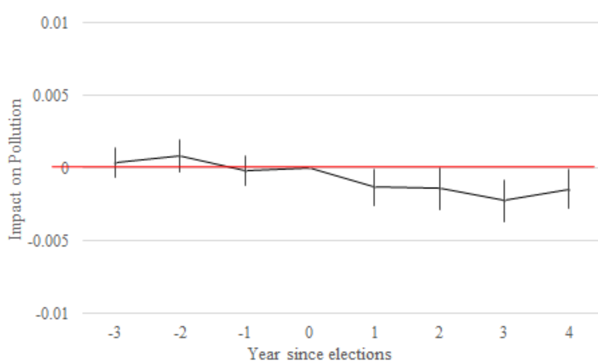
a. NO2



b. Particulates



c. Ozone



Sources: Airdata (EPA) and Election Data

Table A.1: EPA Primary Standards versus WHO Guidelines

Pollutant	EPA	WHO	Averaging Period	Units
CO	9	10[†]	8 hours	ppm
NO2	188	200	1 hour	$\mu g/m^3$
Ozone	150	100	8 hours	$\mu g/m^3$
Particulates	150	50	24 hours	$\mu g/m^3$
SO2		*Not directly comparable*		

Notes: Authors' conversions (for 1 ppb) for SO2 (2.62 $\mu g/m^3$), NO2 (1.88 $\mu g/m^3$), Ozone (2.00 $\mu g/m^3$) Sources: EPA NAAQS (available online at `http://www.epa.gov/air/criteria.html`) WHO Guidelines (available online at `http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf`)

[†] WHO Regional Office for Europe

Table A.2: Summary Statistics (Concentration across States and Time)

Pollutant	Average	Std. Dev.
CO	1.405	(1.684)
NO2	17.135	(15.480)
Ozone	0.0435	(0.008)
Particulate	24.114	(8.995)
SO2	8.045	(16.690)

Notes: State average concentrations for each year: CO2 (ppm), NO2 (ppb), Ozone (ppm), Particulates ($\mu g/m^3$), SO2 (ppb). Standard errors are clustered at the state level. Source: Airdata (EPA)

Table A.3: RD estimates: 2nd order - Exceed Concentration

	(1)	(2)	(3)
Variables	CO	Ozone	Particulates
Dem Gov.	-0.0064	-2.8292***	-0.0014
	(0.0099)	(0.8316)	(0.0841)

Notes: State average concentrations for each year: CO2 (ppm), NO2 (ppb), Ozone (ppm), Particulates ($\mu g/m^3$), SO2 (ppb). Standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1 Source: Airdata (EPA)

Table A.4: RD estimates: Characteristics of States

Fraction population:	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Minority	Educ.	Not Educ.	Age>65	Age<20	ln(Weekly Earnings)
Dem Gov.	-0.0041	0.0024	-0.0024	0.0001	-0.0010	0.0150
	(0.0024)	(0.0038)	(0.0038)	(0.0001)	(0.0008)	(0.0094)

Notes: Standard errors are clustered at the state level.*** p<0.01, ** p<0.05, * p<0.1
Source: March CPS