2015-05

Polluting Politics

Louis-Philippe Beland
Vincent Boucher

mai / may 2015

**Centre de recherche sur les risques
les enjeux économiques et les politiques publiques**

www.crrep.ca

Abstract

This paper estimates the causal impact of party affiliation (Republican or Democrat) of U.S. 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 pollution is lower under Democratic governors. We identify that this is mostly due to environmental policies enacted by Democratic governors.

Keywords : Political Parties, Pollution, Air Quality, Regression Discontinuity

JEL Classification : Q53, Q58, D72

Beland: Department of Economics, Louisiana State University lbeland@lsu.ed

Boucher: Department of Economics, Université Laval and CIRPÉE vincent.boucher@ecn.ulaval.ca

We would like to thank Nick Mangus from the EPA (AQS Team) for his precious help with the data. We would also like to thank Daniel Brent, Briggs Depew and Naci Mocan for their comments and suggestions. Vincent Boucher gratefully acknowledge financial support from FRQSC

1 Introduction

It is estimated that more than 25 million Americans, including 7 million children, suffer from asthma, and that that number has been steadily increasing since 2000 (Akinbami et al., 2012). One important contributor to this increase is exposure to air pollution (e.g. Pénard-Morand et al. (2010)). There is indeed a large body of literature on the negative impacts of air pollution on health (e.g. Greenstone (2004), Chay & Greenstone (2005), Dominici et al. (2014)). Although air pollution is strictly regulated in the U.S. under the Clean Air Act, we observe substantial variability across states and such variation is likely influenced by the states' political environment (Potoski & Woods, 2002). 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 & Case (1995, 2003), Leigh (2008) and Beland (2015)). Party affiliation is then likely to contribute to the realized levels of air pollution.

In this paper, we estimate the causal impact of party affiliation (Democrat or Republican) on the states' levels of five major air pollutants: carbon monoxide (CO), ground-level ozone (Ozone), nitrogen dioxide (NO2), particulate matters (Particulates)[1] and sulfur dioxide (SO2). We find that the concentrations of nitrogen dioxide, ground-level Ozone and particulate matters are significantly lower under Democratic governors. We find no influence of party affiliation on the levels of the other pollutants. Interestingly, we find that changes in the levels mostly happen *below* EPA standards.

We further investigate the likely channels through which party affiliation affects the concentration of pollutants. Using dummy variables for major regulation changes for nitrogen dioxide and sulfur dioxide, we argue that frequent changes in the regulation of nitrogen dioxide explain a significant portion of our results. This is in agreement with Hansjürgens (2011) who argues that regulatory uncertainty may have significant negative impacts on the efficiency of NO2 and SO2 markets.

[1] Technical definition: PM10 Total 0-10um STP

This paper contributes to the growing literature linking politics and the environment (e.g. Fredriksson & Neumayer (2013), Bianchini & Revelli (2013), Cremer et al. (2008)). Our results complement the literature's fndings that the election of Democratic (or left-centrist, see Garmann (2014)) politicians have a positive impact on the environment. Fredriksson & Wollscheid (2010) find that party discipline, strength, and political instability are strong determinants of policy outcomes, while List & Sturm (2006) argues that policies are largely influenced by lobbying and finds a strong link between electoral incentives and environmental policies. Innes & Mitra (2015) find that new Republican representatives significantly depress inspection rates in the year following their election.

We contribute to this literature by estimating the causal impact of party affiliation of U.S. governors on the actual levels of air pollutants. Our analysis suggests that party affiliation has a significant impact on the quality of life as measured by the concentration of air pollutants, and that this impact is mostly a result of policy choices. In addition to the obvious health consequences, our focus on the actual environmental measures (as opposed to environmental policies) is also motivated by the recent literature linking air quality to happiness (Levinson, 2012).

The rest of the paper is organized as follows. In section 2, we present the data and discuss historical trends and context. In section 3, we present our methodology. In section 4, we present our results. In section 5, we present robustness checks. We conclude in section 6.

2 Data and Descriptive Statistics

2.1 Data

The main data on air pollution come from the United States Environmental Protection Agency's (EPA) AirData from 1975 to 2013. We use information on yearly average concentrations in a given state for five major pollutants: carbon monoxide (CO), ground-Level ozone (Ozone), nitrogen dioxide (NO2), particulate matter (Particulate) and sulfur dioxide

(SO2). Concentration levels represent unweighed averages across the states' monitoring stations. Using the National Ambient Air Quality Standards, we also report the yearly exceedance levels.[2] Table 1 presents the summary statistics.

We use two main sources for the election data: ICPSR 7757 (1995) and *Atlas of U.S. Presidential Elections*. The first source is available for data prior to 1990 and the second is used for the years 1990 to 2013. We use two main pieces of information from these sources: the party that is in power in year t and state s, and the margin of victory. For the purpose of this study we only consider states where either a Democrat or a Republican won. The margin of victory is calculated as the party of the winner minus the second candidate. We set the margin of victory to be positive if the Democratic candidate won and negative otherwise. The discontinuity is set at 0%. From 1975 to 2013, there are 1906 state-year observations where either a Democratic or a Republican governor won. Over that period, Democrats where in power 54% of the time.

2.2 Background Information and Historical Trends

We concentrate on five pollutants: carbon monoxide (CO), ground-Level ozone (Ozone), nitrogen dioxide (NO2), particulate matter (Particulate) and sulfur dioxide (SO2). In this section, we briefly describe each of these pollutants, their main effects on health, and their historical trends.[3]

Three pollutants are directly emitted as a result of human activities: CO, NO2 and SO2. Carbon monoxide is emitted mostly from combustion of mobile (cars, trucks, etc.) sources and fires. It affects health mostly by reducing oxygen delivery to the organs and tissues. Nitrogen dioxide is also produced as a result of combustion, principally from mobile sources, fires, and industrial processes. Direct health effects of NO2 include inflammation of the respiratory system and asthma. NO2 also contributes to the formation of ground-level

[2]We use primary standards, see `http://www.epa.gov/air/criteria.html` for a precise description of those standards.

[3]Source: EPA, more information are available on EPA's website. See `http://www.epa.gov/airquality/`.

ozone, particulate pollution (see below), and acid rain. Sulfur dioxide is emitted from the combustion of fossil fuels, mostly from power plants. SO2's main direct effects on health are also related to the respiratory system. SO2 also has indirect effects on health as it contributes to the formation of particulate matter and acid rain.

The two remaining pollutants, ground-level ozone and particulate matters, are not directly emitted and are the result of the interactions between other pollutants. Ozone is formed by the interaction between nitrite oxides (including NO2) and volatile organic compounds (from organic chemicals, present in household products, paint, etc.). Ozone mostly affects individuals with lung diseases. Children and the elderly are also particularly sensitive to Ozone. Particulate matters represent a mixture of a large variety of chemicals, dust, and acids. The effects of particulate matters on health are wide and depend on the size of the particulates. Smaller particulates (on which this paper focusses) have the strongest impact on health, contributing (among many others) to lung diseases, non-fatal heart attacks, and asthma.

Over the years the concentrations of those five pollutants have been steadily decreasing (see Figure 4). A likely contributor to that decrease is the Clean Air Act (established in 1970 with major amendments in 1977 and 1990) which requires the EPA to establish quality standards for six major pollutants (including the five pollutants studied here as well as lead). Although states are required to adopt strategies in order to meet those quality standards, implementation is highly heterogeneous across states and pollutants. We shall see that this heterogeneity in implementation has a measurable impact on the concentration levels, and can be (at least partly) explained by states' political dynamics.

3 Methodology

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

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

Y_{st} represents the air quality measure of interest. We look at five different measures of air quality: the average concentration of NO2, SO2, Particulates, Ozone and CO2. 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 & Imbens (2014), the pure party effect, β_1, is estimated by controlling for the margin of victory using a second-order polynomial of the margin of victory: $F(MDV_{st})$. MDV_{st} refers to the margin of victory in the most recent gubernatorial election prior to year t in state s. As an example, the party of the winner of the 2004 gubernatorial election in Indiana and the margin of victory are used in regressions for 2005, 2006, 2007 and 2008 in that state. 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 if he or she lost. We exclude observations where neither a Democrat nor a Republican won. γ_s captures state fixed effects and ν_t captures year fixed effects. X_{st} refers to time-varying state characteristics used in some specifications. Standard errors are clustered at the state level to account for potential serial correlation. We also present alternate polynomials and local-linear regression in the section 5, using optimal bandwidth choice by Imbens & Kalyanaraman (2012).

4 Results

4.1 Graphical Evidence

As is customary in RD analysis, we first present some graphical evidence on the impact of Democratic governors on concentration levels for our outcomes of interest: carbon monoxide, ground-level ozone, nitrogen dioxide, particulate matter and sulfur dioxide. Figure I explore the discontinuity at 0% when a Democratic governor barely wins over a Republican.

In each graph, each dot represents the average outcome that follows election t, grouped by margin of victory intervals. The solid curves in the figures represent the predicted values from the quadratic polynomial fit without covariates. Figures for outcomes suggests that concentration levels are lower under Democratic governors. In the next section, we estimate these effects more precisely.

4.2 Main results

Table 2 presents RD estimates for outcome variables: concentrations of CO, Ozone, NO2, Particulates, and SO2. The tables report only the coefficient of interest: β_1, which captures the impact of the Democratic governor on the outcome variable of interest. Table 2 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.

Table 3 investigate whether the concentrations of the substances are higher than recommended by EPA. Table 3 shows that under Democratic governors, it is less likely that ozone emission will exceed the limits. There is no significant difference for the rest of the substances (CO and particulate), and NO2 and SO2 never goes above the recommended limit. In summary, Table 2 and 3 both suggest that concentrations are lower under Democratic governors, although only the ozone limit is less likely to be met under Democratic governors.

Although Democratic governors mostly affect concentrations of pollutants for levels in accordance with the EPA standards, the impacts on health may still be important. In particular for Ozone and Particulates, the EPA standards are significantly weaker than the guidelines suggested by the World Health Organization (WHO, see Table A.3). As discussed in section 2.2, Ozone and Particulates are not directly emitted and are the result of complex interactions between many pollutants. This implies that pollution reduction is more challenging for those pollutants, and that they are therefore more prone to political manipulation (Potoski & Woods, 2002). In the next section, we discuss how this section' results can be partly explained by state regulations.

4.3 The Impact of State Regulations

Table 4, Table 5 and Table 6 investigate potential channels to explain the difference in pollution under Democratic governors. We concentrate on two main channels: policies and public spending on parks and recreation and natural resources.

We expect the main channel to be through changes in policies. According to Potoski & Woods (2002), changes in Air pollution regulations are strongly influenced by the political game, and by lobbies. By opposition, spending is more dependent on the complexity of the environmental problem and mainly goes through bureaucracies, which are likely to be less influenced by changes in the governor's party affiliation.

As discussed in section 2.2, a likely contributor to the decrease in the measured concentrations of pollutants is the Clean Air Act, established in 1970 and revised in 1977 and 1990. State level implementations of the Clean Air Act differ substantially across states (again, see section 2.2). We argue that those differences are, at least partly, sourced in the political game between Democrats and Republicans.

We will focus on the trading systems for the nitrogen dioxide and the sulfur dioxide as they are widely recognized to have significantly impacted the concentrations of those two pollutants (Burtraw & Szambelan, 2009). Figures 5 and 6 present the differences in average concentration levels for states participating or not in the trading programs.[4] We see that, for both pollutants, those trading programs have been implemented in states with relatively high levels of pollutants. The impact, however, seems to be much stronger for SO2. One of the possible explanations is that there were far fewer changes to the program's regulation for SO2 than for NO2. We include those changes as controls in our RD regressions. Specifically, we add a dummy variable for the states involved in those trading programs as well as for

[4] Note that the trading program started in 1995 for SO2 and in 1990 for NO2.

major changes in those programs.

Table 4 replicates the results of Table 2 while including additional controls for the policies discussed above. 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. This is in accordance with Ines and Mitra (2015).

Table 6 replicates the results of Table 2 and includes additional controls for spending on parks and recreation and natural resources, but no policy controls. Results are similar to Table 2 and show a significant decrease for ozone and particulates.[5] Table 5 control for policies and spending on parks and recreation and natural resources. Results are similar to table 2 and not significant.

Table 4, 5 and 6 suggest that the main channel through which governors affect pollution is the implemented policies. Although controlling for spending of parks and recreation and natural resources adds noise to the estimates, the estimated coefficient is only marginaly affected. By opposition, controlling for changes in policies have a strong downside impact on the magnitude of the coefficient. This interpretation is also supported by the fact that we found little impact of the political game on the probability that a state met the exceedance levels. Indeed, violation of the primary exceedance levels is small, and relatively homogeneous across states and time. This suggests that the politico-environmental game happens for relatively low levels of concentration, i.e. in accordance with federal regulation.

5 Robustness and Different samples

We investigate the validity of the RD methodology in our context. We first look at the density of the elections around the cutoff. Figure 2 shows the distribution of the margin of victory (MV) for Democrats across all elections in our sample. The distribution is clustered around the cutoff point with no unusual jumps. Figure 3 presents the McCrary test. It represents the density function of the margin of victory according to the procedure outlined

[5]The results for spending are similar to Fredricksson et al. (2010) who find no effect of party affiliation on environmental spending.

in McCrary (2008). We find no unusual jumps around the cutoff.[6]

Second, we investigate the robustness of the results to alternate polynomials. Following Lee & Lemieux (2014), we verify that our results are similar using first and third degree polynomials. Results presented in Table 8 and Table 9 show that results are quite similar regardless of the order of the polynomials used. We also present local linear regression discontinuity, using optimal procedure by Imbens & Kalyanaraman (2012). Results presented in Table 7 also show that Democratic governors decrease pollution levels.

Third, we run a placebo RDD, using outcomes in the previous term to remove concerns of the persistence of results. One concern is that the decrease in concentrations found above could result from long term trends. To remove this concern, we use concentration data in the previous term as an outcome and run placebo RD test. We find that there is no discontinuity in concentration outcomes in the year prior to the election (T-1), which imparts confidence in the RDD. Results are presented in Table 10.

Fourth, results are robust to adding controls for characteristics of the election to better isolate the impact of the gubernatorial election. Results are qualitatively the same if we control for characteristics of governors (gender and ethnic group), and the term of the governor. The results are also qualitatively the same if we exclude the first year a governor is in power, to remove potential lags in policy. The Democratic Party has some conservative members whose political views are similar to their Republican counterparts, and they are mainly found in Southern states. Consequently, we investigated the impact of party affiliation on air pollution when Southern states are excluded from the sample. Results are presented in Appendix Table A.1. The analysis using this subsample yields qualitatively the same conclusion: Democrats decrease air pollution. Appendix Table A.2 presents results when governors and state legislatures are of the same party (united government); one

[6] We also investigate whether campaign spending by Democrats across states in close elections differs from that by Republicans (Caughey and Sekhon (2011)). Using data from Jensen & Beyle (2003), we find no evidence for this. Furthermore, for close elections to be regarded as fully random, the elections won by Democratic governors should not be more likely to come with a Democratic legislature. We checked and confirmed that those variables are not statistically different when Democrats barely won.

might argue that party affiliation plays a more important role in such a case. Results of Table A.2 point all to the same conclusion: Democratic governors decrease air pollution.[7] These additional robustness checks provide confidence that Democratic governors have a significant impact on air quality.

6 Conclusion

In this paper, we found a significant causal impact of party allegiance on the realized levels of air pollution for nitrogen dioxide, ground-Level Ozone and particulate matters. Conformably to the literature, we find that the causal effect of governors are likely sourced in the parties' chosen policies. We contribute to the literature by showing that political party in power have measurable impacts on the realized levels of pollutants. 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 for relatively low levels of pollution, i.e. below the national standards. This suggests that national regulations, such as the EPA standards, are effective not only in reducing pollution, but also in tempering the political power play between Republican and Democratic governors.

[7] For the sake of brevity, we present RD estimates on non-Southern states and united governments. Detailed results are available upon request.

References

Akinbami, O. J., et al. (2012). Trends in asthma prevalence, health care use, and mortality in the united states, 2001-2010.

Beland, L.-P. (2015). Political parties and labor market outcomes: Evidence from u.s. states. *American Economic Journal: Applied*, *forthcoming*.

Besley, T., & Case, A. (1995). Does electoral accountability affect economic policy choices? evidence from gubernatorial term limits. *The Quarterly Journal of Economics*, *110*(3), pp. 769–798.

Besley, T., & Case, A. (2003). Political institutions and policy choices: Evidence from the united states. *Journal of Economic Literature*, *41*(1), pp. 7–73.

Bianchini, L., & Revelli, F. (2013). Green polities: Urban environmental performance and government popularity. *Economics and Politics*, *25*(1), 72–90.

Burtraw, D., & Szambelan, S. J. F. (2009). Us emissions trading markets for so2 and nox. *Resources for the Future Discussion Paper*, (09-40).

Caughey, D., & Sekhon, J. S. (2011). Elections and the regression discontinuity design: Lessons from close us house races, 1942–2008. *Political Analysis*, *19*(4), pp.385–408.

Chay, K. Y., & Greenstone, M. (2003). The impact of air pollution on infant mortality: Evidence from geographic variation in pollution shocks induced by a recession. *The Quarterly Journal of Economics*, (pp. 1121–1167).

Chay, K. Y., & Greenstone, M. (2005). Does air quality matter? evidence from the housing market. *Journal of Political Economy*, *113*(2).

Cremer, H., Donder, P. D., & Gahvari, F. (2008). Political competition within and between parties: An application to environmental policy. *Journal of Public Economics*, *92*(34), 532 – 547.

Currie, J., Neidell, M., & Schmieder, J. F. (2009). Air pollution and infant health: Lessons from new jersey. *Journal of Health Economics*, *28*(3), 688–703.

Currie, J., & Walker, R. (2011). Traffic congestion and infant health: Evidence from e-zpass. *American Economic Journal: Applied Economics*, *3*(1), 65–90.

Currie, J., Zivin, J. G., Mullins, J., & Neidell, M. (2014). What do we know about short- and long-term effects of early-life exposure to pollution? *Annual Review of Resource Economics*, *6*(1), 217–247.

Dominici, F., Greenstone, M., & Sunstein, C. R. (2014). Particulate matter matters. *Science*, *344*(6181), 257.

Ferreira, F., & Gyourko, J. (2009). Do political parties matter? evidence from u.s. cities. *The Quarterly Journal of Economics*, *124*(1), pp. 399–422.

Ferreira, F., & Gyourko, J. (2015). Does gender matter for political leadership? the case of u.s. mayors. *Journal of Public Economics*, *(forthcoming)*.

Fredriksson, P. G., & Neumayer, E. (2013). Democracy and climate change policies: Is history important? *Ecological Economics*, *95*(0), 11 – 19.

Fredriksson, P. G., & Wang, L. (2011). Sex and environmental policy in the u.s. house of representatives. *Economics Letters*, *113*(3), 228 – 230.

Fredriksson, P. G., Wang, L., & Mamun, K. A. (2011). Are politicians office or policy motivated? the case of u.s. governors' environmental policies. *Journal of Environmental Economics and Management*, *62*(2), 241 – 253.

Fredriksson, P. G., & Wollscheid, J. R. (2010). Party discipline and environmental policy: The role of smoke-filled back rooms*. *Scandinavian Journal of Economics*, *112*(3), 489–513.

Garmann, S. (2014). Do government ideology and fragmentation matter for reducing co 2-emissions? empirical evidence from oecd countries. *Ecological Economics*, *105*, 1–10.

Gelman, A., & Imbens, G. (2014). Why high-order polynomials should not be used in regression discontinuity designs. Tech. rep., NBER Working paper.

Greenstone, M. (2004). Did the clean air act cause the remarkable decline in sulfur dioxide concentrations? *Journal of Environmental Economics and Management*, *47*(3), 585–611.

Hansjürgens, B. (2011). Markets for so2 and noxwhat can we learn for carbon trading? *Wiley Interdisciplinary Reviews: Climate Change*, *2*(4), 635–646.

Imbens, G., & Kalyanaraman, K. (2012). Optimal bandwidth choice for the regression discontinuity estimator. *Review of Economic Studies*, *79*(3), 933–959.

Innes, R., & Mitra, A. (2015). Parties, politics, and regulation: Evidence from clean air act enforcement. *Economic Inquiry*, *53*(1), 522–539.

Isen, A., Rossin-Slater, M., & Walker, W. R. (2014). Every breath you take-every dollar you'll make: The long-term consequences of the clean air act of 1970. Tech. rep., National Bureau of Economic Research.

Jensen, J. M., & Beyle, T. (2003). Of footnotes, missing data, and lessons for 50-state data collection: The gubernatorial campaign finance data project, 1977–2001. *State Politics & Policy Quarterly*, *3*(2), 203–214.

Lee, D. S. (2001). The electoral advantage to incumbency and voters' valuation of politicians' experience: A regression discontinuity analysis of elections to the u.s house. Working Paper 8441, National Bureau of Economic Research.

Lee, D. S. (2008). Randomized experiments from non-random selection in u.s. house elections. *Journal of Econometrics*, *142*(2), pp. 675–697.

Lee, D. S., & Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, *48*(2), pp. 281–355.

Lee, D. S., & Lemieux, T. (2014). Regression discontinuity designs in social sciences. In H. Best, & C. Wolf (Eds.) *The SAGE Handbook of Regression Analysis and Causal Inference*, (pp. 301–27). SAGE Publications.

Lee, D. S., Moretti, E., & Butler, M. J. (2004). Do voters affect or elect policies? evidence from the u. s. house. *The Quarterly Journal of Economics*, *119*(3), pp. 807–859.

Leigh, A. (2008). Estimating the impact of gubernatorial partisanship on policy settings and economic outcomes: A regression discontinuity approach. *European Journal of Political Economy*, *24*(1), pp. 256–268.

Levinson, A. (2012). Valuing public goods using happiness data: The case of air quality. *Journal of Public Economics*, *96*(910), 869 – 880.

List, J. A., & Sturm, D. M. (2006). How elections matter: Theory and evidence from environmental policy. *The Quarterly Journal of Economics*, *121*(4), 1249–1281.

McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, *142*(2), pp. 698–714.

Pénard-Morand, C., Raherison, C., Charpin, D., Kopferschmitt, C., Lavaud, F., Caillaud, D., & Annesi-Maesano, I. (2010). Long-term exposure to close-proximity air pollution and asthma and allergies in urban children. *European Respiratory Journal*, *36*(1), 33–40.

Pettersson-Lidbom, P. (2008). Do parties matter for economic outcomes? a regression-discontinuity approach. *Journal of the European Economic Association*, *6*(5), pp. 1037–1056.

Poterba, J. M. (1994). State responses to fiscal crises: The effects of budgetary institutions and politics. *Journal of Political Economy*, *102*(4), pp. 799–821.

Potoski, M., & Woods, N. D. (2002). Dimensions of state environmental policies. *Policy Studies Journal*, *30*(2), 208–226.

Reed, W. R. (2006). Democrats, republicans, and taxes: Evidence that political parties matter. *Journal of Public Economics*, *90*(4-5), pp. 725–750.

Sanders, N. J. (2012). What doesnt kill you makes you weaker prenatal pollution exposure and educational outcomes. *Journal of Human Resources*, *47*(3), 826–850.

Schlenker, W., & Walker, W. R. (2011). Airports, air pollution, and contemporaneous health. Tech. rep., National Bureau of Economic Research.

Table 1: 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), Particulate ($\mu g/m^3$), SO2 (ppb). Standard errors are clustered at the state level. Source: Airdata (EPA)

Table 2: RD estimates: 2nd order - Concentration

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.0315	-0.1359**	-0.0022***	-0.0715**	-0.0952
	(0.0268)	(0.0664)	(0.0006)	(0.0283)	(0.0624)

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

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

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

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

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

Notes: State average concentrations for each year: CO_2 (ppm), NO_2 (ppb), Ozone (ppm), Particulate ($\mu g/m^3$), SO_2 (ppb). Standard errors are clustered at the state level. Source: Airdata (EPA)

Table 4: RD estimates: 2nd order - Concentration and control for policies

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	0.0124	-0.0092	0.0001	-0.0085	0.0388
	(0.0105)	(0.0312)	(0.0004)	(0.0163)	(0.0341)

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

Notes: State average concentrations for each year: CO_2 (ppm), NO_2 (ppb), Ozone (ppm), Particulate ($\mu g/m^3$), SO_2 (ppb). Standard errors are clustered at the state level. Source: Airdata (EPA)

Table 5: RD estimates: 2nd order - Concentration and control for policies and control for spending on parks and recreation and natural ressources

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	0.0021	-0.0012	0.0001	0.0038	0.0633
	(0.0230)	(0.0334)	(0.0004)	(0.0163)	(0.0605)

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

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

Table 6: RD estimates: 2nd order - Concentration and control for spending on parks and recreation and natural resources

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.0170	-0.0891	-0.0021***	-0.0643**	0.0600
	(0.0258)	(0.0659)	(0.0007)	(0.0273)	(0.0623)

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

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

Table 7: Local-linear RD estimates with optimal bandwidth by IK

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.1358**	-0.2269***	-0.0022**	-0.0664*	-0.2368*
	(0.0547)	(0.0660)	(0.0010)	(0.0394)	(0.1380)

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

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

Table 8: RD estimates: 1st order - Concentration

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.0057	-0.1367***	-0.0014***	-0.0394*	-0.0604
	(0.0211)	(0.0522)	(0.0005)	(0.0231)	(0.0479)

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

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

Table 9: RD estimates: 3rd order - Concentration

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.0224	-0.2663***	-0.0023***	-0.1026***	-0.0952
	(0.0308)	(0.0762)	(0.0007)	(0.0366)	(0.0624)

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

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

Table 10: Placebo RD estimates: T-1

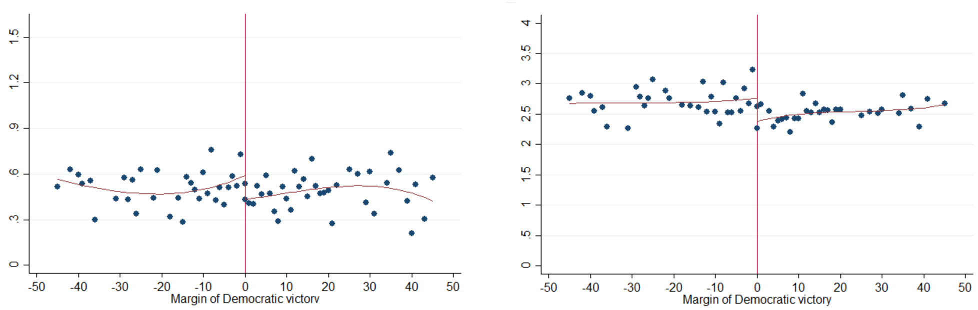
	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.0156	0.0711	-0.0003	-0.0253	0.1040
	(0.0301)	(0.0623)	(0.0009)	(0.0407)	(0.0754)

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

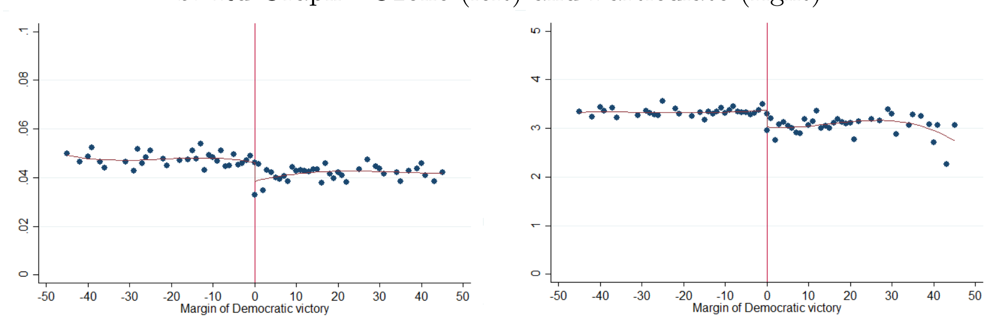
Notes: State average concentrations for each year: CO2 (ppm), NO2 (ppb), Ozone (ppm), Particulate ($\mu g/m^3$), SO2 (ppb). Standard errors are clustered at the state level. Source: Airdata (EPA)

Figure I: The Impact of Democratic Governors on Air Quality

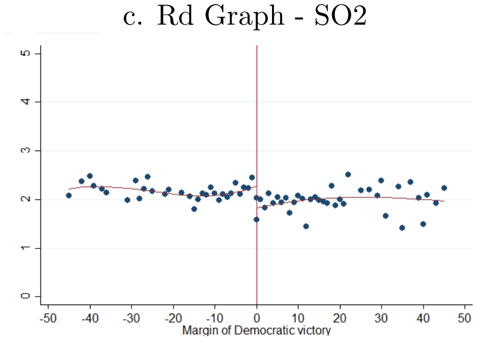
a. Rd Graph - CO (left) and NO2 (right)



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



c. Rd Graph - SO2



Sources: EEPA and Election Data

Figure 2: Distribution of the Margin of Democratic Victory

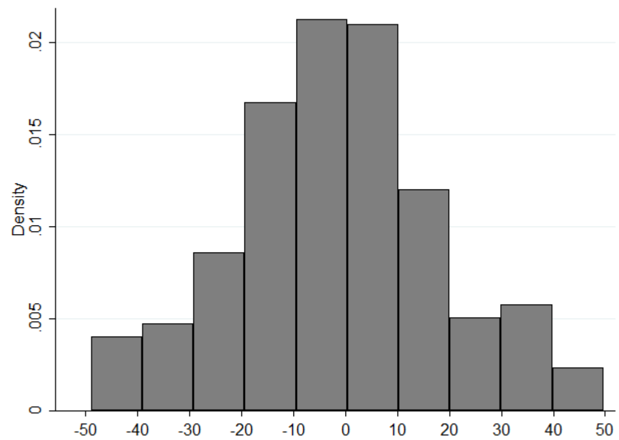


Figure 3: McCrary test

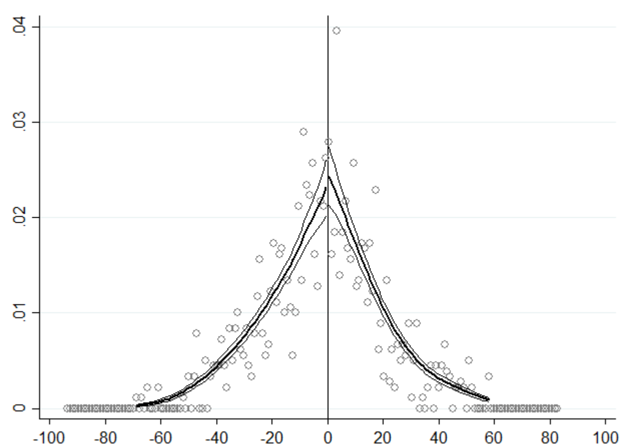
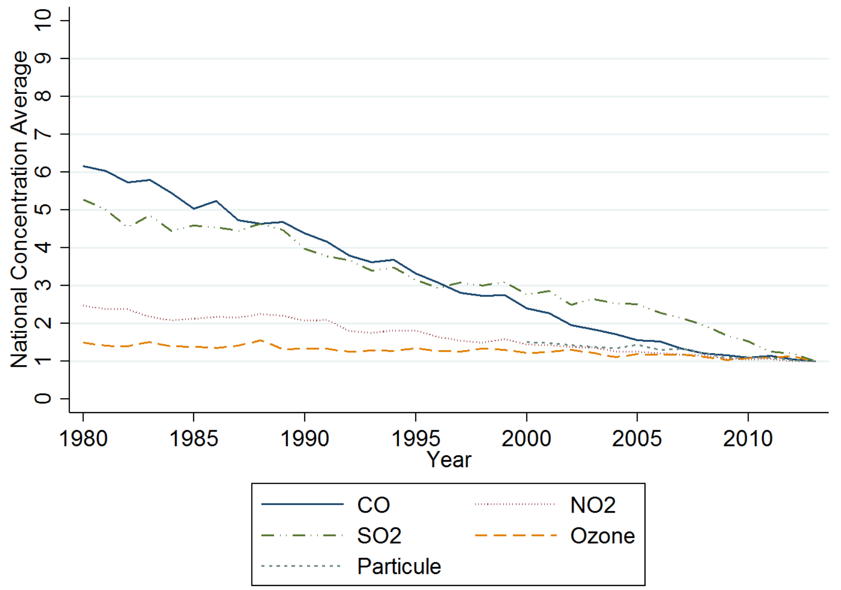
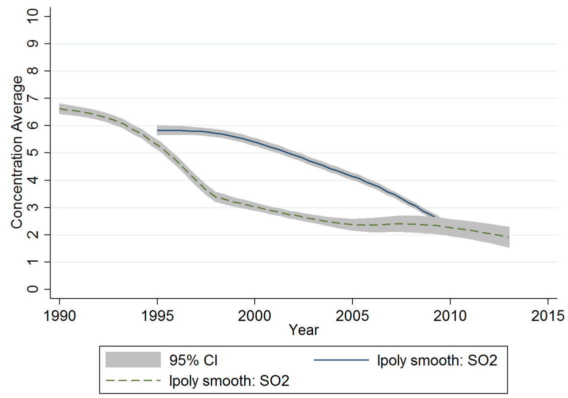


Figure 4: Historic National Trends (Concentration Levels, 2013=1)



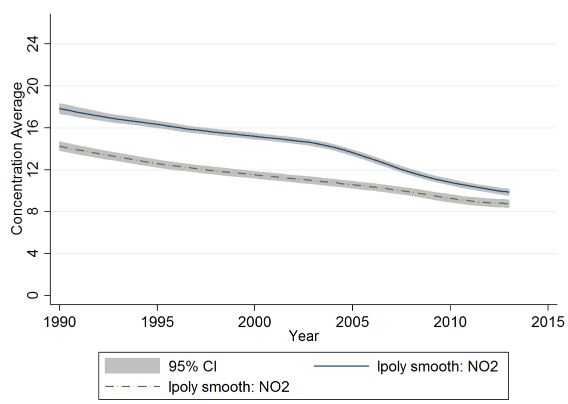
Source: EPA

Figure 5: Historic National Trends, Sulfur Dioxide (Concentrations, ppb)



Source: EPA

Figure 6: Historic National Trends, Nitrogen Dioxide (Concentrations, ppb)



Source: EPA

Appendix

Table A.1: RD estimates: Non-Southern states - Concentration

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	0.0036	-0.2883***	-0.0035***	-0.0918**	-0.1837**
	(0.0360)	(0.0942)	(0.0009)	(0.0425)	(0.0842)

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

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

Table A.2: RD estimates: Governors, State Legislature same party - Concentration

	(1)	(2)	(3)	(4)	(5)
Variables	CO	NO2	Ozone	Particulate	SO2
Democratic Gov.	-0.0480	-0.1192*	-0.0023***	-0.0830**	-0.1232*
	(0.0304)	(0.0713)	(0.0007)	(0.0330)	(0.0689)

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

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

Table A.3: 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	$\mu g/m^3$
Particulate	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 (available online at

`http://www.euro.who.int/__data/assets/pdf_file/0020/123059/AQG2ndEd_5_5carbonmonoxide.PDF`