

Online Appendix for ‘The impact of political business cycles on the environment’

A.1 Growth-focused environmental policymaking

Formally, environmental policymaking in Vietnam seeks to follow a centralized structure, in which central authorities decide and implement policies in a top-down fashion. However, in reality, sub-national governments command a high level of autonomy and discretion. This is due to a lack of policy coordination between central and local authorities caused by institutional separation of key environmental policymaking units at the different levels of government (Ortmann 2017).

Figure A.1 summarizes the organizational structure of environmental policymaking in Vietnam. The main agency tasked with the issuance, implementation and management of environmental protection policies at the central level of government is the Vietnam Environment Administration (VEA), which is part of the Ministry of Natural Resources and Environment (MONRE). For example, as part of its monitoring responsibility, the VEA is in charge of monitoring environmental performance of all companies operating in Vietnam through its network of environmental inspectors. Below the central level, Vietnam has environmental protection units at each level of government that mimic the central-level institutional arrangements. For example, at the provincial level, there are the departments of natural resources and environments (DONREs), which are also able to issue environmental regulations within their specific provinces. In addition, many provinces have also established Environmental Protection Agencies (EPAs) whose main functions mirror the central-level VEA’s responsibilities. These institutions, however, do not work under the supervision of the MONRE, but are instead under the control of the provincial People’s Committee, the province-level executive branch. Similarly, at the district level, the Offices of Natural Protection and the Environment are responsible to the district’s People’s Committees. Finally, under the direction of the responsible provincial DONREs communal authorities oversee and manage local environmental and land issues.

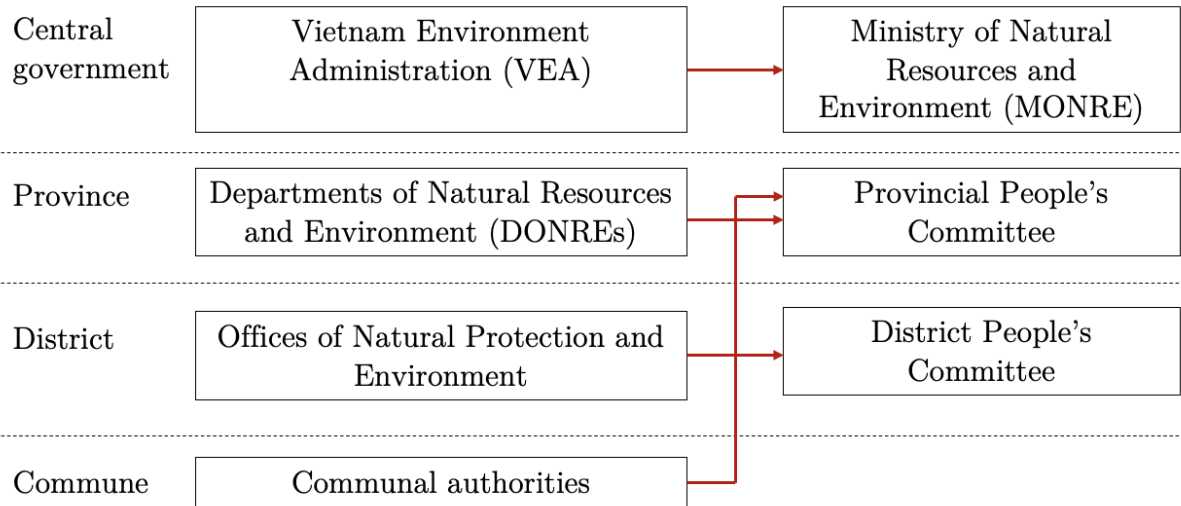


Figure A.1: Environmental policymaking across different levels of government

This duplication of institutional arrangements for environmental protection at different levels of government inevitably leads to inconsistent and overlapping distribution of responsibilities causing confusion to actors that are affected by the environmental laws and regulations as well as potentially causing conflict between local and central authorities. For example, both

MONRE and the Ministry of Police from the central government and the provincial People's Committees and their DONREs are authorized to impose sanctions against environmental violators. Likewise, actors from both the central-level and local governments are involved in the licensing of wastewater discharge, including the MONRE, provincial People's Congresses and local DONREs (Nguyen et al. 2015).

These trends have been furthered by the national government's adoption of a number of decentralization policies since the Doi Moi reforms (Malesky 2022).¹⁴ Most notably, the adoption of the 2002 State Budget Law (SBL) has granted local authorities considerable fiscal autonomy, expanding their influence in local policymaking, including in environmental protection. Notably, in its 2012 National Strategy, the Ministry of Natural Resources and Environment complains about the ineffective implementation of environmental protection policies and laws and considers the lack of cooperation by local officials who, due to the need to perform economically to obtain promotion to higher offices, have strong incentives to prioritize economic growth over environmental protection, to be a major factor (Nguyen et al. 2015, p: 103).

Since local officials' success in the VNA vetting and election process – and by extension, promotions and career prospects – depend on their economic performance, local politicians often use their discretionary power to manipulate environmental stringency, particularly those which could affect economic growth (Ortmann 2017). As the environmental governance framework in Vietnam provides local governments with a high level of autonomy from environmental agencies and mandates of the central-government level, they typically are and can be more responsive to local economic interest groups that have little appetite in the strict implementation of environmental regulations. From firms' perspective, environmental requirements increase the costs of business operations. However, instead of blocking any institutional reforms of the environmental reform process, these powerful economic interest groups have instead adopted a strategy of disregarding and contravening the evolving environmental regime. This approach has been much more effective than attempts to weaken, dilute, or even block environmental legislation or planning in part thanks to the high degree of discretion that has given local officials considerable room for illicit deals that serve business interests at the expense of the environment (Ortmann 2017).

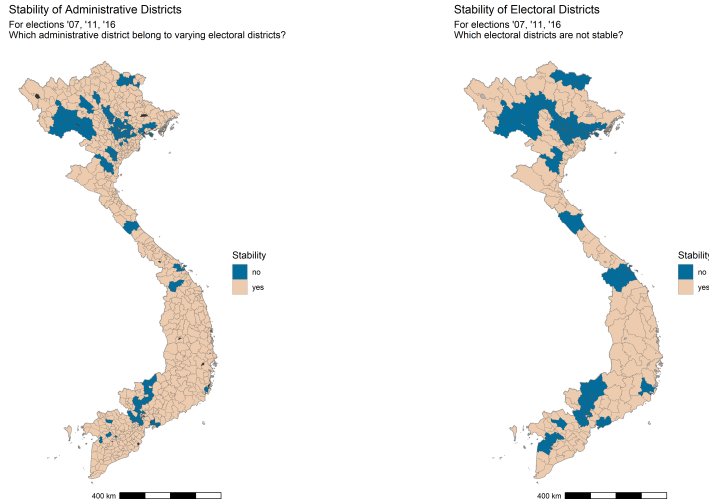
Van Suu (2007) identifies three major areas of business influence through corrupt means in rural Vietnam in three main areas: land management and use, infrastructure projects, and financial management. All three areas contribute to environmental degradation as relates to activities with major environmental impacts, such as the establishment of industrial zones, licensing of business permits or land rights use, investment in waste/water treatment facilities, fee collection for the use of natural resources, etc. Similarly, the prioritization of business interests is also evident in the area of environmental sanctions. Historically not a single company has been permanently shut down for serious environmental violations. At the most, administrators have temporarily closed companies and forced them to pay relatively modest fines (Ortmann 2017).

In a nutshell, while local government departments often mirror the central structure, there is little direct control from the central level and local officials enjoy high discretionary power in the implementation of environmental policies. Given the political incentive structure that ties achieving economic growth to career prospects, lower-level politicians are incentivized to prioritise economic goals over environmental protection by catering to business interests that have little interest in the enforcement of environmental regulations that impact their business operations. In the next section, we argue that such prioritisation is especially prevalent during time periods in which lower-level politicians' performance is reviewed by their political higher-ups.

¹⁴With the Doi Moi reforms the Vietnamese government introduced a whole set of economic reform policies in the late 1980s with the aim to establish a “socialist-oriented market economy”. These reforms have contributed significantly to Vietnam's economic success.

A.2 Changes in Administrative and Electoral Districts

Over the course of the three electoral cycles under study, a number of administrative districts (132 in total; less than 20%) have been reassigned to another electoral district. Zooming in, [Figure A.2](#) shows that in many cases (see central Vietnam), only one of the (smaller) administrative units is re-assigned to a different (larger) electoral district. In other regions, notably in the region surrounding the capital Hanoi, more and larger administrative districts were reassigned. For the main analysis, we use the shapefiles of electoral districts based on the 2011 definition of the electoral districts as main geographical unit of analysis. The robustness checks include results based on only the stable electoral districts ([Figures A.18 and A.19](#)).



(a) Administrative Districts

(b) Electoral Districts

Figure A.2: Stability of administrative and electoral districts. left: 561 administrative districts are stable, 132 are changing, right: 117 electoral districts are stable, 66 are changing. While a non-negligible number of electoral districts remain unstable over the course of the three electoral cycles, in many of these instances, only individual administrative districts (multiple of which make up the electoral districts) are re-assigned.

A.3 Summary of Candidate Variables

Summary of 2007 VNA Members Biographical Information

Summary statistics

time-invariant variables	min	25%	median	mean	75%	max	n
Sex (Female)	0.00	0.00	0.00	0.26	1.00	1.00	1932
Year joining party	1950	1975	1982	1,982.68	1988	2007	1728
Age when elected	24	46	51	49.55	55	78	1900
Ethnicity (Kinh)	0.00	1.00	1.00	0.82	1.00	1.00	1932
Religion	0.00	0.00	0.00	0.03	0.00	1.00	1932
Party membership	0.00	1.00	1.00	0.90	1.00	1.00	1932
Prior VNA membership	0.00	0.00	0.00	0.31	1.00	1.00	1932
Prior other membership	0.00	0.00	0.00	0.32	1.00	1.00	1932
Level of political connections	0.00	1.00	2.00	1.72	3.00	3.00	1932

Table A.1: Summary statistics of the 2007 VNA Members

Summary of 2011 VNA Members Biographical Information

Summary statistics

time-invariant variables	min	25%	median	mean	75%	max	n
Sex (Female)	0.00	0.00	0.00	0.24	0.00	1.00	2495
Year joining party	1963	1981	1985	1,986.61	1992	2010	2240
Age when elected	25	47	52	50.18	55	71	2480
Ethnicity (Kinh)	0.00	1.00	1.00	0.85	1.00	1.00	2495
Religion	0.00	0.00	0.00	0.03	0.00	1.00	2495
Party membership	0.00	1.00	1.00	0.91	1.00	1.00	2495
Prior VNA membership	0.00	0.00	0.00	0.38	1.00	1.00	2495
Prior other membership	0.00	1.00	1.00	0.99	1.00	1.00	2495
Level of political connections	0.00	2.00	2.00	2.16	3.00	3.00	2495

Table A.2: Summary statistics of the 2011 VNA Members

Summary of 2016 VNA Members Biographical Information

Summary statistics

time-invariant variables	min	25%	median	mean	75%	max	n
Sex (Female)	0.00	0.00	0.00	0.27	1.00	1.00	2460
Age when elected	24	45	51	49.55	55	74	2450
Ethnicity (Kinh)	0.00	1.00	1.00	0.83	1.00	1.00	2460
Religion	0.00	0.00	0.00	0.03	0.00	1.00	2460
Party membership	0.00	1.00	1.00	0.96	1.00	1.00	2460
Prior VNA membership	0.00	0.00	0.00	0.36	1.00	1.00	2460
Prior other membership	0.00	0.00	0.00	0.38	1.00	1.00	2460
Level of political connections	0.00	1.00	2.00	1.89	3.00	3.00	2460

Table A.3: Summary statistics of the 2016 VNA Members

A.4 Summary of Control Variables

Variable	Description	Source
PM2.5	monthly global gridded (0.01x0.01 degrees) in ug/m3	https://sites.wustl.edu/acag/datasets/surface/pm2-5/#V5.GL.03
NO2	daily global gridded (0.25x0.25 degree) in 10 ¹⁵ molecules/cm ²	https://disc.gsfc.nasa.gov/datasets/OMNO2d_003/summary
Administrative Districts	shapefile of administrative districts	personal communication with Ngyuen Viet Cuong
Candidates	information on electoral district, candidates, incl biographical information	full lists of candidates published by Government, information on who won seats from Wikipedia (https://w.wiki/5FRJ)
Precipitation	precipitation in mm/h	https://disc.gsfc.nasa.gov/datasets/GPM_3IMERGM_06/summary
Temperature	Monthly land surface temperature in Kelvin	https://lpdaac.usgs.gov/products/mod11c3v006/

Table A.4: Variable sources

Summary of Independent Variables

Summary statistics

time-variant variables	min	25%	median	mean	75%	max	n
rain_2007	0.01	0.01	0.02	0.07	0.13	0.19	183
rain_2008	0.02	0.06	0.09	0.10	0.13	0.21	183
rain_2009	0.01	0.02	0.12	0.09	0.15	0.25	183
rain_2010	0.00	0.01	0.04	0.06	0.11	0.23	183
rain_2011	0.05	0.10	0.15	0.20	0.33	0.49	183
rain_2012	0.02	0.05	0.09	0.10	0.16	0.25	183
rain_2013	0.03	0.04	0.09	0.09	0.14	0.25	183
rain_2014	0.01	0.03	0.10	0.13	0.23	0.32	183
rain_2015	0.04	0.06	0.09	0.10	0.12	0.24	183
rain_2016	0.02	0.03	0.07	0.09	0.13	0.22	183
rain_2017	0.02	0.05	0.10	0.16	0.27	0.42	183
rain_2018	0.01	0.03	0.04	0.09	0.17	0.24	183
rain_2019	0.02	0.03	0.03	0.04	0.06	0.12	183
rain_2020	0.02	0.03	0.05	0.07	0.10	0.17	183
rain_2021	0.01	0.02	0.10	0.10	0.16	0.23	183
temp_2007	296.22	299.63	301.02	301.27	302.28	311.37	183
temp_2008	295.59	299.58	300.73	300.89	302.00	308.56	182
temp_2009	295.99	299.61	300.67	300.90	301.87	311.38	182
temp_2010	296.81	300.41	301.59	301.80	302.75	310.93	183
temp_2011	295.66	298.66	300.24	300.64	302.29	308.75	178
temp_2012	296.33	299.11	300.23	300.55	301.98	306.49	175
temp_2013	296.30	299.67	301.42	301.35	302.51	308.02	179
temp_2014	296.28	299.45	301.24	301.26	302.51	309.01	179
temp_2015	296.77	300.36	301.60	301.78	302.88	309.43	181
temp_2016	296.81	300.41	301.96	302.21	303.43	311.51	183
temp_2017	296.57	300.10	301.22	301.17	302.09	308.49	178
temp_2018	296.25	299.37	300.49	300.90	302.12	310.15	183
temp_2019	296.86	300.81	301.89	301.74	302.50	308.12	179
temp_2020	296.17	300.26	301.29	301.43	302.55	307.91	180
temp_2021	295.72	299.49	300.59	300.62	301.47	307.61	179

Table A.5: Summary statistics of the time-varying control variables

A.5 Additional Results for PM2.5

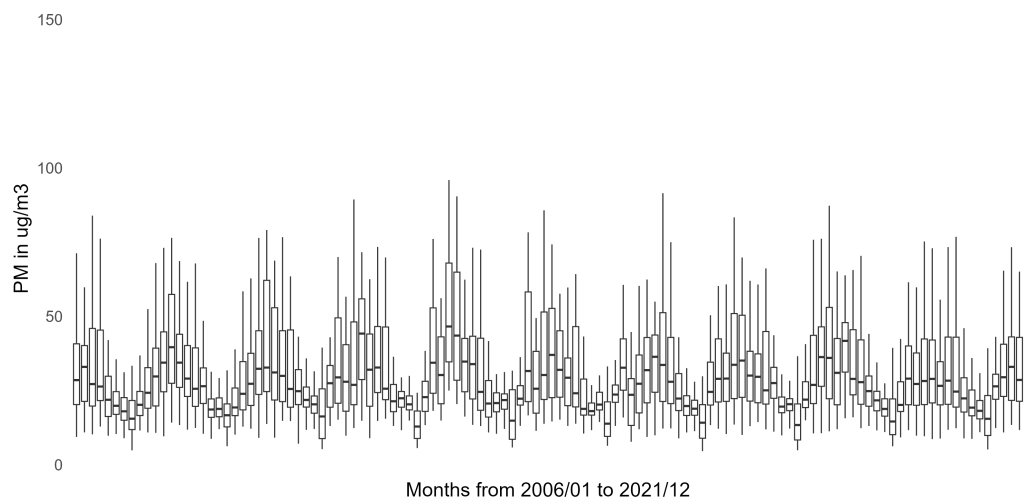


Figure A.3: Average PM2.5 pollution for each electoral district and month in the study period, showing the seasonal patterns in pollution

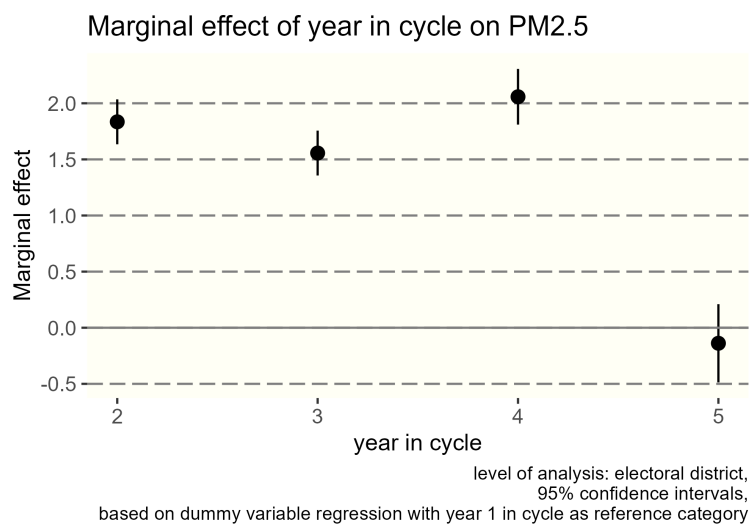


Figure A.4: Marginal effects of the electoral cycle on PM2.5 pollution (based on Equation 1). Full regression results in Appendix Table A.6.

Complete Regression Tables

	PM2.5
(Intercept)	558.863 (44.821)
year 2 in cycle	1.835 (0.102)
year 3 in cycle	1.556 (0.102)
year 4 in cycle	2.058 (0.127)
year 5 in cycle	-0.138 (0.178)
pol_connect(2)	-1.519 (0.294)
pol_connect(3)	-0.366 (0.269)
pol_connect(4)	-0.892 (0.304)
rain	15.415 (1.201)
temp	-1.715 (0.149)
sex_female	-0.159 (0.153)
age_elected	0.001 (0.011)
ethnicity_kinh	0.248 (0.225)
religion_yes	-0.233 (0.390)
electoral district FE	yes
Num.Obs.	6769
R2	0.912
R2 Adj.	0.909
Std.Errors	by: electoral district

Table A.6: Effect of electoral cycle on PM2.5 air pollution with year 1 in cycle as reference category. See predicted values in [Figure 4](#) and marginal effects in [Figure A.4](#).

	PM2.5
(Intercept)	545.634 (45.995)
year 2 in cycle	1.685 (0.267)
year 3 in cycle	1.651 (0.272)
year 4 in cycle	1.864 (0.295)
year 5 in cycle	-0.321 (0.398)
pol_connect(2)	-2.359 (0.338)
pol_connect(3)	-0.172 (0.353)
pol_connect(4)	-0.901 (0.374)
rain	15.662 (1.248)
temp	-1.671 (0.153)
sex_female	-0.160 (0.153)
age_elected	0.001 (0.011)
ethnicity_kinh	0.244 (0.225)
religion_yes	-0.223 (0.388)
year 2 in cycle $\times$ pol_connect(2)	1.036 (0.316)
year 3 in cycle $\times$ pol_connect(2)	0.222 (0.312)
year 4 in cycle $\times$ pol_connect(2)	1.498 (0.312)
year 5 in cycle $\times$ pol_connect(2)	1.052 (0.441)
year 2 in cycle $\times$ pol_connect(3)	-0.206 (0.284)
year 3 in cycle $\times$ pol_connect(3)	-0.153 (0.283)
year 4 in cycle $\times$ pol_connect(3)	-0.401 (0.300)
year 5 in cycle $\times$ pol_connect(3)	-0.178 (0.408)
year 2 in cycle $\times$ pol_connect(4)	0.082 (0.282)
year 3 in cycle $\times$ pol_connect(4)	-0.126 (0.270)
year 4 in cycle $\times$ pol_connect(4)	-0.007 (0.296)
year 5 in cycle $\times$ pol_connect(4)	0.097 (0.391)
electoral district FE	yes
Num.Obs.	6769
R2	0.912
R2 Adj.	0.909
Std.Errors	by: electoral district

Table A.7: Effect of electoral cycle and political variables on PM2.5 air pollution with year 1 in cycle as reference category. pol connect is a factor variable with the reference category "no party membership" and included levels 2 "party member", 3 "prior local pol. experience", 4 "prior VNA membership". See predicted values in [Figure 6](#).

	PM2.5
(Intercept)	608.818 (107.748)
year 2 in cycle	-0.975 (1.160)
year 3 in cycle	10.901 (1.496)
year 4 in cycle	5.378 (1.288)
year 5 in cycle	5.596 (1.498)
informal charges	0.093 (0.239)
rain	14.788 (2.040)
temp	-1.956 (0.354)
sex_female	-0.095 (0.129)
age_elected	-0.002 (0.008)
ethnicity_kinh	0.137 (0.177)
religion_yes	0.108 (0.228)
year 2 in cycle $\times$ informal charges	0.434 (0.186)
year 3 in cycle $\times$ informal charges	-1.615 (0.268)
year 4 in cycle $\times$ informal charges	-0.537 (0.238)
year 5 in cycle $\times$ informal charges	-0.907 (0.256)
province FE	yes
Num.Obs.	6887
R2	0.917
R2 Adj.	0.917
Std.Errors	by: province

Table A.8: Effect of electoral cycle and informal charges on PM2.5 air pollution with year 1 in cycle as reference category. informal charges = PCI measurement, 1 lower to 10 highest levels of informal charges. See predicted values in [Figure 8](#).

A.5.1 Placebo test on China

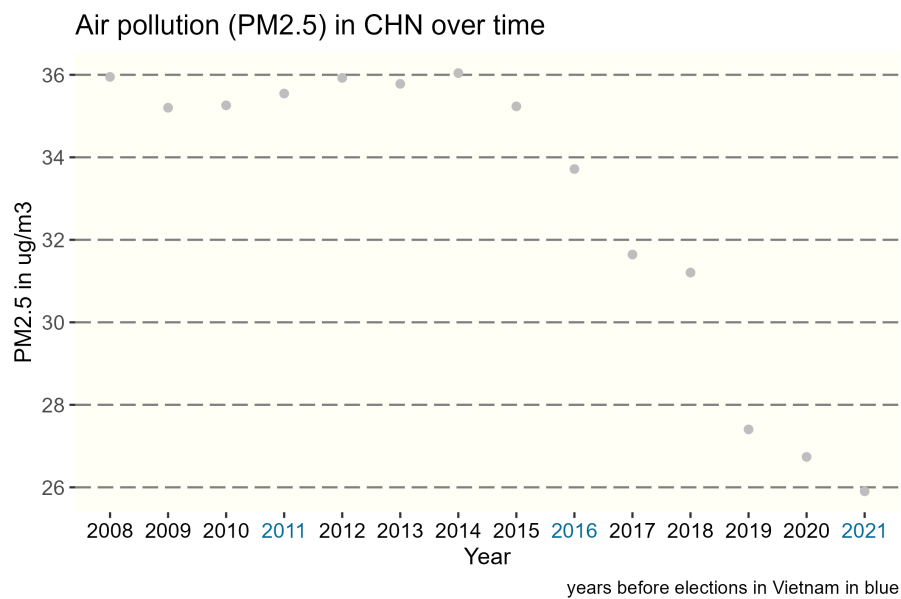


Figure A.5: PM2.5 in China over the (electoral) years 2008-2021

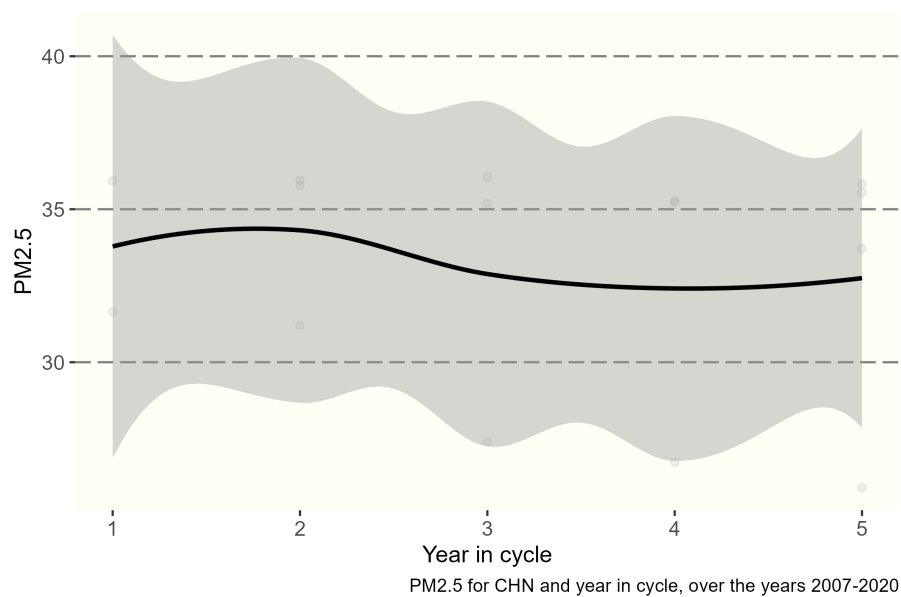


Figure A.6: Locally weighted scatterplot smoothing curve of PM2.5 in China over the years of the VNA electoral cycle

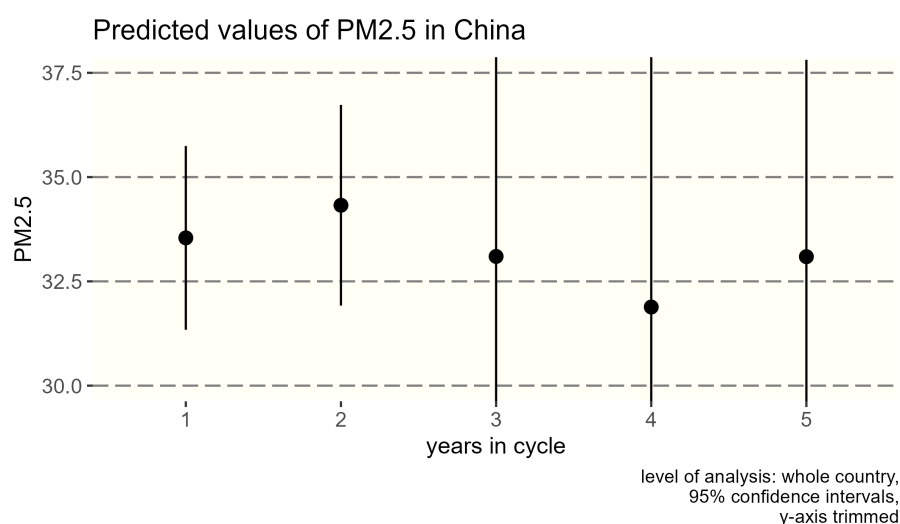


Figure A.7: Predicted values of PM2.5 in China over the VNA electoral cycle. Full regression results in Appendix Table A.9.

	PM2.5
(Intercept)	434.534 (603.427)
year 2 in cycle	0.782 (1.572)
year 3 in cycle	−0.445 (3.328)
year 4 in cycle	−1.658 (3.292)
year 5 in cycle	−0.451 (2.644)
rain	121.925 (189.236)
temp	−1.416 (2.062)
Num.Obs.	15
R2	0.082
R2 Adj.	−0.607

Table A.9: Effect of VNA electoral cycle on PM2.5 air pollution with year 1 in cycle as reference category. See predicted values in Figure A.7.

A.5.2 Electoral cycle fixed effects

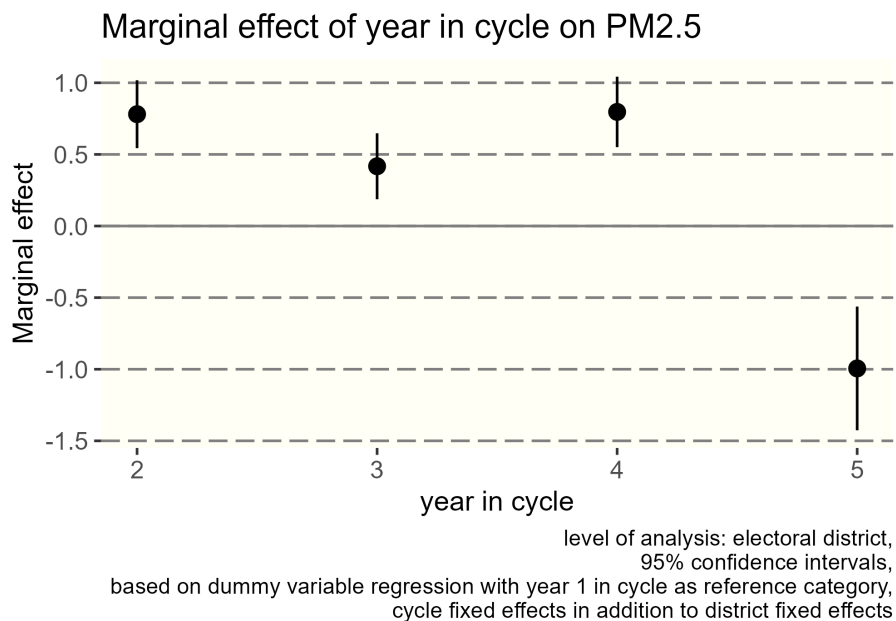


Figure A.8: Marginal effects of the electoral cycle on PM2.5 pollution, controlling for electoral cycle fixed effects. Full regression results in Appendix Table A.10.

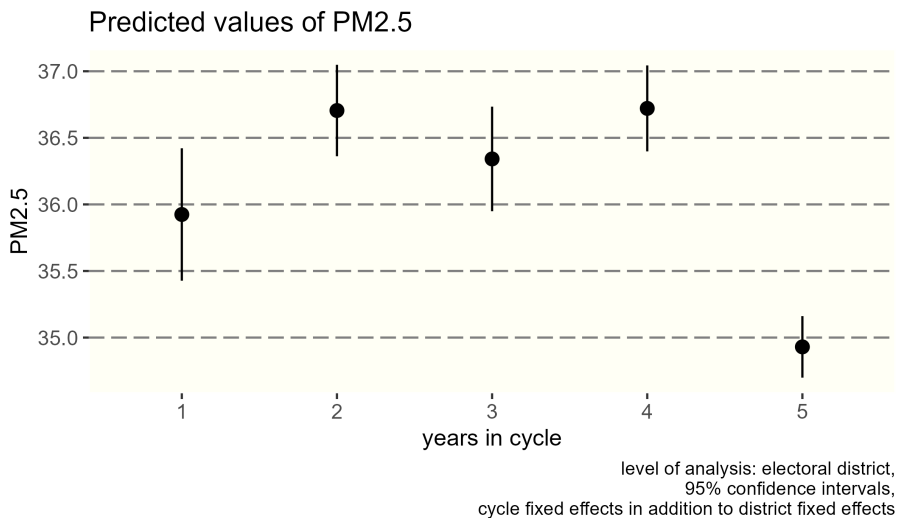


Figure A.9: Predicted values of PM2.5 over the VNA electoral cycle, controlling for electoral cycle fixed effects. Full regression results in Appendix Table A.10.

	PM 2.5
(Intercept)	540.747 (27.304)
year 2 in cycle	0.781 (0.121)
year 3 in cycle	0.417 (0.117)
year 4 in cycle	0.797 (0.126)
year 5 in cycle	−0.994 (0.220)
rain	8.474 (0.665)
temp	−1.646 (0.091)
sex_female	−0.073 (0.105)
pol_connect (2)	0.070 (0.214)
pol_connect (3)	−0.057 (0.202)
pol_connect (4)	−0.014 (0.218)
age_elected	−0.002 (0.007)
ethnicity_kinh	0.111 (0.142)
religion_yes	0.068 (0.292)
electoral district FE	yes
electoral cycle FE	yes
Num.Obs.	6769
R2	0.946
R2 Adj.	0.945
Std.Errors	by: electoral district

Table A.10: Effect of electoral cycle on PM2.5 air pollution with year 1 in cycle as reference category. Analysis includes cycle fixed effects. See marginal effects in [Figure A.8](#) and predicted values in [Figure A.7](#).

A.5.3 Results of parametric analysis

To make our results more closely comparable to previous work on EPBC, we also implement a parametric analysis of the pollution patterns, which builds on previous operationalisations of a U-shaped pattern ([Cao, Kostka, and Xu 2019](#)). Based on the pattern, we use up to the fourth polynomial of the “year in cycle”-variable to fit the data. We confirm that this is the appropriate number of polynomials by optimizing the Akaike information criterion in a step-wise approach with varying levels of polynomials included using the `step()`-function in R. Accordingly, the parametric analysis models EPBC using the following functional form:

$$Pollution_{jt} = \beta_1 yic_{it} + \beta_2 yic_{it}^2 + \beta_3 yic_{it}^3 + \beta_4 yic_{it}^4 + \beta_5 \mathbf{X}_{it} + \alpha_j + \epsilon_{jt} \quad (2)$$

As can be seen in [Figure A.10](#) (and [Figure A.11](#) and [Figure A.12](#) for the interaction models), the results are highly congruent with the results of the non-parametric analysis.

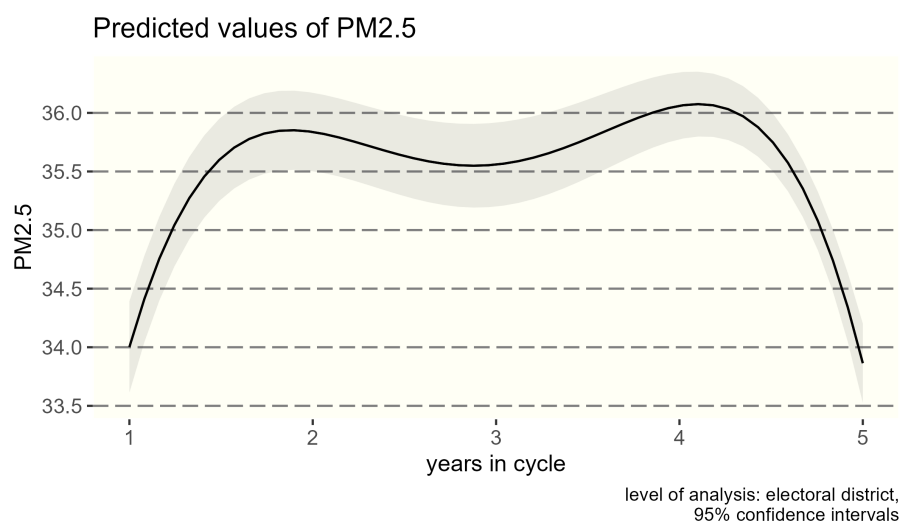


Figure A.10: Predicted values of PM2.5 over the electoral cycle, results based on Equation 2. Full regression results in Appendix Table A.11.

	PM2.5
(Intercept)	545.651 (44.776)
yic	23.582 (2.175)
yic ²	−13.241 (1.291)
yic ³	3.137 (0.308)
yic ⁴	−0.265 (0.025)
rain	15.415 (1.201)
temp	−1.715 (0.149)
sex_female	−0.159 (0.153)
pol_connect (2)	−1.519 (0.294)
pol_connect (3)	−0.366 (0.269)
pol_connect (4)	−0.892 (0.304)
age_elected	0.001 (0.011)
ethnicity_kinh	0.248 (0.225)
religion_yes	−0.233 (0.390)
electoral district FE	yes
Num.Obs.	6769
R2	0.912
R2 Adj.	0.909
Std.Errors	by: electoral district

Table A.11: Effect of electoral cycle on PM2.5 air pollution, results based on Equation 2. See predicted values in Figure A.10.

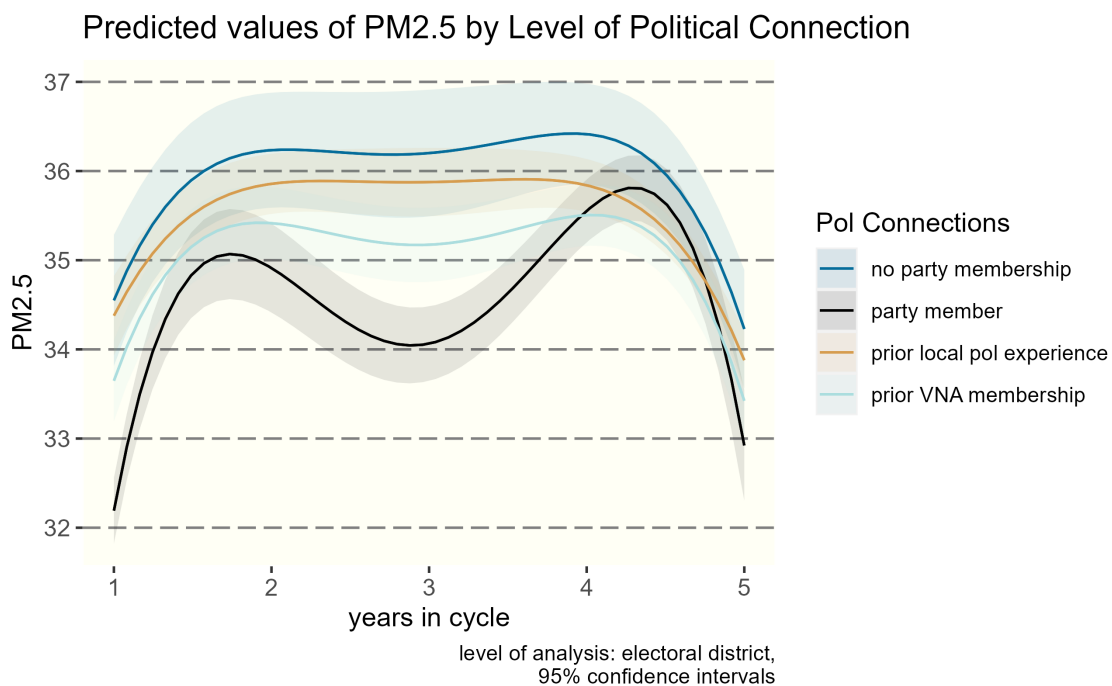


Figure A.11: Predicted values of PM2.5 over the electoral cycle for different levels of political connections, results based on Equation 2. Full regression results in Appendix Table A.12.

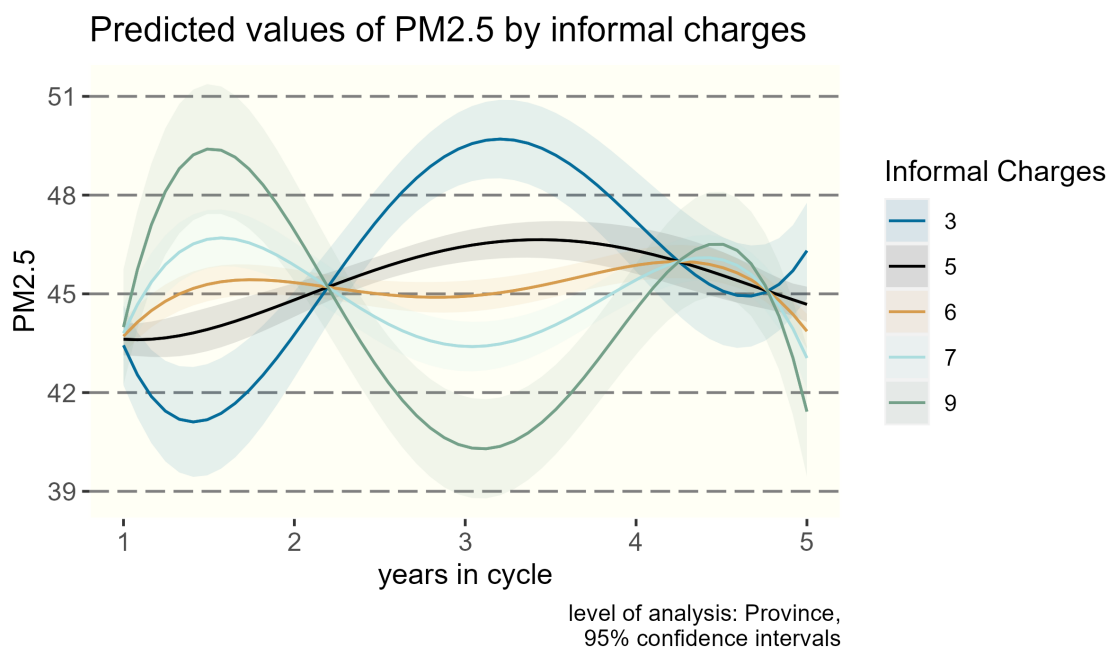


Figure A.12: Predicted values of PM2.5 over the electoral cycle for different levels of Informal Charges, results based on Equation 2. Full regression results in Appendix Table A.13.

	PM2.5
(Intercept)	535.660 (45.743)
yic	17.462 (4.468)
yic ²	−9.543 (2.647)
yic ³	2.247 (0.632)
yic ⁴	−0.192 (0.052)
pol_connect (2)	−16.943 (2.716)
pol_connect (3)	2.181 (2.738)
pol_connect (4)	−2.855 (2.675)
rain	15.662 (1.248)
temp	−1.671 (0.153)
sex_female	−0.160 (0.153)
age_elected	0.001 (0.011)
ethnicity_kinh	0.244 (0.225)
religion_yes	−0.223 (0.388)
yic × pol_connect (2)	27.196 (4.715)
yic × pol_connect (3)	−4.389 (4.786)
yic × pol_connect (4)	3.658 (4.606)
yic ² × pol_connect (2)	−16.177 (2.753)
yic ² × pol_connect (3)	2.628 (2.831)
yic ² × pol_connect (4)	−2.168 (2.713)
yic ³ × pol_connect (2)	3.888 (0.649)
yic ³ × pol_connect (3)	−0.648 (0.674)
yic ³ × pol_connect (4)	0.504 (0.645)
yic ⁴ × pol_connect (2)	−0.323 (0.053)
yic ⁴ × pol_connect (3)	0.055 (0.056)
yic ⁴ × pol_connect (4)	−0.040 (0.053)
electoral district FE	yes
Num.Obs.	6769
R2	0.912
R2 Adj.	0.909
Std.Errors	by: electoral district

Table A.12: Effect of electoral cycle on PM2.5 air pollution for different levels of political connections, results based on Equation 2. See predicted values in [Figure A.11](#).

	PM2.5
(Intercept)	706.281 (109.753)
yic	-186.934 (26.608)
yic ²	114.533 (16.103)
yic ³	-27.287 (3.873)
yic ⁴	2.225 (0.322)
informal_charges	-18.618 (2.344)
rain	14.788 (2.040)
temp	-1.956 (0.354)
sex_female	-0.095 (0.129)
age_elected	-0.002 (0.008)
ethnicity_kinh	0.137 (0.177)
religion_yes	0.108 (0.228)
yic × informal_charges	35.661 (4.508)
yic ² × informal_charges	-21.704 (2.746)
yic ³ × informal_charges	5.179 (0.664)
yic ⁴ × informal_charges	-0.424 (0.055)
province FE	yes
Num.Obs.	6887
R2	0.917
R2 Adj.	0.917
Std.Errors	by: province

Table A.13: Effect of electoral cycle on PM2.5 air pollution for different levels of Informal Charges, results based on Equation 2. See predicted values in [Figure A.12](#).

A.5.4 Spatial autocorrelation

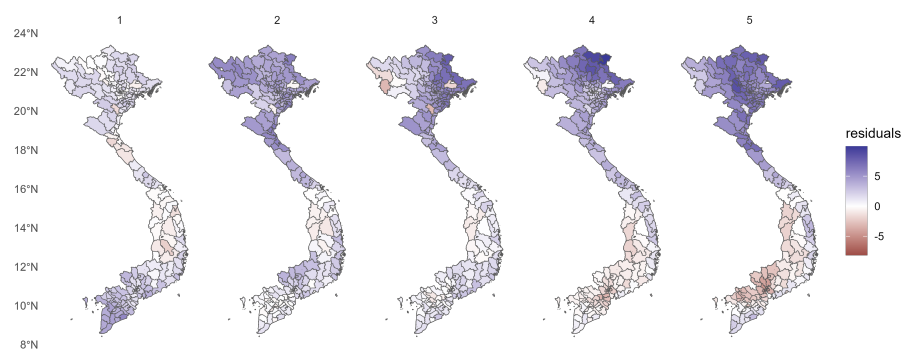


Figure A.13: Visual check for spatial dependence in regression residuals (based on Equation 1 with data aggregated to the level of electoral districts).

	Main Model	Simple Linear Model	Spatial Lag Model	Spatial Error Model
(Intercept)	545.658*** (46.530)	545.658*** (28.887)	621.443*** (27.915)	549.060*** (27.724)
year 2 in cycle	1.847*** (0.098)	1.847*** (0.204)	1.800*** (0.191)	1.848*** (0.196)
year 3 in cycle	1.532*** (0.106)	1.532*** (0.207)	1.493*** (0.194)	1.533*** (0.199)
year 4 in cycle	2.005*** (0.134)	2.005*** (0.219)	1.957*** (0.205)	2.013*** (0.210)
year 5 in cycle	-0.069 (0.174)	-0.069 (0.199)	-0.067 (0.186)	-0.070 (0.191)
rain	15.008*** (1.136)	15.008*** (1.207)	14.620*** (1.130)	15.012*** (1.159)
temp	-1.671*** (0.153)	-1.671*** (0.096)	-1.633*** (0.090)	-1.682*** (0.092)
share of female pol.	-0.505 (0.922)	-0.505 (0.395)	-0.500 (0.369)	-0.518 (0.379)
mean level pol. con. = 0.5	2.951 (3.298)	2.951+ (1.519)	2.859* (1.421)	2.967* (1.447)
mean level pol. con. = 1	-2.394 (3.120)	-2.394+ (1.236)	-2.361* (1.156)	-2.377* (1.174)
mean level pol. con. = 1.5	-2.046 (3.201)	-2.046 (1.272)	-2.026+ (1.190)	-2.034+ (1.209)
mean level pol. con. = 2	-1.537 (3.103)	-1.537 (1.235)	-1.528 (1.155)	-1.524 (1.173)
mean level pol. con. = 2.5	-0.639 (3.136)	-0.639 (1.266)	-0.647 (1.184)	-0.612 (1.203)
mean level pol. con. = 3	-1.881 (3.071)	-1.881 (1.231)	-1.862 (1.152)	-1.867 (1.170)
average age of pol.	-0.003 (0.048)	-0.003 (0.020)	-0.003 (0.019)	-0.003 (0.019)
share of Kinh pol.	1.331 (1.373)	1.331* (0.571)	1.295* (0.534)	1.338* (0.548)
share of religious pol.	1.266 (1.836)	1.266 (0.919)	1.224 (0.860)	1.251 (0.881)
rho			-1.954*** (0.185)	
lambda				-2.005*** (0.183)
Num.Obs.	2536	2536		
RMSE	2.80	2.80	2.73	2.73
AIC	12 819.0	12 819.0	12 765.5	12 762.8
R2 Adj.	0.905	0.905		
Morans I	-	-0.013	-0.013	-0.013
Std.Errors	by: ID_elect_2011			

Table A.14: Regression results for the main model (1), a simple linear regression without clustered standard errors (2), a spatial lag model (3) and a spatial error model (4). All have PM2.5 as dependent variable.

A.5.5 Effects at the province level

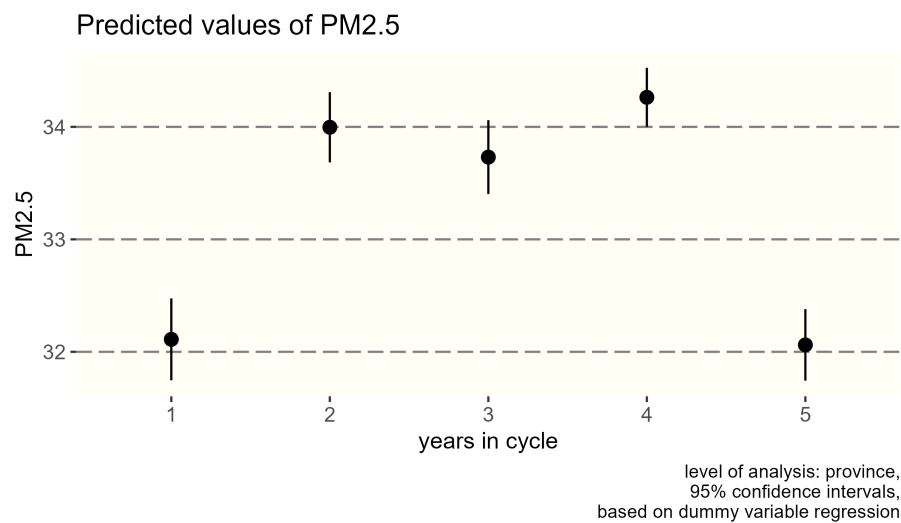


Figure A.14: Predicted values of PM2.5 over the electoral cycle at the province level. Full regression results in Appendix Table A.15 (Model 1).

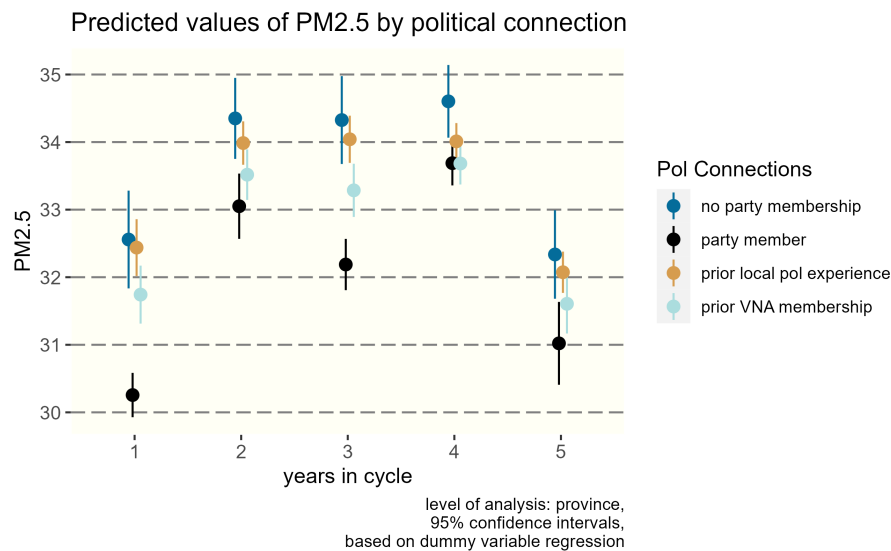


Figure A.15: Predicted values of PM2.5 over the electoral cycle for different levels of political connections at the province level. Full regression results in Appendix Table A.15 (Model 2).

	PM2.5 Model 1	PM2.5 Model 2
(Intercept)	585.300 (49.167)	571.697 (50.752)
year 2 in cycle	1.886 (0.097)	1.792 (0.263)
year 3 in cycle	1.620 (0.095)	1.768 (0.252)
year 4 in cycle	2.152 (0.127)	2.045 (0.295)
year 5 in cycle	-0.049 (0.177)	-0.221 (0.401)
rain	15.347 (1.117)	15.601 (1.169)
temp	-1.802 (0.163)	-1.757 (0.169)
sex_female	-0.150 (0.148)	-0.151 (0.148)
pol_connect (2)	-1.525 (0.286)	-2.302 (0.338)
pol_connect (3)	-0.332 (0.263)	-0.119 (0.345)
pol_connect (4)	-0.874 (0.293)	-0.815 (0.363)
age_elected	-0.001 (0.010)	-0.002 (0.010)
ethnicity_kinh	0.256 (0.223)	0.250 (0.223)
religion_yes	-0.249 (0.364)	-0.241 (0.362)
year 2 in cycle $\times$ pol_connect (2)		1.002 (0.319)
year 3 in cycle $\times$ pol_connect (2)		0.164 (0.290)
year 4 in cycle $\times$ pol_connect (2)		1.387 (0.308)
year 5 in cycle $\times$ pol_connect (2)		0.987 (0.445)
year 2 in cycle $\times$ pol_connect (3)		-0.246 (0.271)
year 3 in cycle $\times$ pol_connect (3)		-0.165 (0.257)
year 4 in cycle $\times$ pol_connect (3)		-0.473 (0.286)
year 5 in cycle $\times$ pol_connect (3)		-0.144 (0.409)
year 2 in cycle $\times$ pol_connect (4)		-0.018 (0.275)
year 3 in cycle $\times$ pol_connect (4)		-0.225 (0.247)
year 4 in cycle $\times$ pol_connect (4)		-0.105 (0.283)
year 5 in cycle $\times$ pol_connect (4)		0.085 (0.387)
Province FE	yes	yes
Num.Obs.	6887	6887
R2	0.913	0.914
R2 Adj.	0.911	0.911
Std.Errors	by: electoral district	by: electoral district

Table A.15: Effects of electoral cycle on PM2.5 air pollution at the province level. Model 2 shows effects for different levels of political connections. See predicted values in [Figure A.14](#) (Model 1) and [Figure A.15](#) (Model 2).

A.5.6 Effects for provincial party congress calendar

While our results focus on the calendar for the VNA election, including the national party congress, it could also be possible that the subnational level is more important, namely the provincial party congresses which take place around six months before the national party congress.

To study this explanation, we created an original dataset with the timing of provincial party congresses in 2005 (two take place in 2006), 2010, 2015 and 2020. As these congresses take place during slightly different moments in time, usually between October and December, the political calendar is different for each province. If one congress takes place in December and the next one in October, year five of the cycle only has ten months in our coding; conversely, the last year of the cycle can also be longer than twelve months. Apart from this, the coding is in line with the logic of the “political year” in the main analyses, with years ending in the month before the election and year 1 in the cycle being the year directly after the election. The model is based on Equation 1 at the province level (including province fixed effects) without the biographical information on VNA candidates; instead, it only uses the year in cycle information and temperature and precipitation as control variables.

Figure A.16 shows the marginal effects across the provincial congress cycle. Compared to the effects of the VNA electoral calendar, marginal effects are at about half the size, resulting also in smaller absolute fluctuations (see the resulting predicted values in Figure A.17). Importantly, the overall patterns remain stable and we do not find a classic peak of pollution right before the provincial congress. We conclude from this that while the provincial calendar may also play a role or lead to similar dynamics as the VNA calendar, we do not find any evidence that it plays a more important role or leads to stronger environmental political business cycles. Rather, it provides an additional puzzle piece in line with the evidence at the national level, pointing towards the importance of the party’s congress meetings.

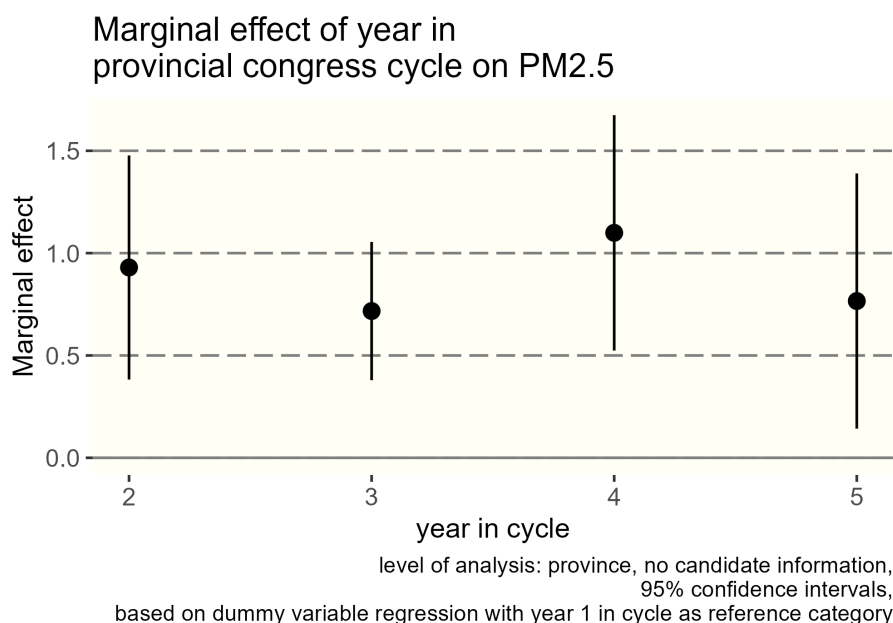


Figure A.16: Marginal effects of the political calendar for provincial party congresses on PM2.5 pollution at the province level. Full regression results in Appendix Table A.16.

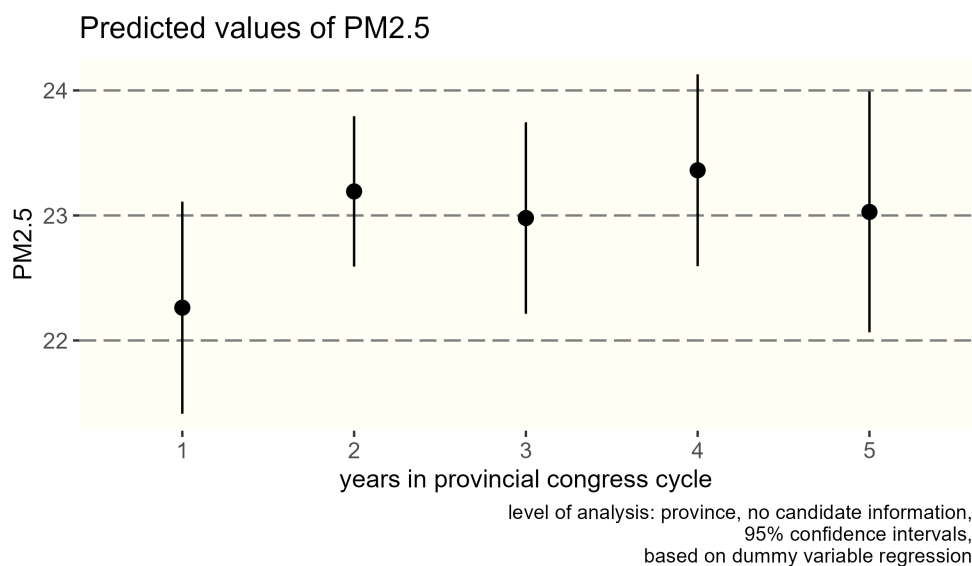


Figure A.17: Predicted values of PM2.5 over the political calendar for provincial party congresses. Full regression results in Appendix Table A.16.

	(1)
(Intercept)	505.366 (90.487)
yic_fact2	0.930 (0.279)
yic_fact3	0.717 (0.172)
yic_fact4	1.099 (0.293)
yic_fact5	0.766 (0.318)
rain_cong	12.610 (2.431)
temp_cong	−1.610 (0.300)
Province FE	yes
Num.Obs.	882
R2	0.914
R2 Adj.	0.906
AIC	4417.7
BIC	4752.4
RMSE	2.73
Std.Errors	by: province

Table A.16: Effects of political calendar for provincial party congresses on PM2.5 air pollution at the province level. See predicted values in Figure A.17.

A.5.7 Subset of stable electoral districts

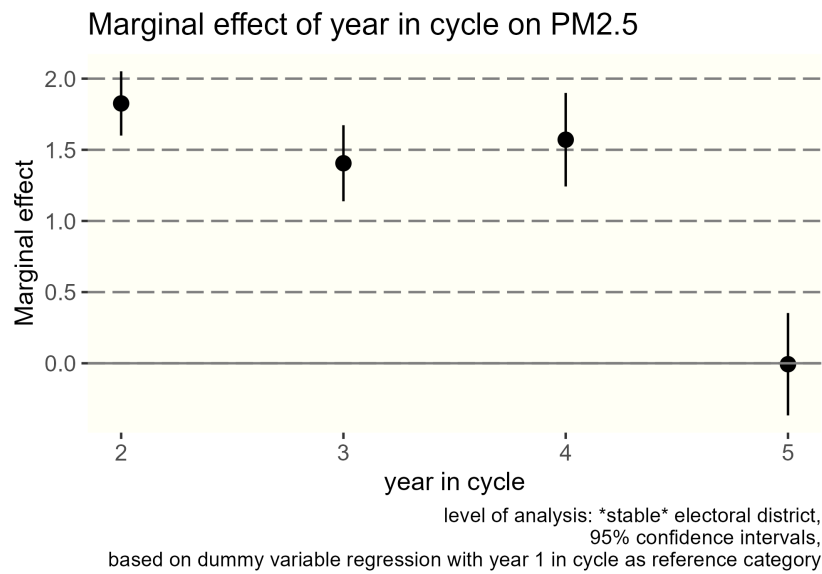


Figure A.18: Marginal Effects of the electoral cycle on PM2.5 pollution, subset of stable electoral districts. Full regression results in Appendix Table A.17 (Model 1).

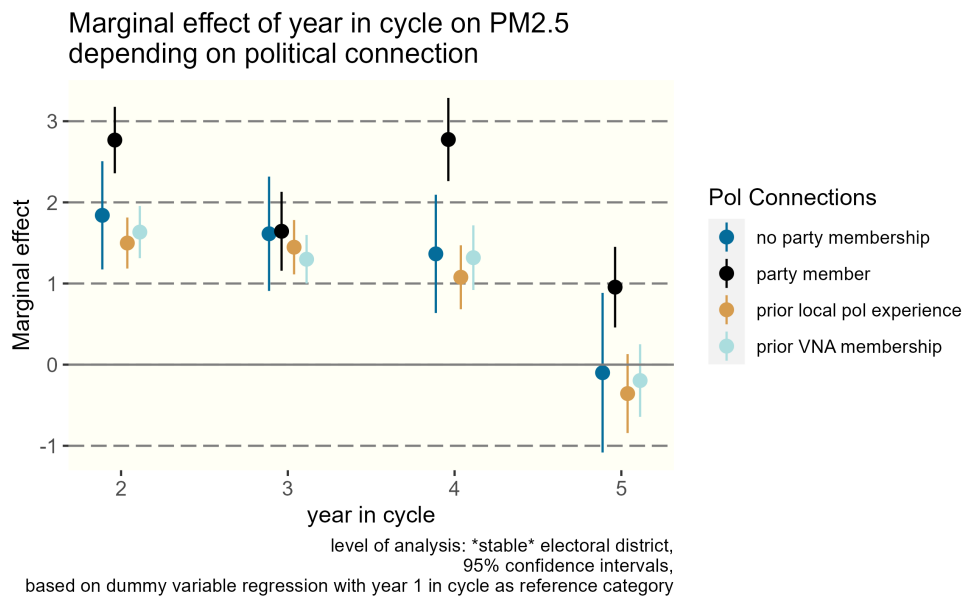


Figure A.19: Marginal Effects of the electoral cycle on PM2.5 pollution for different levels of political connections, subset of stable electoral districts. Full regression results in Appendix Table A.17 (Model 2).

	PM2.5 Model 1	PM2.5 Model 2
(Intercept)	355.326 (64.101)	342.556 (65.670)
year 2 in cycle	1.826 (0.115)	1.840 (0.340)
year 3 in cycle	1.405 (0.136)	1.613 (0.359)
year 4 in cycle	1.571 (0.168)	1.365 (0.372)
year 5 in cycle	-0.007 (0.184)	-0.099 (0.502)
rain	13.158 (1.290)	13.242 (1.345)
temp	-1.113 (0.213)	-1.071 (0.219)
sex_female	-0.109 (0.199)	-0.106 (0.198)
pol_connect (2)	-1.228 (0.410)	-1.976 (0.447)
pol_connect (3)	-0.172 (0.376)	0.053 (0.456)
pol_connect (4)	-0.622 (0.399)	-0.474 (0.453)
age_elected	-0.003 (0.013)	-0.004 (0.013)
ethnicity_kinh	0.299 (0.208)	0.295 (0.207)
religion_yes	0.070 (0.335)	0.078 (0.331)
year 2 in cycle $\times$ pol_connect (2)		0.928 (0.387)
year 3 in cycle $\times$ pol_connect (2)		0.031 (0.395)
year 4 in cycle $\times$ pol_connect (2)		1.409 (0.377)
year 5 in cycle $\times$ pol_connect (2)		1.054 (0.559)
year 2 in cycle $\times$ pol_connect (3)		-0.341 (0.348)
year 3 in cycle $\times$ pol_connect (3)		-0.166 (0.353)
year 4 in cycle $\times$ pol_connect (3)		-0.288 (0.359)
year 5 in cycle $\times$ pol_connect (3)		-0.257 (0.508)
year 2 in cycle $\times$ pol_connect (4)		-0.206 (0.354)
year 3 in cycle $\times$ pol_connect (4)		-0.314 (0.341)
year 4 in cycle $\times$ pol_connect (4)		-0.047 (0.355)
year 5 in cycle $\times$ pol_connect (4)		-0.097 (0.477)
electoral district FE	yes	yes
Num.Obs.	4254	4254
R2	0.900	0.901
R2 Adj.	0.896	0.897
Std.Errors	by: electoral district	by: electoral district

Table A.17: Effects of electoral cycle on PM2.5 air pollution, subset of stable electoral districts. Model 2 shows effects for different levels of political connections. See predicted values in [Figure A.18](#) (Model 1) and [Figure A.19](#) (Model 2).

A.5.8 Subset of electoral districts with median 80% pollution

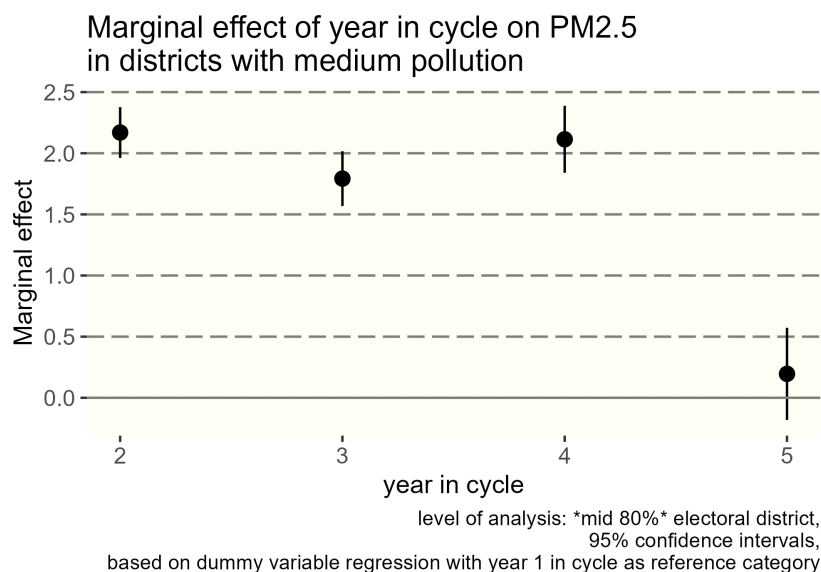


Figure A.20: Marginal Effects of the electoral cycle on PM2.5 pollution, subset of electoral districts with middle 80% of pollution. Full regression results in Appendix Table A.18 (Model 1).

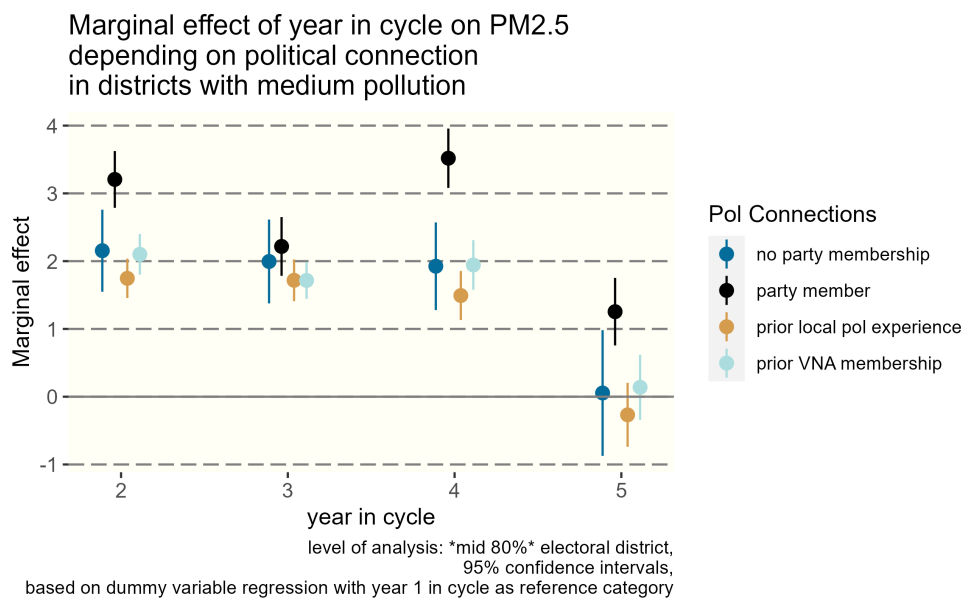


Figure A.21: Marginal Effects of the electoral cycle on PM2.5 pollution for different levels of political connections, subset of electoral districts with middle 80% of pollution. Full regression results in Appendix Table A.18 (Model 2).

	PM2.5 Model 1	PM2.5 Model 2
(Intercept)	510.666 (57.411)	495.584 (58.149)
year 2 in cycle	2.169 (0.106)	2.154 (0.309)
year 3 in cycle	1.792 (0.114)	1.995 (0.316)
year 4 in cycle	2.114 (0.140)	1.925 (0.330)
year 5 in cycle	0.196 (0.192)	0.055 (0.473)
rain	15.363 (1.275)	15.536 (1.322)
temp	-1.576 (0.187)	-1.527 (0.189)
sex_female	-0.155 (0.193)	-0.158 (0.193)
pol_connect (2)	-1.190 (0.375)	-2.090 (0.374)
pol_connect (3)	-0.175 (0.348)	0.128 (0.386)
pol_connect (4)	-0.684 (0.381)	-0.631 (0.413)
age_elected	-0.005 (0.013)	-0.006 (0.013)
ethnicity_kinh	0.288 (0.261)	0.286 (0.261)
religion_yes	-0.152 (0.420)	-0.140 (0.416)
year 2 in cycle $\times$ pol_connect (2)		1.052 (0.373)
year 3 in cycle $\times$ pol_connect (2)		0.222 (0.357)
year 4 in cycle $\times$ pol_connect (2)		1.594 (0.352)
year 5 in cycle $\times$ pol_connect (2)		1.200 (0.519)
year 2 in cycle $\times$ pol_connect (3)		-0.408 (0.329)
year 3 in cycle $\times$ pol_connect (3)		-0.278 (0.320)
year 4 in cycle $\times$ pol_connect (3)		-0.432 (0.342)
year 5 in cycle $\times$ pol_connect (3)		-0.323 (0.481)
year 2 in cycle $\times$ pol_connect (4)		-0.054 (0.335)
year 3 in cycle $\times$ pol_connect (4)		-0.280 (0.308)
year 4 in cycle $\times$ pol_connect (4)		0.019 (0.328)
year 5 in cycle $\times$ pol_connect (4)		0.084 (0.466)
electoral district FE	yes	yes
Num.Obs.	5247	5247
R2	0.875	0.876
R2 Adj.	0.872	0.872
Std.Errors	by: electoral district	by: electoral district

Table A.18: Effects of electoral cycle on PM2.5 air pollution, subset of electoral districts with median 80% pollution. Model 2 shows effects for different levels of political connections. See predicted values in [Figure A.20](#) (Model 1) and [Figure A.21](#) (Model 2).

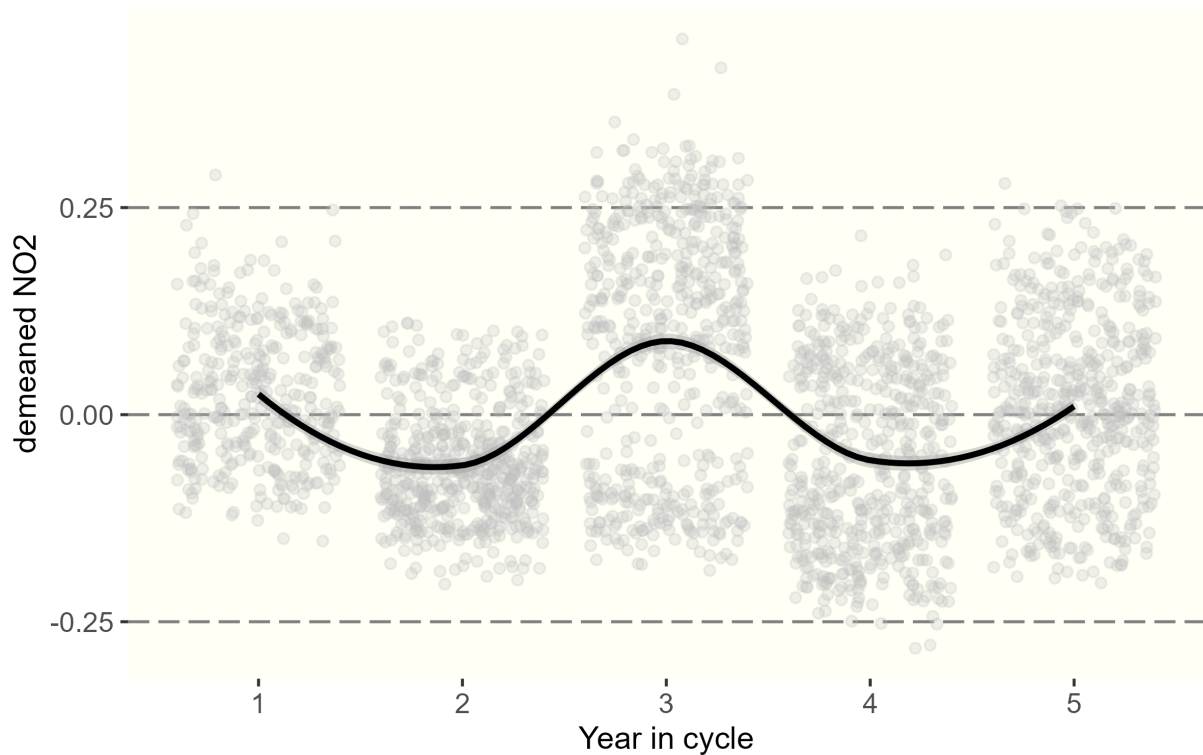
A.6 Results for NO2

As a second air pollution type, we use Nitrogen dioxide (NO2) emissions, the aerosols of which compose one major part of PM2.5 and in combination with ultraviolet light form ozone (WHO 2022b). NO2 is mainly produced by combustion engines in industrial production processes and private vehicles (AQI 2022b). One advantage of using NO2 in the context of Vietnam is that, in contrast to other air pollutants such as carbon monoxide and sulfur oxides, it is caused in almost equal shares by industrial production and the transport sector (Hoang, Chu, and Van Tran 2017). It is also an interesting second pollutant in addition to PM2.5 as it shows different regional patterns, with P Compared to other air pollutants such as CO2, NO2 is short-lived (less than one day during the warm season) and concentrated near its emission source (Krotkov et al. 2016, p. 4606), thus reflecting local pollution levels (Shen 2022, p. 117). Based on its impact on the respiratory system, NO2 is the most dangerous toxin for human health (Hoang, Chu, and Van Tran 2017).

The NO2 data we use comes from the OMNO2d dataset¹⁵ which provides daily measures of global, cloud-screened NO2 values (Krotkov 2013) at a resolution of 0.25 degree x 0.25 degrees, which at Vietnam's position close to the equator converts to rasters of less than 25 square kilometres. The data is collected by the NASA's Earth Observing System (EOS) program based on multiple satellites traversing the earth on a daily basis, capturing aerosol optical depth.

Compared to PM2.5, the LOESS curve in Figure A.22 and the raw data over time plotted in Figure A.23 already show stronger evidence of fluctuations in NO2 along the review calendar. The predicted values in Figure A.24 support this notion: for NO2, we also find that an environmental political business cycle exists. Similar to PM2.5, pollution peaks in the middle of the review calendar. Differently than for PM2.5, NO2 also increases at the end of the review calendar before the VNA elections.

¹⁵Full dataset name "OMI/Aura NO2 Cloud-Screened Total and Tropospheric Column L3 Global Gridded 0.25 degree x 0.25 degree V3".



NO2 for each electoral district and year in cycle, demeaned within district over the years 2007-2020

Figure A.22: Locally weighted scatterplot smoothing curve of demeaned NO2 over the years of the electoral cycle.

	NO2
(Intercept)	4.046 (0.920)
year 2 in cycle	-0.072 (0.004)
year 3 in cycle	0.081 (0.003)
year 4 in cycle	-0.057 (0.005)
year 5 in cycle	-0.011 (0.004)
rain	0.328 (0.032)
temp	-0.003 (0.003)
sex_female	-0.003 (0.002)
pol_connect(2)	-0.008 (0.004)
pol_connect(3)	0.016 (0.004)
pol_connect(4)	0.011 (0.004)
age_elected	0.000 (0.000)
ethnicity_kinh	0.006 (0.003)
religion_yes	0.008 (0.007)
electoral district FE	yes
Num.Obs.	6769
R2	0.784
R2 Adj.	0.778
Std.Errors	by: electoral district

Table A.19: Effect of VNA electoral cycle on NO2 air pollution with year 1 in cycle as reference category. See predicted values in [Figure A.24](#).

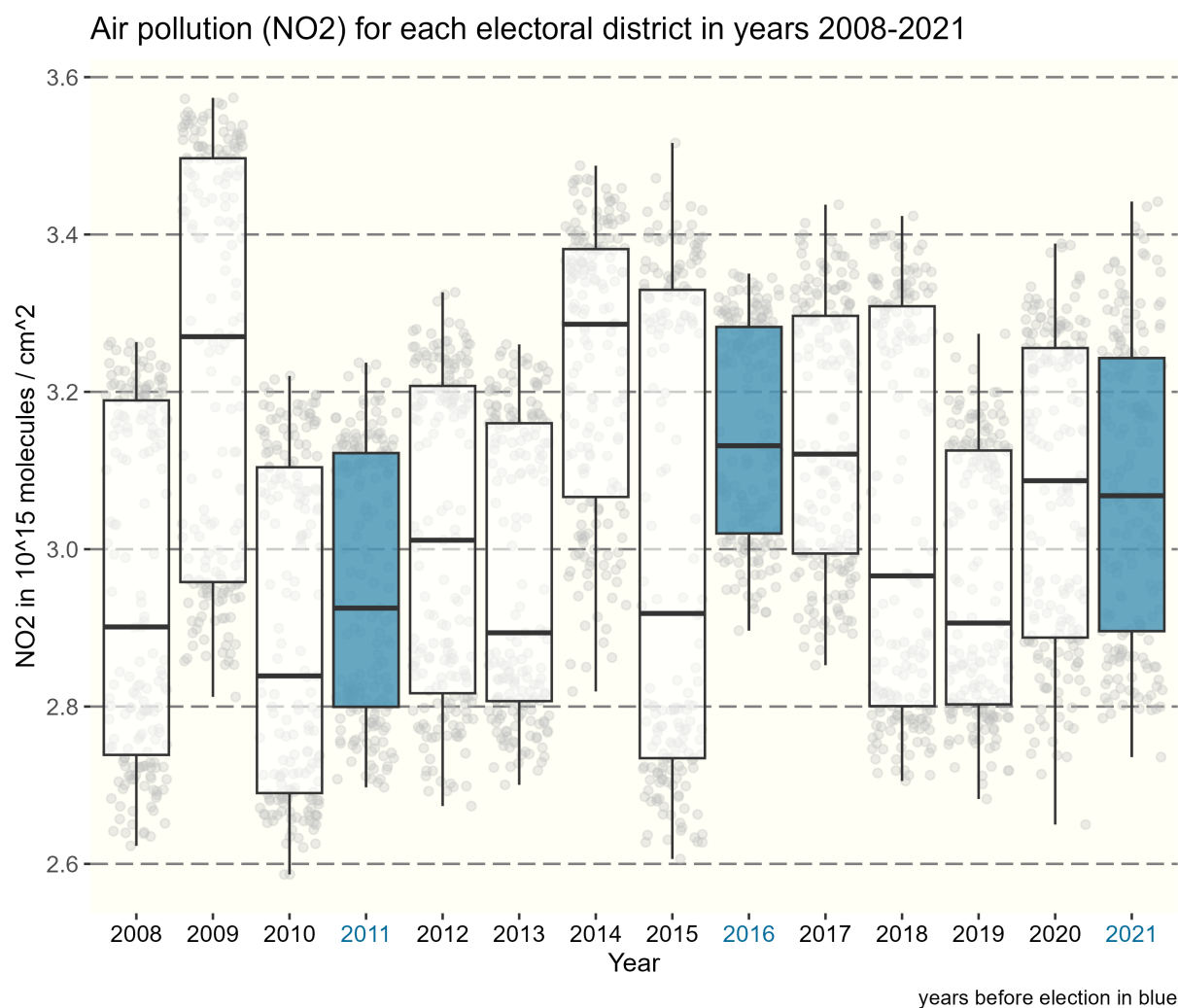


Figure A.23: NO₂ in each electoral district and year from 2008-2021.

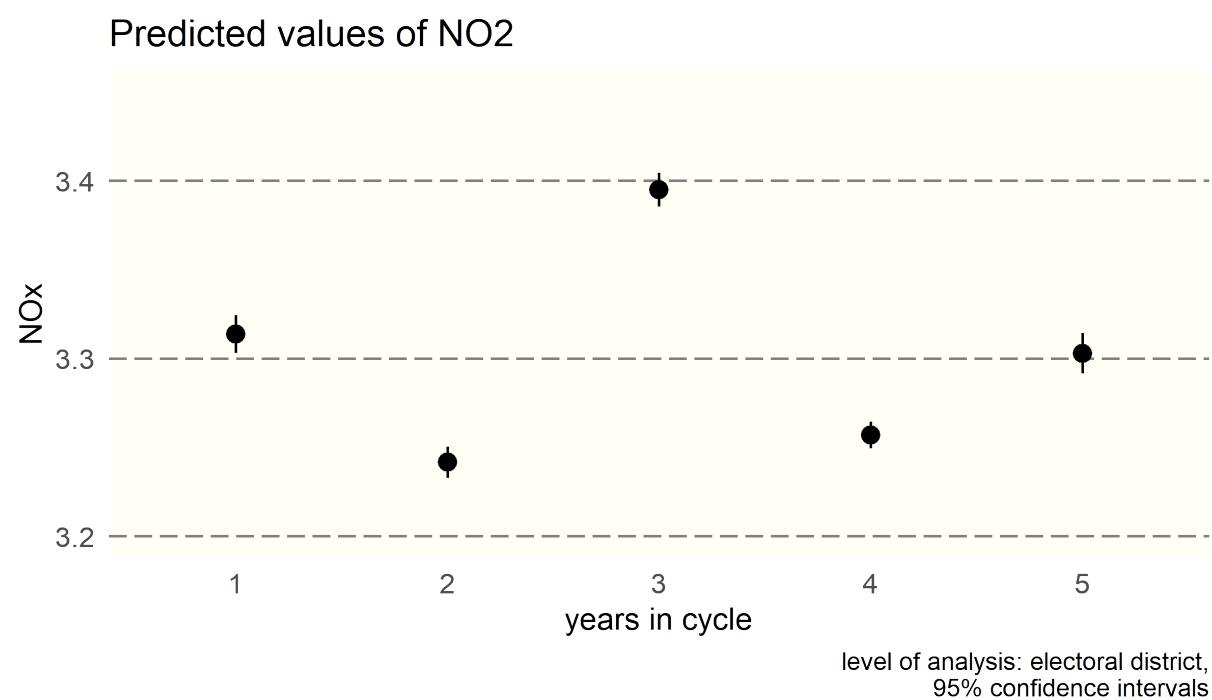


Figure A.24: Predicted values of NO₂ over the electoral cycle. Full regression results in Appendix Table A.19.

Placebo Test

We implement the same placebo outcome test that we used for PM2.5, using China as our control group. For NO2, we can see that the patterns in China look more similar to the ones we find in Vietnam, both in the raw data (Figure A.25), and the smoothed LOESS curve (Figure A.26). The resulting predicted values (Figure A.7) including controls for precipitation and temperature do lead to a different pattern though, with pollution showing a weak inverse U-shaped fluctuation pattern. Thus, while we are a little more cautious in interpreting the results we find for Vietnam, we are still quiet convinced that we do not spuriously interpret a regional or global macro shock as the impact of the Vietnamese review calendar.

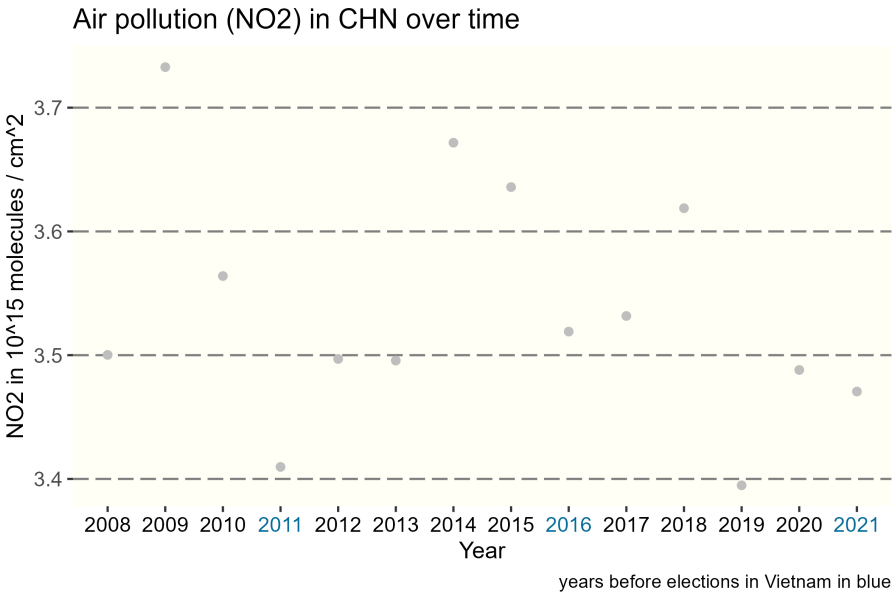


Figure A.25: NO2 in China over the (electoral) years 2008-2021

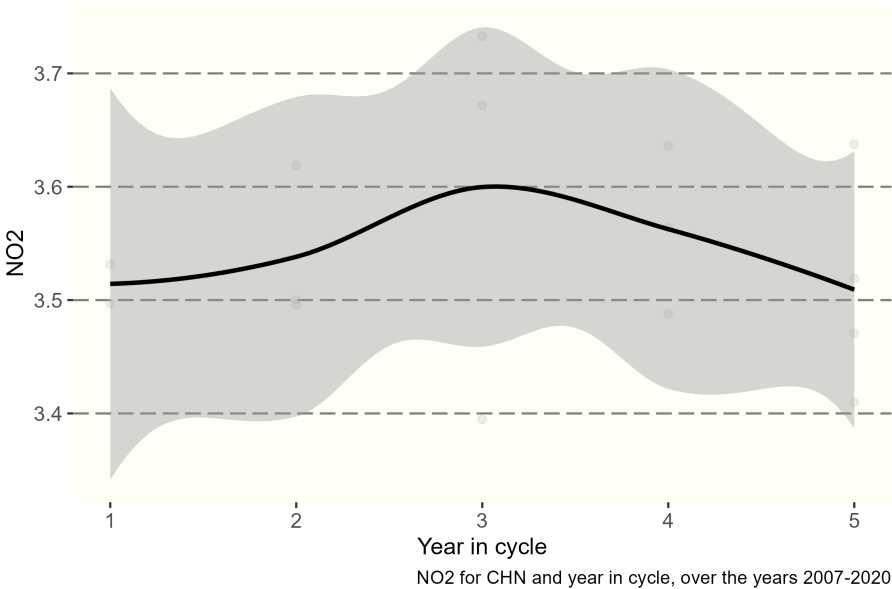


Figure A.26: Locally weighted scatterplot smoothing curve of NO2 in China over the years of the VNA electoral cycle

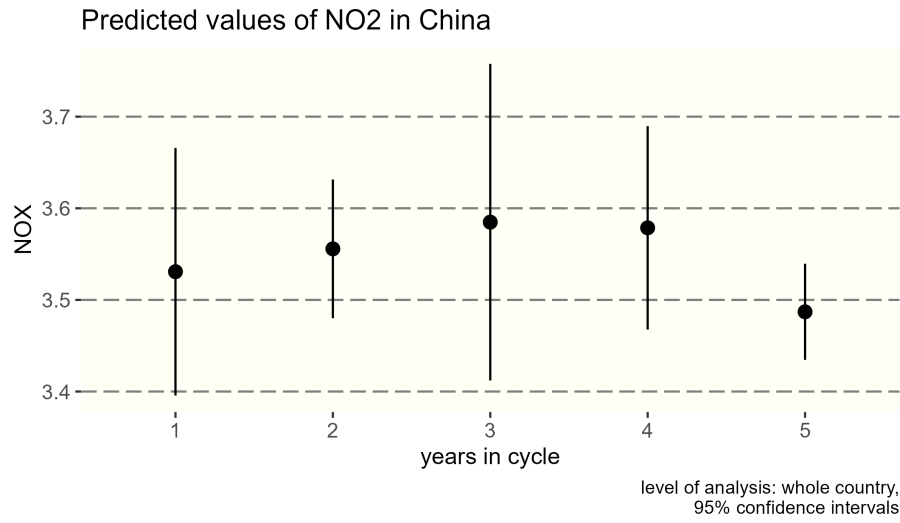


Figure A.27: Predicted values of NO2 in China over the VNA electoral cycle. Full regression results in Appendix Table A.20.

	NO2
(Intercept)	−32.971 (16.482)
year 2 in cycle	0.025 (0.079)
year 3 in cycle	0.054 (0.113)
year 4 in cycle	0.048 (0.089)
year 5 in cycle	−0.044 (0.075)
rain	−1.004 (4.681)
temp	0.126 (0.057)
Num.Obs.	15
R2	0.432
R2 Adj.	0.006

Table A.20: Effect of VNA electoral cycle on NO2 air pollution with year 1 in cycle as reference category. See predicted values in Figure A.27.

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