ONLINE APPENDIX

Supporting Information

Political Institutions, Energy Transitions, and Air Quality: Evidence from Global Urban Areas

To be published as Online Appendix. Also available via Harvard Dataverse at: https://doi.org/10.7910/DVN/PFTKFN

Contents

1 Data Definitions and Sources

Variable	Description	Source
PM2.5 Rates	Cases attributable to $PM_{2.5}$ per 100,000	Southerland et al. (2022); *Urban Air Quality Explorer* (2023)
NO2 Rates	Cases attributable to NO_2 per 100,000	Anenberg et al. (2022)
PM	Total emissions of particulate matter smaller than 2.5 micrometers of diameter	Hammer et al. (2020); *Urban Air Quality Explorer* (2023)
NO2	Total emissions of nitrogen dioxide	Anenberg et al. (2022)
CO2	Total emissions of carbon dioxide	Crippa et al. (2019)
Electoral Democracy	Measure of electoral democracy as an index	Coppedge et al. (2021); Lindberg et al. (2014)
Political Regime	Classification of political regimes based on their Polity IV score	Lührmann, Tannenberg and Lindberg (2018); *V-Dem Country-Year (Full + Others) v14 [original data]* (2024)
Polity IV	Categorical variable that measures regime type	Polity (2011)
Proximity to a Retired Coal Power Plan (50)	Binary variable that takes the value of 1 if the centroid of an urban area is within 50 kilometers from a retired coal power plant and 0 otherwise	Author's own elaboration with data from (*Urban Air Quality Explorer*, 2023; *Global Coal Plant Tracker*, 2024)
Proximity to a Retired Coal Power Plan (100)	Binary variable that takes the value of 1 if the centroid of an urban area is within 100 kilometers from a retired coal power plant and 0 otherwise	Author's own elaboration with data from (*Urban Air Quality Explorer*, 2023; *Global Coal Plant Tracker*, 2024)
Proximity to a Retired Coal Power Plan (150)	Binary variable that takes the value of 1 if the centroid of an urban area is within 150 kilometers from a retired coal power plant and 0 otherwise	Author's own elaboration with data from (*Urban Air Quality Explorer*, 2023; *Global Coal Plant Tracker*, 2024)
Proximity to an Operating Coal Power Plan (50)	Binary variable that takes the value of 1 if the centroid of an urban area is within 50 kilometers from an operating coal power plant and 0 otherwise	Author's own elaboration with data from (*Urban Air Quality Explorer*, 2023; *Global Coal Plant Tracker*, 2024)
Proximity to Operating Coal Power Plan (100)	Binary variable that takes the value of 1 if the centroid of an urban area is within 100 kilometers from an operating coal power plant and 0 otherwise	Author's own elaboration with data from (*Urban Air Quality Explorer*, 2023; *Global Coal Plant Tracker*, 2024)
Proximity to Operating Coal Power Plan (150)	Binary variable that takes the value of 1 if the centroid of an urban area is within 150 kilometers from an operating coal power plant and 0 otherwise	Author's own elaboration with data from (*Urban Air Quality Explorer*, 2023; *Global Coal Plant Tracker*, 2024)

1.1 Only Cities Proximate to Operating or Retired Coal Power Plants

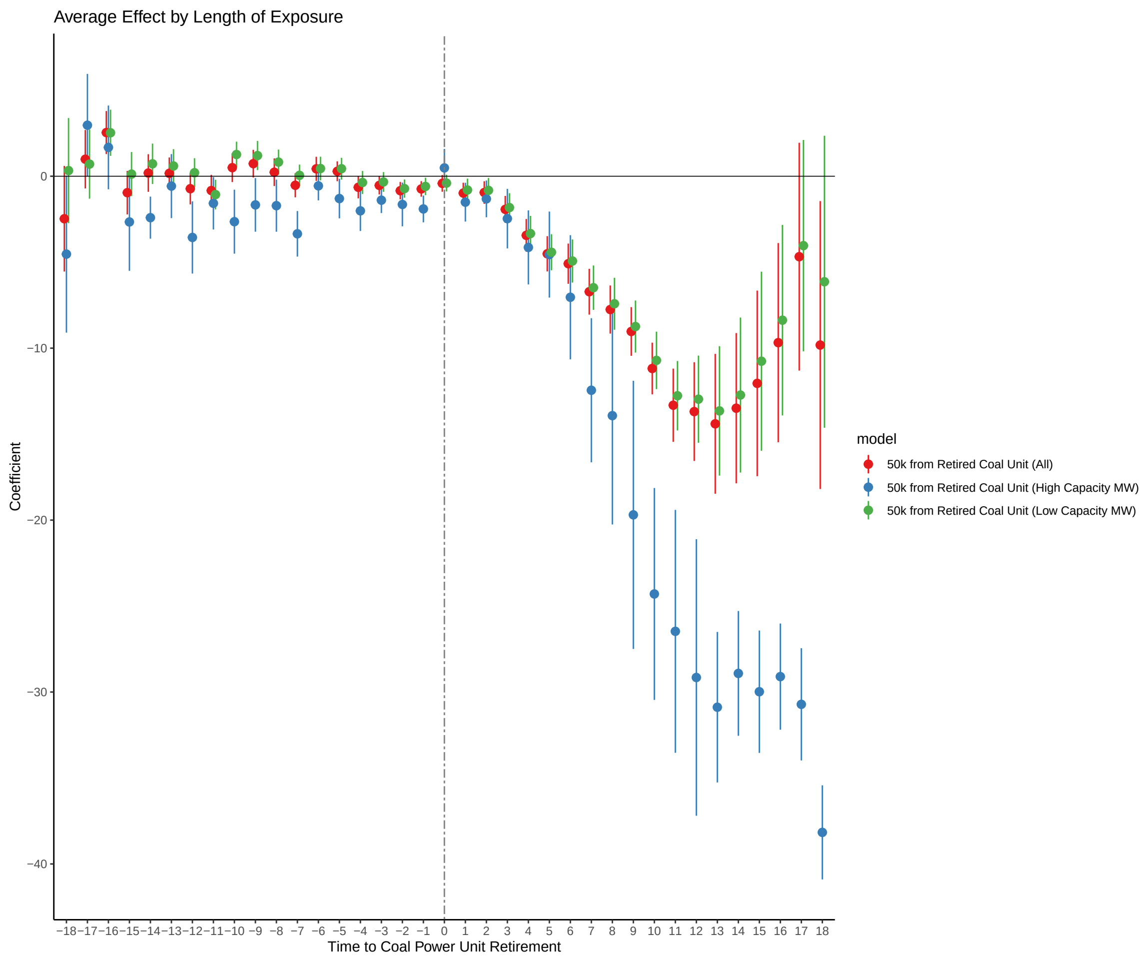

Figure S1: **Staggered difference-in-differences for $PM_{2.5}$ Rates / Proximity to Operating or Retired Plants Only**. Outcome variable is the number of cases attributable to this pollutant, before and after retirement; the model uses bootstrapped standard errors and a varying base period with no covariates. The sample includes only cities within 50KM of a retired coal power plant or within 50KM of a currently operating coal power plant to improve comparability. The models split the data by type of plant phasing out.

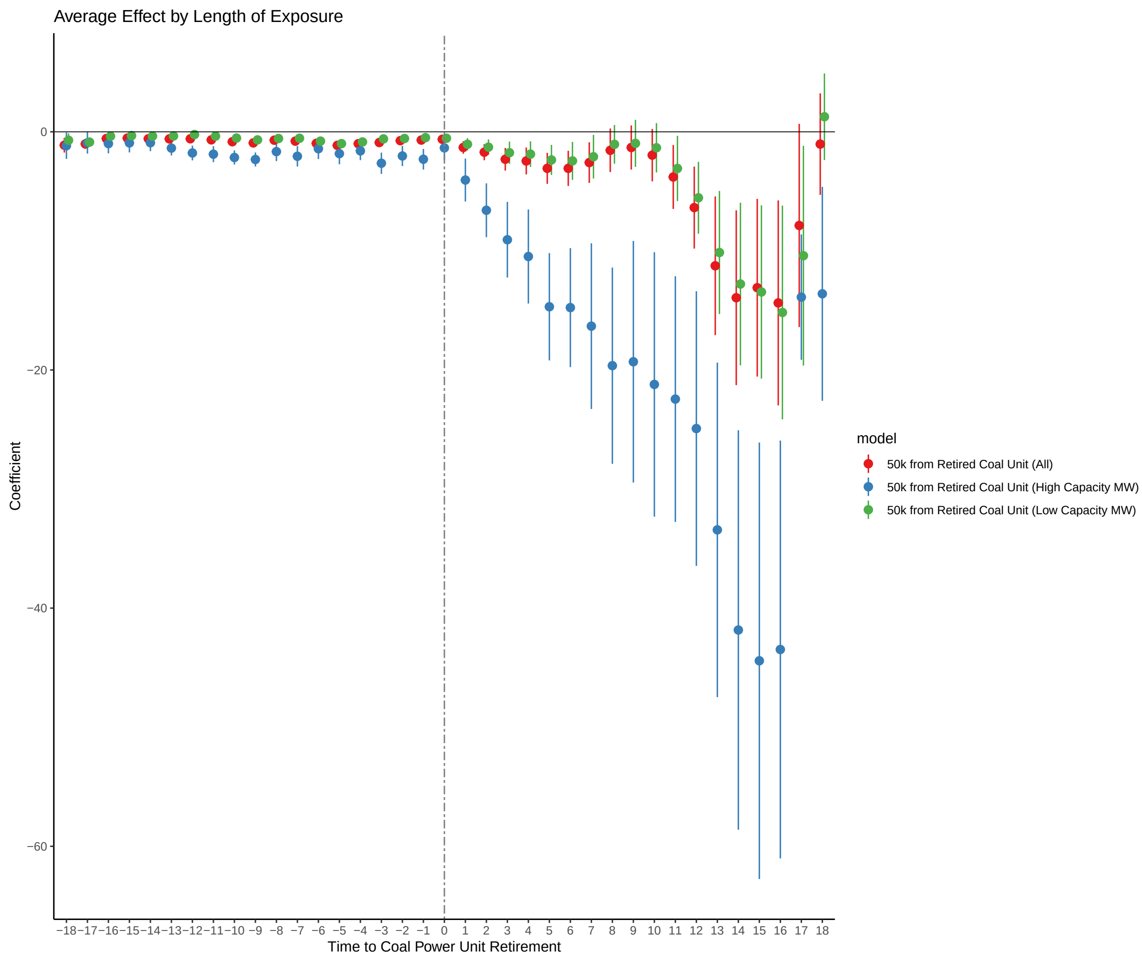

Figure S2: **Staggered difference-in-differences for NO_2 Rates / Proximity to Operating or Retired Plants Only**. Outcome variable is the number of cases attributable to this pollutant, before and after retirement; the model uses bootstrapped standard errors and a varying base period with no covariates. The sample includes only cities within 50KM of a retired coal power plant or within 50KM of a currently operating coal power plant to improve comparability. The models split the data by type of plant phasing out.

2 Staggered Difference-in-Differences

2.1 Simple Aggregation

Model	ATT	Std. Error	[95% Conf. Int.]
Model 1	-1.7793	0.2595	[-2.2879, -1.2706]*
Model 2	-1.7793	0.2714	[-2.3111, -1.2474]*
Model 3	-1.4354	0.2956	[-2.0147, -0.8561]*
Model 4	-1.4354	0.297	[-2.0174, -0.8534]*
Model 5	-0.8031	0.1870	[-1.1696, -0.4367]*
Model 6	0.1171	0.1907	[-0.2566, 0.4908]
Model 7	-4.2131	0.8384	[-5.8564, -2.5698]*
Model 8	-1.7168	0.2763	[-2.2583, -1.1752]*
Model 9	-2.0838	0.3392	[-2.7485, -1.419]*
Model 10	-2.0838	0.3434	[-2.7569, -1.4107]*
Model 11	-1.7946	0.4072	[-2.5927, -0.9966]*
Model 12	-1.7946	0.4105	[2.5993, -0.99]*
Model 13	-1.2446	0.2234	[-1.6823, -0.8068]*
Model 14	-0.6956	0.1918	[-1.0716, -0.3196]*
Model 15	-9.9758	1.0833	[-12.0989, -7.8526]*
Model 16	-1.7825	0.3415	[-2.4518, -1.1132]*

Table S1: Signif. codes: * confidence band does not cover 0
Control Group: Never Treated, Anticipation Periods: 0
Estimation Method: Doubly Robust. Model 1: PM2.5 mortality rate, varying base period, no covariates; Model 2: PM2.5 mortality rate universal base period, no covariates; Model 3: PM2.5 mortality rate varying base period, covariates; Model 4: PM2.5 mortality rate, universal base period, covariates; Model 5: PM2.5 mortality rate, 100KM from retired unit, varying period, no covariates; Model 6: PM2.5 mortality rate, 150KM from retired unit, varying base period, no covariates; Model 7: PM2.5 mortality rate, 50KM from high capacity unit, varying base period, no covariates; Model 8: PM2.5 mortality rate, 50KM from low capacity unit, varying base period, no covariates; Model 9: NO2 mortality rate, varying base period, no covariates; Model 10: NO2 mortality rate universal base period, no covariates; Model 11: NO2 mortality rate varying base period, covariates; Model 12: NO2 mortality rate, universal base period, covariates; Model 13: NO2 mortality rate, 100KM from retired unit, varying period, no covariates; Model 14: NO2 mortality rate, 150KM from retired unit, varying base period, no covariates; Model 15: NO2 mortality rate, 50KM from high capacity unit, varying base period, no covariates; Model 16: NO2 mortality rate, 50KM from low capacity unit, varying base period, no covariates

2.2 Cohort Aggregation

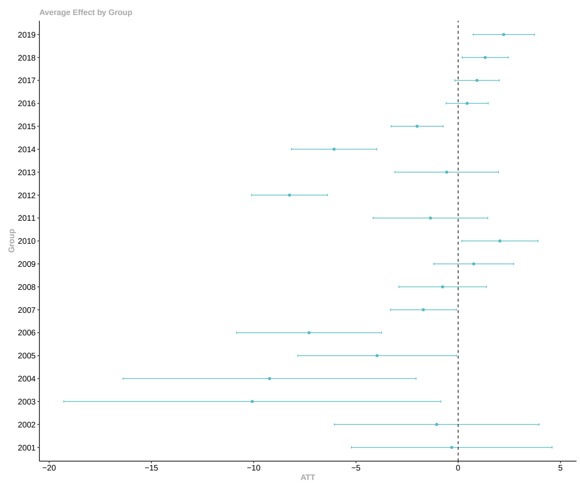

Figure S3: **Staggered differences-in-differences, cohort aggregation ($PM_{2.5}$ Rates)**. The figure shows the group-average treatment affect on the treated by group, defined as the year of exposure.

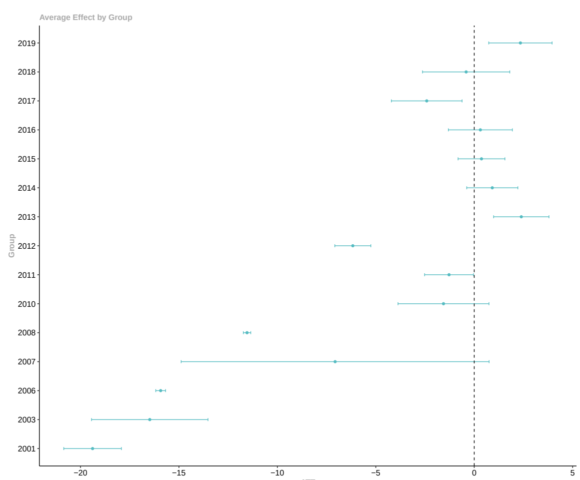

Figure S4: **Staggered differences-in-differences, cohort aggregation ($PM_{2.5}$ Rates), large coal power plants**. The figure shows the group-average treatment affect on the treated by group, defined as the year of exposure (only exposure to large power plants).

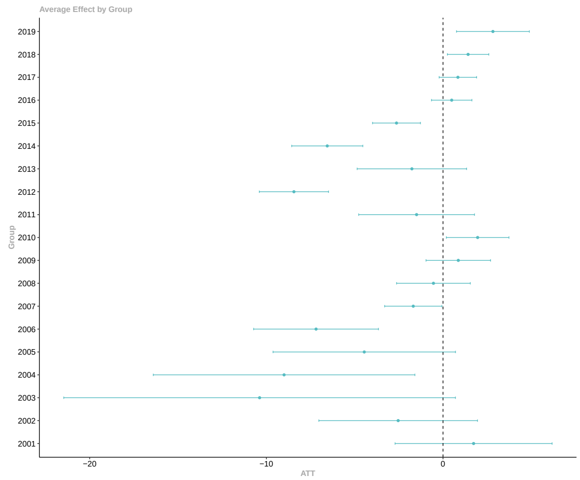

Figure S5: **Staggered differences-in-differences, cohort aggregation ($PM_{2.5}$ Rates), small coal power plants**. The figure shows the group-average treatment affect on the treated by group, defined as the year of exposure (only exposure to small power plants).

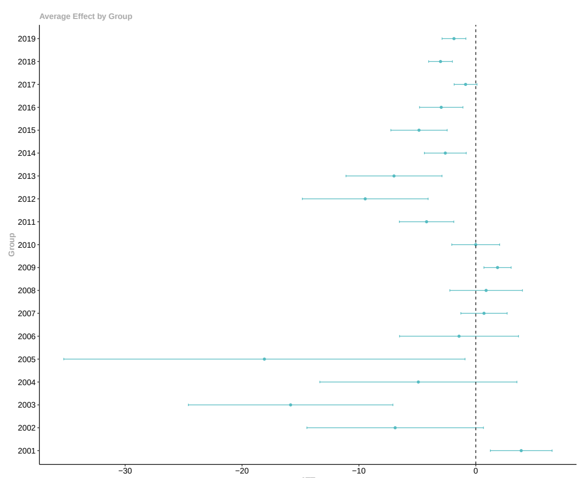

Figure S6: **Staggered differences-in-differences, cohort aggregation (NO_2 Rates)**. The figure shows the group-average treatment affect on the treated by group, defined as the year of exposure.

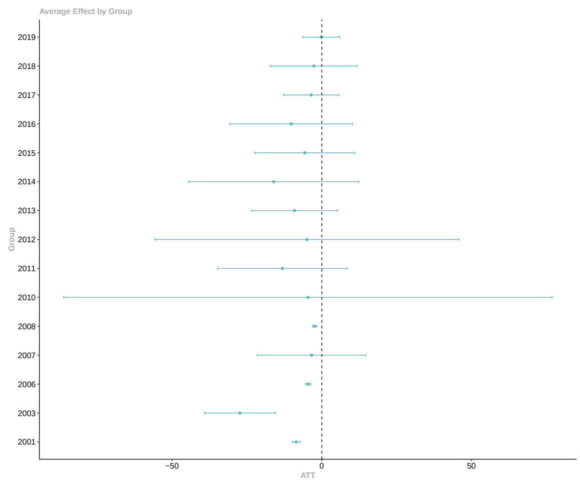

Figure S7: **Staggered differences-in-differences, cohort aggregation (NO_2 Rates), large coal power plants**. The figure shows the group-average treatment affect on the treated by group, defined as the year of exposure (only exposure to large power plants).

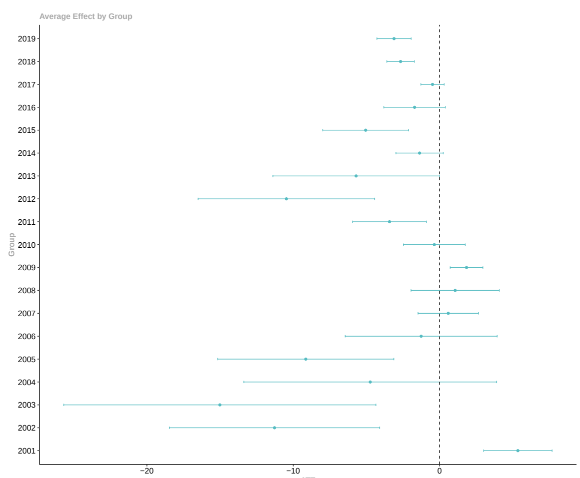

Figure S8: **Staggered differences-in-differences, cohort aggregation (NO_2 Rates), small coal power plants**. The figure shows the group-average treatment affect on the treated by group, defined as the year of exposure (only exposure to small power plants).

2.3 Only Retired Plants (No Mothballed or Shelved)

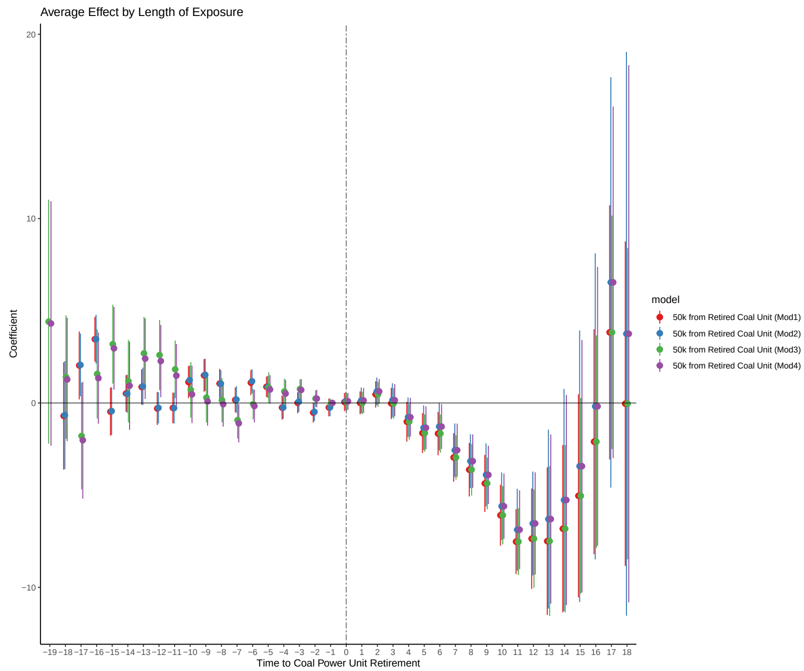

Figure S9: **Staggered differences-in-differences, event study ($PM_{2.5}$ Rates)**. Outcome variable is the number of cases attributable to this pollutant, before and after retirement. Model 1 employs a varying base period with no time-varying covariates. Model 2 uses a varying base period with time-varying covariates. Model 3 employs a universal base period with no time-varying covariates. Model 4 uses a universal base period with time-varying covariates.

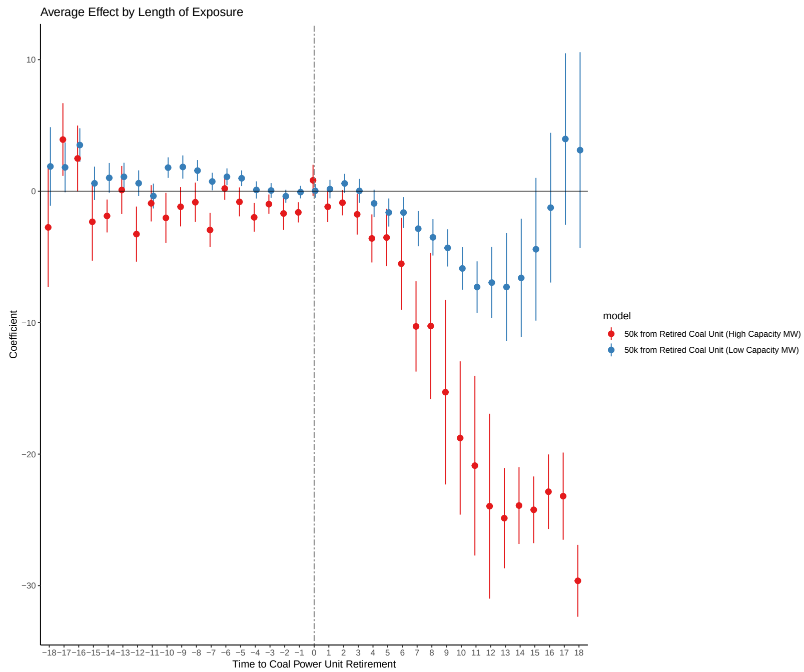

Figure S10: **Staggered differences-in-differences, event study ($PM_{2.5}$ Rates) by capacity**. Outcome variable is the number of cases attributable to this pollutant, before and after retirement. The model employs a varying base period with no time-varying covariates.

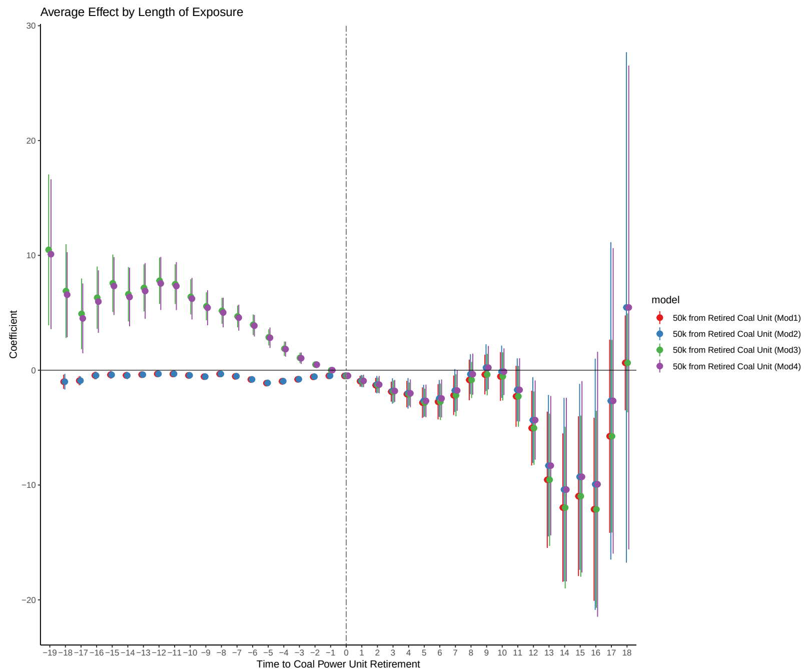

Figure S11: **Staggered differences-in-differences, event study** (NO_2 **Rates**). Outcome variable is the number of cases attributable to this pollutant, before and after retirement. Model 1 employs a varying base period with no time-varying covariates. Model 2 uses a varying base period with time-varying covariates. Model 3 employs a universal base period with no time-varying covariates. Model 4 uses a universal base period with time-varying covariates.

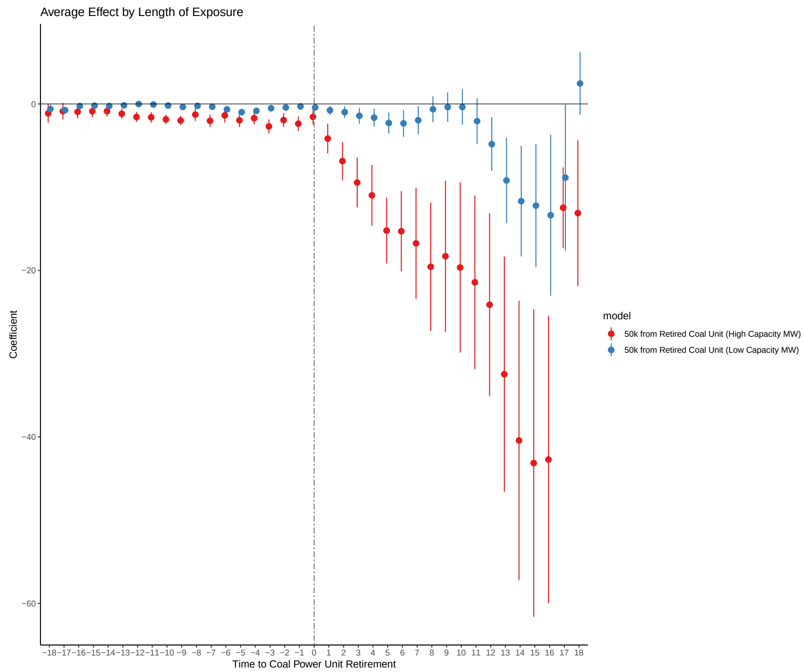

Figure S12: **Staggered differences-in-differences, event study (**NO_2 **Rates) by capacity**. Outcome variable is the number of cases attributable to this pollutant, before and after retirement. The model employs a varying base period with no time-varying covariates.

3 Robustness Checks: Alternative Estimators (Standard Two-Way Fixed Effects)

3.1 Variations of Fixed Effects

3.1.1 City and Year FE

	NO_2 Rates	$PM_{2.5}$ Rates
Proximate to Coal Retirement (50KM)	-4.40^{***}	-2.82^{***}
	(0.41)	(0.28)
Log(CO_2 Emissions)	6.93^{***}	8.99^{***}
	(0.38)	(0.43)
Num. obs.	81719	81479
Num. groups: City	4086	4074
Num. groups: Year	20	20
R^2 (full model)	0.95	0.95
Adj. R^2 (full model)	0.94	0.95

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S2: **Standard TWFE: Mortality Rates**. The outcome variable for both models is number of cases attributable to each pollutant per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability. The models include city and year fixed effects.

	NO_2	$PM_{2.5}$	CO_2
Proximate to Coal Retirement (50KM)	-0.86^{***}	-4.18^{***}	-0.11^{***}
	(0.06)	(0.27)	(0.01)
Log(CO_2 Emissions)	1.52^{***}	6.08^{***}	
	(0.07)	(0.28)	
Num. obs.	81415	81479	81720
Num. groups: City	4086	4074	4086
Num. groups: Year	20	20	20
R^2 (full model)	0.86	0.93	0.99
Adj. R^2 (full model)	0.85	0.93	0.98

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S3: **Standard TWFE: Total Emissions**. The outcome variable for the three models is the total emissions of each pollutant. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability. The models include city and year fixed effects.

3.1.2 City, Country, and Year FE

	Model 1	Model 2
Proximate to Coal Retirement (50KM)	-4.40^{***}	-2.82^{***}
	(0.41)	(0.28)
Log(CO_2 Emissions)	6.94^{***}	8.99^{***}
	(0.38)	(0.43)
Num. obs.	81699	81479
Num. groups: City	4085	4074
Num. groups: Country	87	86
Num. groups: Year	20	20
R^2 (full model)	0.95	0.95
Adj. R^2 (full model)	0.94	0.95

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S4: **Standard TWFE: Mortality Rates**. The outcome variable for both models is number of cases attributable to each pollutant per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability. The models include city, country, and year fixed effects

	NO_2	$PM_{2.5}$	CO_2
Proximate to Coal Retirement (50KM)	-0.86^{***}	-4.18^{***}	-0.11^{***}
	(0.06)	(0.27)	(0.01)
Log(CO_2 Emissions)	1.52^{***}	6.08^{***}	
	(0.07)	(0.28)	
Num. obs.	81400	81479	81700
Num. groups: City	4085	4074	4085
Num. groups: Country	87	86	87
Num. groups: Year	20	20	20
R^2 (full model)	0.86	0.93	0.99
Adj. R^2 (full model)	0.85	0.93	0.98

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S5: **Standard TWFE: Total Emissions**. The outcome variable for the three models is number of cases attributable to each pollutant per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability. The models include city, country, and year fixed effects

3.2 Distance to Coal Power Plants

3.2.1 Mortality Rates Attributable to $PM_{2.5}$

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-2.82^{***}		
	(0.28)		
Proximate to Coal Retirement (100KM)		-2.46^{***}	
		(0.22)	
Proximate to Coal Retirement (150KM)			-1.49^{***}
			(0.20)
Log(CO_2 Emissions)	8.99^{***}	9.39^{***}	9.49^{***}
	(0.43)	(0.38)	(0.35)
Num. obs.	81479	134799	160299
Num. groups: City	4074	6740	8015
Num. groups: Country	86	104	108
Num. groups: Year	20	20	20
R^2 (full model)	0.95	0.95	0.95
Adj. R^2 (full model)	0.95	0.94	0.94

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S6: **Standard Two-Way Fixed Effects: Mortality Rates by Distance to the Closest Retired Unit**. The outcome variable for the three models is the number of cases attributable to particulate matter per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM / 100KM / 150KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM / 100KM / 150KM of both retired or operating coal power plans). The models include city, country, and year fixed effects.

3.2.2 Mortality Rates Attributable to NO_2

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-4.40^{***}		
	(0.41)		
Proximate to Coal Retirement (100KM)		-3.19^{***}	
		(0.27)	
Proximate to Coal Retirement (150KM)			-2.45^{***}
			(0.23)
Log(CO_2 Emissions)	6.94^{***}	6.83^{***}	6.77^{***}
	(0.38)	(0.30)	(0.27)
Num. obs.	81699	135059	160659
Num. groups: City	4085	6753	8033
Num. groups: Country	87	105	109
Num. groups: Year	20	20	20
R^2 (full model)	0.95	0.94	0.95
Adj. R^2 (full model)	0.94	0.94	0.94

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S7: **Standard Two-Way Fixed Effects: Mortality Rates by Distance to the Closest Retired Unit**. The outcome variable for the three models is the number of cases attributable to nitrogen dioxide per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM / 100KM / 150KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM / 100KM / 150KM of both retired or operating coal power plans). The models include city, country, and year fixed effects

3.2.3 Emissions of $PM_{2.5}$

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-4.18^{***}		
	(0.27)		
Proximate to Coal Retirement (100KM)		-4.36^{***}	
		(0.21)	
Proximate to Coal Retirement (150KM)			-3.21^{***}
			(0.18)
Log(CO_2 Emissions)	6.08^{***}	6.71^{***}	6.71^{***}
	(0.28)	(0.26)	(0.24)
Num. obs.	81479	134799	160299
Num. groups: City	4074	6740	8015
Num. groups: Country	86	104	108
Num. groups: Year	20	20	20
R^2 (full model)	0.93	0.94	0.94
Adj. R^2 (full model)	0.93	0.93	0.93

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S8: **Standard Two-Way Fixed Effects: Emissions by Distance to the Closest Retired Unit**. The outcome variable for the three models is the level of emissions from particulate matter. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM / 100KM / 150KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM / 100KM / 150KM of both retired or operating coal power plans). The models include city, country, and year fixed effects

3.2.4 Emissions of NO_2

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-0.86^{***}		
	(0.06)		
Proximate to Coal Retirement (100KM)		-0.67^{***}	
		(0.04)	
Proximate to Coal Retirement (150KM)			-0.51^{***}
			(0.04)
Log(CO_2 Emissions)	1.52^{***}	1.45^{***}	1.44^{***}
	(0.07)	(0.06)	(0.05)
Num. obs.	81400	134560	160035
Num. groups: City	4085	6753	8033
Num. groups: Country	87	105	109
Num. groups: Year	20	20	20
R^2 (full model)	0.86	0.87	0.87
Adj. R^2 (full model)	0.85	0.86	0.87

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S9: **Standard Two-Way Fixed Effects: Emissions by Distance to the Closest Retired Unit**. The outcome variable for the three models is the level of emissions from nitrogen dioxide. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM / 100KM / 150KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM / 100KM / 150KM of both retired or operating coal power plans). The models include city, country, and year fixed effects

3.2.5 Emissions of CO_2

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-0.11^{***}		
	(0.01)		
Proximate to Coal Retirement (100KM)		-0.08^{***}	
		(0.01)	
Proximate to Coal Retirement (150KM)			-0.07^{***}
			(0.01)
Num. obs.	81700	135060	160660
Num. groups: City	4085	6753	8033
Num. groups: Country	87	105	109
Num. groups: Year	20	20	20
R^2 (full model)	0.99	0.99	0.99
Adj. R^2 (full model)	0.98	0.99	0.99

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S10: **Standard Two-Way Fixed Effects: Emissions by Distance to the Closest Retired Unit**. The outcome variable for the three models is the level of emissions of carbon dioxide. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM / 100KM / 150KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM / 100KM / 150KM of both retired or operating coal power plans). The models include city, country, and year fixed effects

3.3 Coal Power Plant Capacity

3.3.1 Mortality Rates Attributable to $PM_{2.5}$ by Capacity

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-2.82^{***}		
	(0.28)		
Proximate to Coal Retirement (50KM, High Capacity)		-9.82^{***}	
		(0.55)	
Proximate to Coal Retirement (50KM, Low Capacity)			-2.21^{***}
			(0.29)
Log(CO_2 Emissions)	8.99^{***}	8.88^{***}	9.06^{***}
	(0.43)	(0.42)	(0.43)
Num. obs.	81479	81479	81479
Num. groups: City	4074	4074	4074
Num. groups: Country	86	86	86
Num. groups: Year	20	20	20
R^2 (full model)	0.95	0.95	0.95
Adj. R^2 (full model)	0.95	0.95	0.95

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S11: **Standard Two-Way Fixed Effects: Mortality Rates by Capacity of the Closest Retired Coal Unit**. The outcome variable for the three models is the number of cases attributable to particulate matter per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM of both retired or operating coal power plans). The models include city, country, and year fixed effects. In Model 1, the independent variable measures distance to any retiring coal power plant; in Model 2 the independent variable measures distance to only large (above 300MW) power plants; in Model 3, the independent variable measures distance to only small (below 300 MW) power plants.

3.3.2 Mortality Rates Attributable to NO_2 by Capacity

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-4.40^{***}		
	(0.41)		
Proximate to Coal Retirement (50KM, High Capacity)		-19.10^{***}	
		(1.49)	
Proximate to Coal Retirement (50KM, Low Capacity)			-3.26^{***}
			(0.41)
Log(CO_2 Emissions)	6.94^{***}	6.65^{***}	7.04^{***}
	(0.38)	(0.37)	(0.38)
Num. obs.	81699	81699	81699
Num. groups: City	4085	4085	4085
Num. groups: Country	87	87	87
Num. groups: Year	20	20	20
R^2 (full model)	0.95	0.95	0.94
Adj. R^2 (full model)	0.94	0.94	0.94

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S12: **Standard Two-Way Fixed Effects: Mortality Rates by Capacity of the Closest Retired Coal Unit**. The outcome variable for the three models is the number of cases attributable to nitrogen dioxide per 100,000 inhabitants. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM of both retired or operating coal power plans). The models include city, country, and year fixed effects. In Model 1, the independent variable measures distance to any retiring coal power plant; in Model 2 the independent variable measures distance to only large (greater than 300MW) power plants; in Model 3, the independent variable measures distance to only small (smaller than 300 MW) power plants.

3.3.3 Emissions of $PM_{2.5}$ by Capacity

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-4.18^{***}		
	(0.27)		
Proximate to Coal Retirement (50KM, High Capacity)		-2.87^{***}	
		(0.30)	
Proximate to Coal Retirement (50KM, Low Capacity)			-4.19^{***}
			(0.28)
Log(CO_2 Emissions)	6.08^{***}	6.24^{***}	6.14^{***}
	(0.28)	(0.28)	(0.28)
Num. obs.	81479	81479	81479
Num. groups: City	4074	4074	4074
Num. groups: Country	86	86	86
Num. groups: Year	20	20	20
R^2 (full model)	0.93	0.93	0.93
Adj. R^2 (full model)	0.93	0.93	0.93

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S13: **Standard Two-Way Fixed Effects: Emissions by Capacity of the Closest Retired Coal Unit**. The outcome variable for the three models is emissions of particulate matter. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM of both retired or operating coal power plans). The models include city, country, and year fixed effects. In Model 1, the independent variable measures distance to any retiring coal power plant; in Model 2 the independent variable measures distance to only large (above 300MW) power plants; in Model 3, the independent variable measures distance to only small (below 300 MW) power plants.

3.3.4 Emissions of NO_2 by Capacity

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-0.86^{***}		
	(0.06)		
Proximate to Coal Retirement (50KM, High Capacity)		-2.56^{***}	
		(0.17)	
Proximate to Coal Retirement (50KM, Low Capacity)			-0.77^{***}
			(0.06)
Log(CO_2 Emissions)	1.52^{***}	1.50^{***}	1.53^{***}
	(0.07)	(0.07)	(0.07)
Num. obs.	81400	81400	81400
Num. groups: City	4085	4085	4085
Num. groups: Country	87	87	87
Num. groups: Year	20	20	20
R^2 (full model)	0.86	0.86	0.86
Adj. R^2 (full model)	0.85	0.85	0.85

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S14: **Standard Two-Way Fixed Effects: Emissions by Capacity of the Closest Retired Coal Unit**. The outcome variable for the three models is emissions of nitrogen dioxide. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM of both retired or operating coal power plans). The models include city, country, and year fixed effects. In Model 1, the independent variable measures distance to any retiring coal power plant; in Model 2 the independent variable measures distance to only large (above 300MW) power plants; in Model 3, the independent variable measures distance to only small (below 300 MW) power plants.

3.3.5 Emissions of CO_2 by Capacity

	Model 1	Model 2	Model 3
Proximate to Coal Retirement (50KM)	-0.11^{***}		
	(0.01)		
Proximate to Coal Retirement (50KM, High Capacity)		-0.45^{***}	
		(0.02)	
Proximate to Coal Retirement (50KM, Low Capacity)			-0.09^{***}
			(0.01)
Num. obs.	81700	81700	81700
Num. groups: City	4085	4085	4085
Num. groups: Country	87	87	87
Num. groups: Year	20	20	20
R^2 (full model)	0.99	0.99	0.99
Adj. R^2 (full model)	0.98	0.98	0.98

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S15: **Standard Two-Way Fixed Effects: Emissions by Capacity of the Closest Retired Coal Unit**. The outcome variable for the three models is emissions of carbon dioxide. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes only cities in proximity to retired or operating coal power plants to improve comparability (cities within 50KM of both retired or operating coal power plans). The models include city, country, and year fixed effects. In Model 1, the independent variable measures distance to any retiring coal power plant; in Model 2 the independent variable measures distance to only large (above 300MW) power plants; in Model 3, the independent variable measures distance to only small (below 300 MW) power plants.

3.4 All Cities

	Model 1	Model 2	Model 3	Model 4
Proximate to Coal Retirement (50KM)	-4.91^{***}	-0.13	-3.29^{***}	-1.15^{***}
	(0.44)	(0.30)	(0.25)	(0.07)
Log(CO_2 Emissions)	4.75^{***}	4.73^{***}	4.00^{***}	0.88^{***}
	(0.16)	(0.21)	(0.13)	(0.03)
Num. obs.	259751	258664	258664	258577
Num. groups: City	12988	12934	12934	12988
Num. groups: Country	183	175	175	183
Num. groups: Year	20	20	20	20
R^2 (full model)	0.95	0.95	0.94	0.90
Adj. R^2 (full model)	0.94	0.95	0.94	0.90

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S16: **Standard Two-Way Fixed Effects: Full Sample of All Cities**. The outcome variables are: (1) the number of cases attributable to nitrogen dioxide per 100,000 inhabitants, (2) the number of cases attributable to particulate matter per 100,000 inhabitants, (3) emissions of particulate matter, and (4) emissions of nitrogen dioxide. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement. The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes all cities in the sample regardless of proximity to any coal facility. The models include city, country, and year fixed effects

	Model 1	Model 2	Model 3	Model 4
Proximate to Coal Retirement (50KM, High Capacity)	-20.79^{***}	-9.57^{***}	-4.05^{***}	-3.26^{***}
	(1.50)	(0.52)	(0.21)	(0.17)
Log(CO_2 Emissions)	4.64^{***}	4.64^{***}	4.01^{***}	0.87^{***}
	(0.16)	(0.21)	(0.13)	(0.03)
Num. obs.	259751	258664	258664	258577
Num. groups: City	12988	12934	12934	12988
Num. groups: Country	183	175	175	183
Num. groups: Year	20	20	20	20
R^2 (full model)	0.95	0.95	0.94	0.90
Adj. R^2 (full model)	0.95	0.95	0.94	0.90

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table S17: **Standard Two-Way Fixed Effects: Full Sample of All Cities**. The outcome variables are: (1) the number of cases attributable to nitrogen dioxide per 100,000 inhabitants, (2) the number of cases attributable to particulate matter per 100,000 inhabitants, (3) emissions of particulate matter, and (4) emissions of nitrogen dioxide. The main independent variable is the interaction of proximity to a retired coal power plant (defined as being located within 50KM of a facility) and a binary variable that takes the value of 1 after retirement (it measures distance to the closest large coal power plant retired). The models control for the logged amount of carbon dioxide emissions to approximate energy-intensive activities. The standard errors are clustered at the city level. The sample includes all cities in the sample regardless of proximity to any coal facility. The models include city, country, and year fixed effects

4 Robustness Checks: Alternative Estimators (Fixed Effects Counterfactual Estimators)

4.1 Matrix Completion Method

4.1.1 Particulate Matter

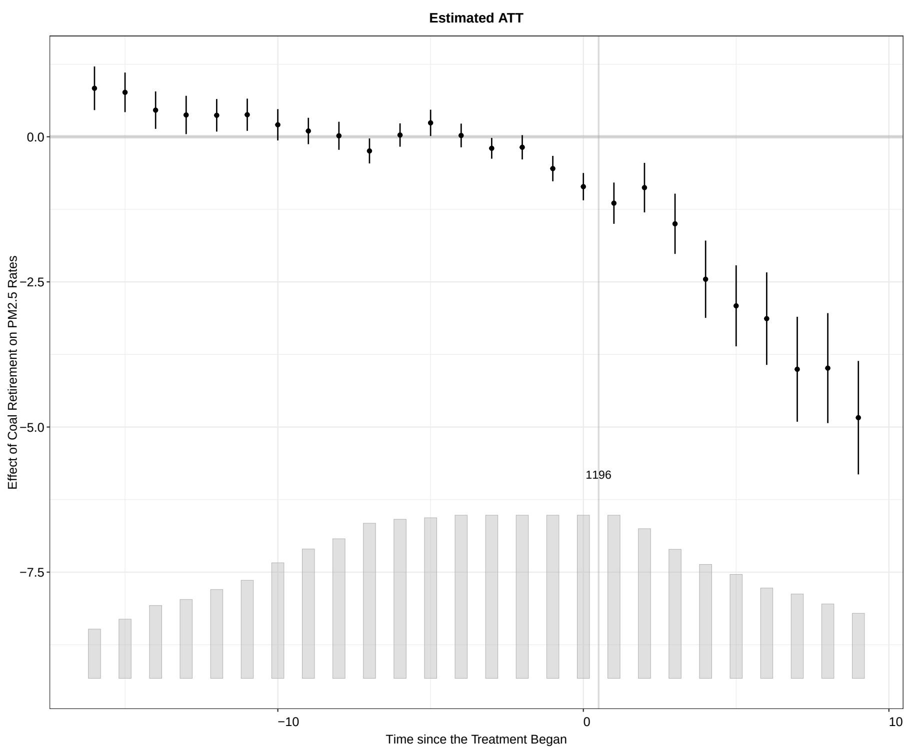

Figure S13: **FEct for Mortality Rates from** $PM_{2.5}$**.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to particulate matter as the dependent variable, the matrix completion imputation algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

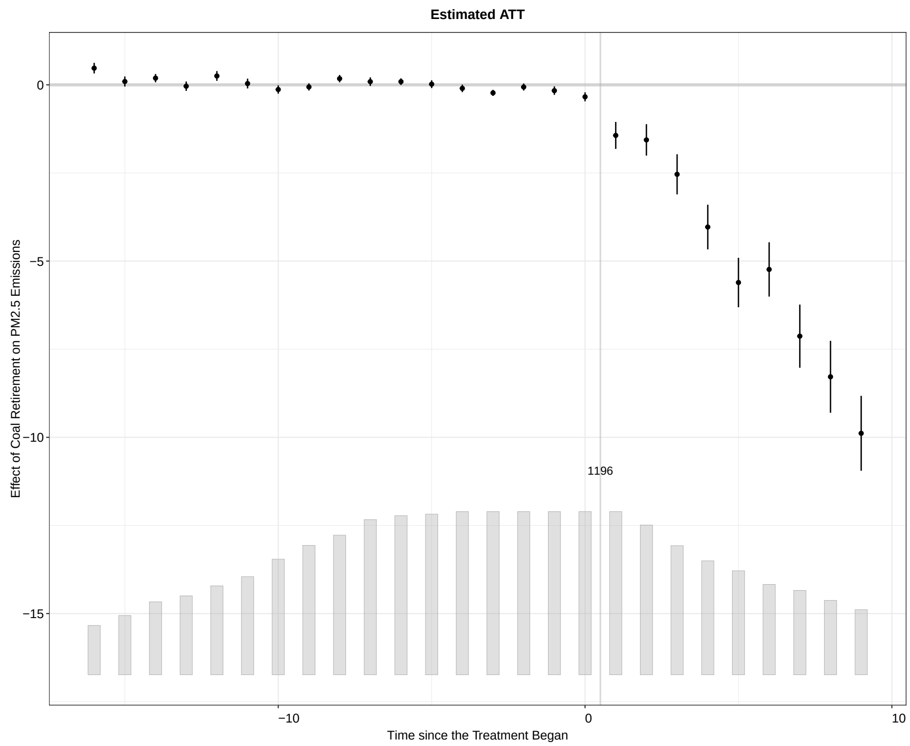

Figure S14: **FEct for Emissions of $PM_{2.5}$.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to particulate matter as the dependent variable, the matrix completion imputation algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

4.1.2 Nitrogen Dioxide

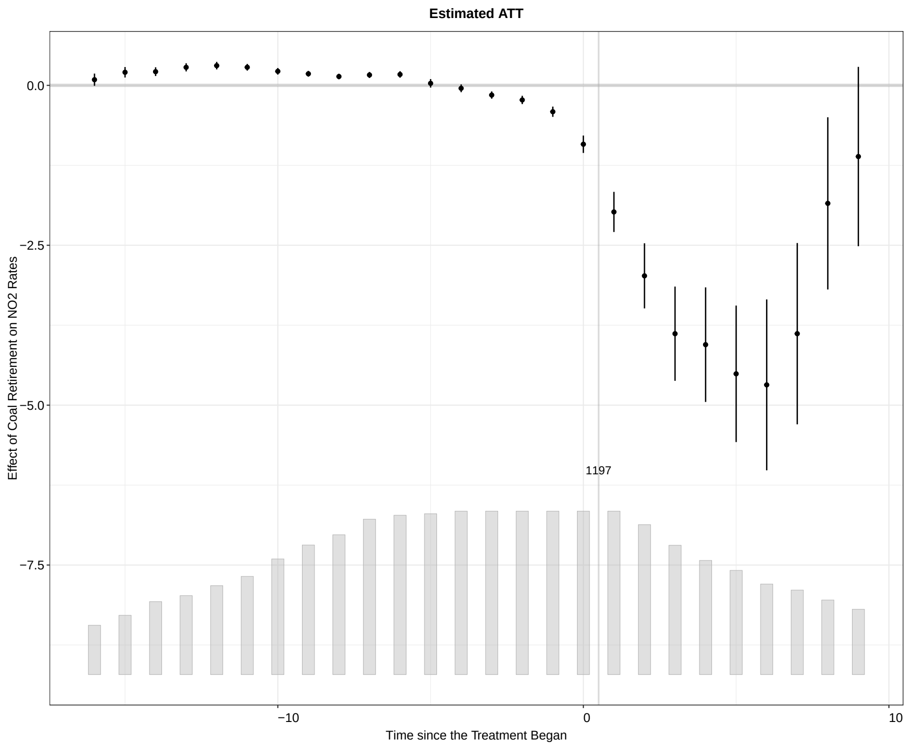

Figure S15: **FEct for Mortality Rates from NO_2.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to nitrogen dioxide as the dependent variable, the matrix completion imputation algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

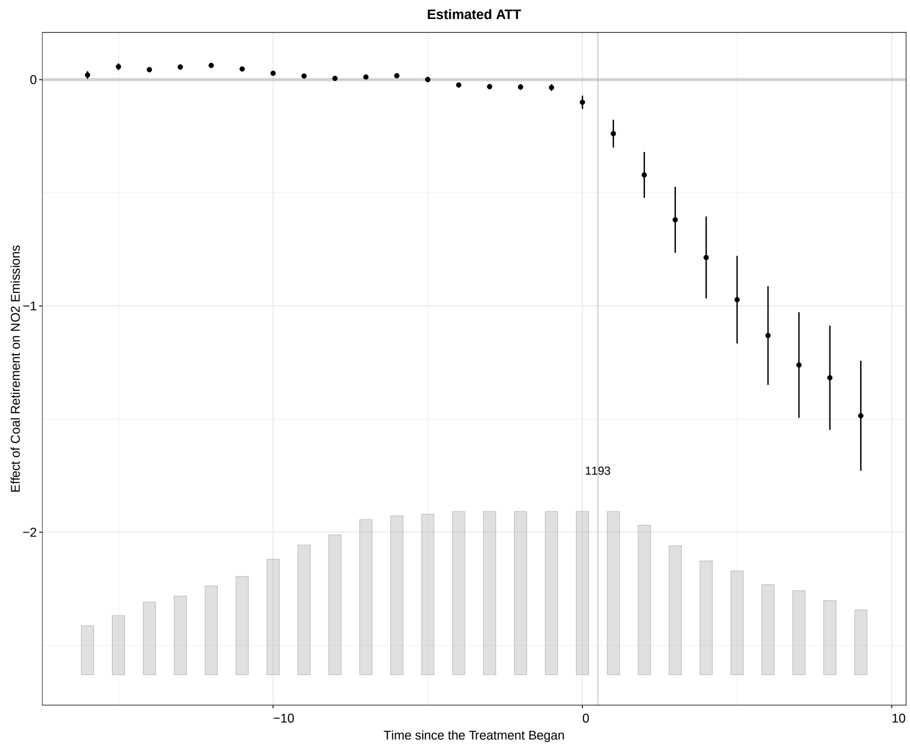

Figure S16: **FEct for Emissions of** NO_2**.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to nitrogen dioxide as the dependent variable, the matrix completion imputation algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

4.2 Fixed Effects

4.2.1 Particulate Matter

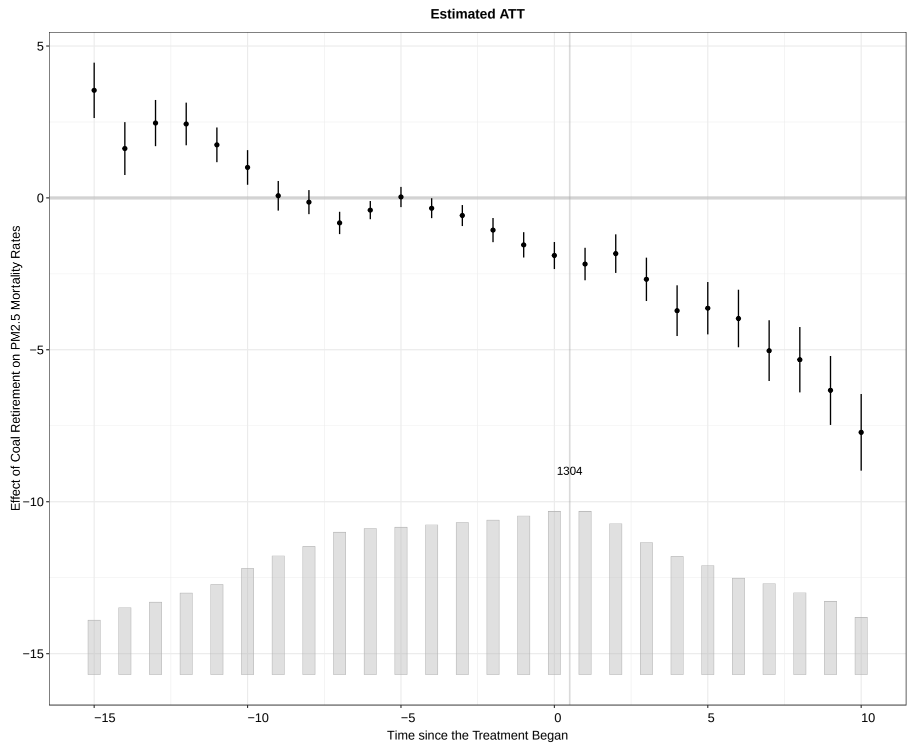

Figure S17: **FEct for Mortality Rates from** $PM_{2.5}$**.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to particulate matter as the dependent variable, the fixed effects algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

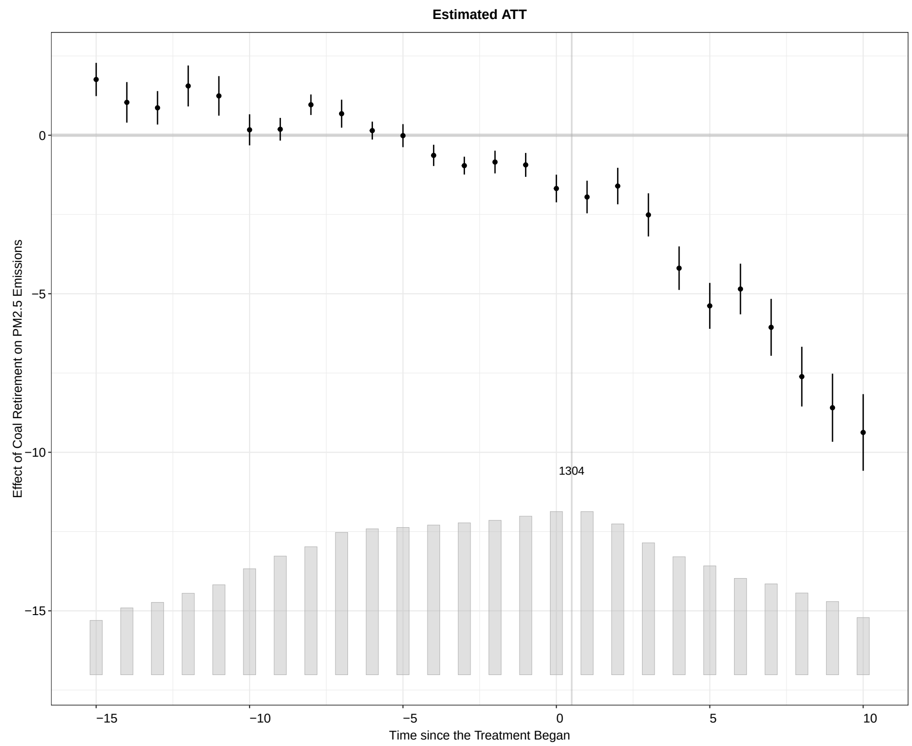

Figure S18: **FEct for Emissions of $PM_{2.5}$.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to particulate matter as the dependent variable, the fixed effects algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

4.2.2 Nitrogen Dioxide

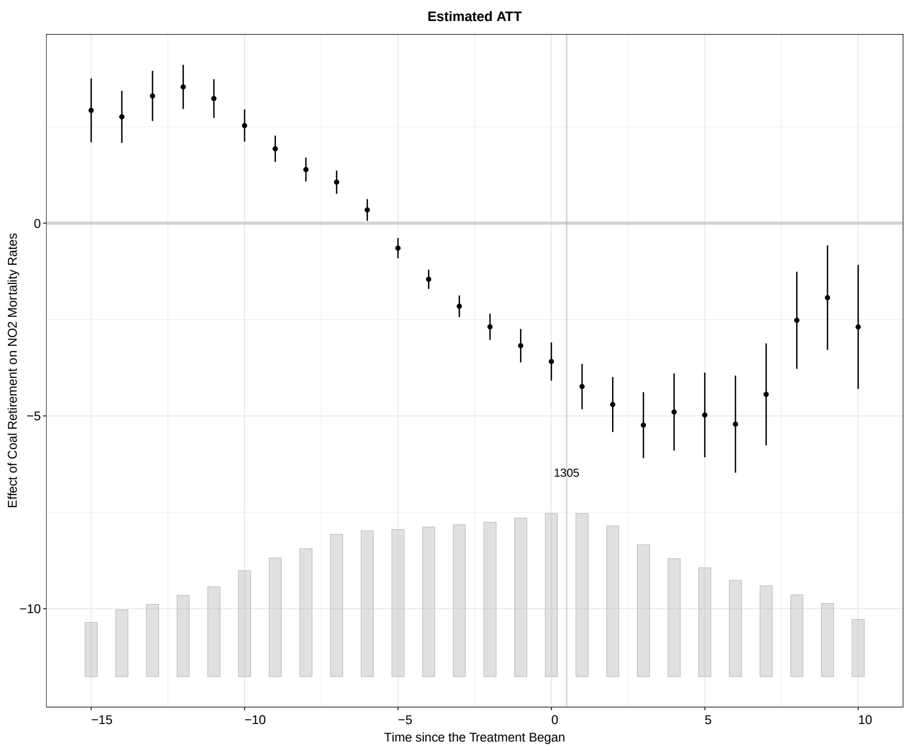

Figure S19: **FEct for Mortality Rates from NO_2.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to particulate matter as the dependent variable, the fixed effects algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

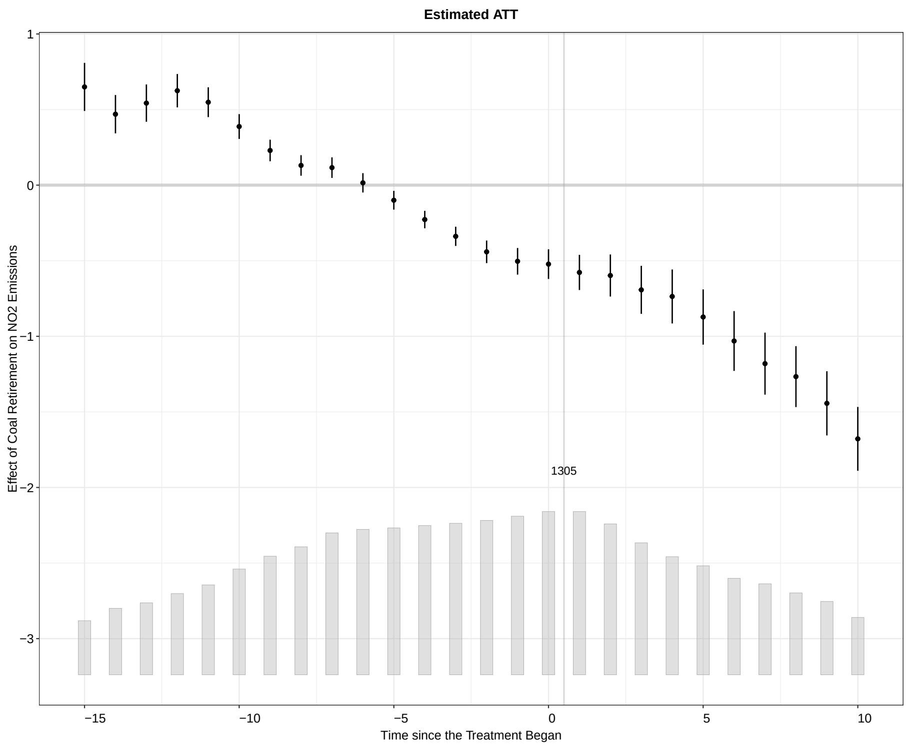

Figure S20: **FEct for Emissions of NO_2.** Results of the *Fixed Effects Counterfactual Estimator* using the number of cases attributable to particulate matter as the dependent variable, the fixed effects algorithm, parallel computing, and 500 bootstrap runs (Liu, Wang and Xu, 2024).

5 Robustness Checks: Sensitivity Analysis

5.1 Particulate Matter

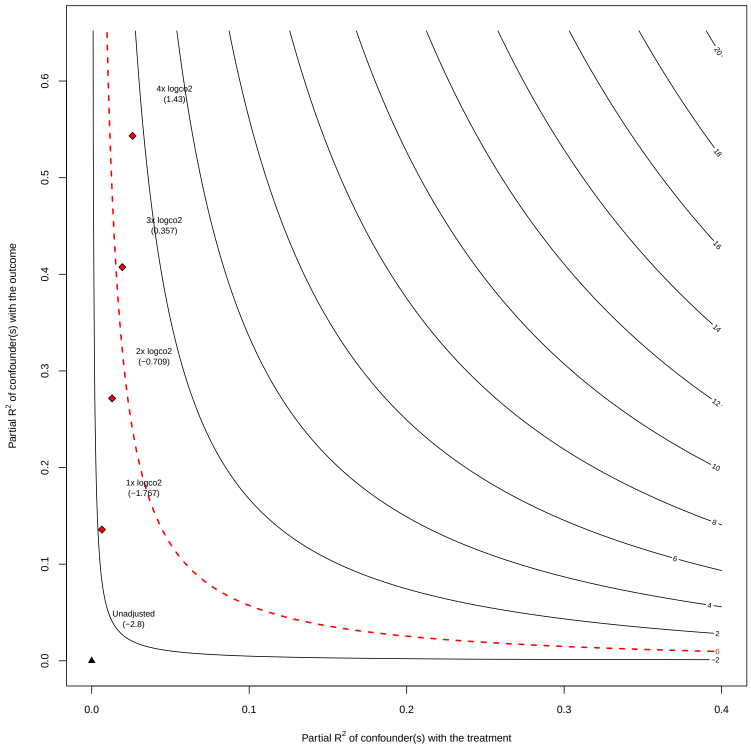

Figure S21:

Outcome: *Cases Attributable to* $PM_{2.5} per 100,000$

Treatment:	Est.	S.E.	t-value	$R^2_{Y\sim D\|\mathbf{X}}$	$RV_{q=1}$	$RV_{q=1,\alpha=0.05}$
Post-Coal Unit Retirement (50KM)	-2.818	0.127	-22.192	0.6%	7.7%	7%
df = 77384				*Bound (1x Log(CO_2))*: $R^2_{Y\sim Z\|\mathbf{X},D} = 13.6\%$, $R^2_{D\sim Z\|\mathbf{X}} = 0.6\%$		

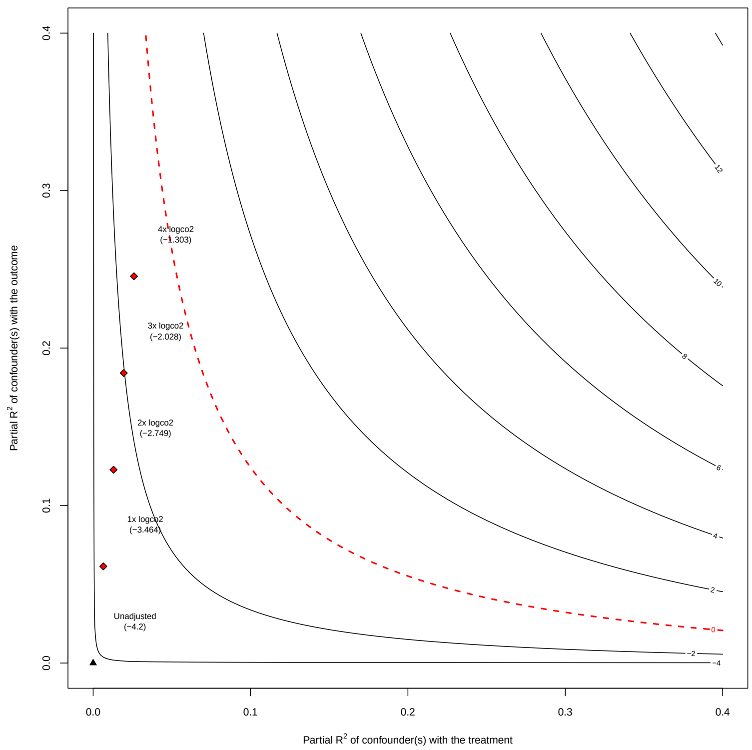

Figure S22:

Outcome: $PM_{2.5}$ *Emissions*

Treatment:	Est.	S.E.	t-value	$R^2_{Y\sim D\|\mathbf{X}}$	$RV_{q=1}$	$RV_{q=1,\alpha=0.05}$
Post-Coal Unit Retirement (50KM)	-4.176	0.128	-32.686	1.4%	11.1%	10.5%
df = 77384			*Bound (1x Log(CO_2))*: $R^2_{Y\sim Z\|\mathbf{X},D} = 6.1\%$, $R^2_{D\sim Z\|\mathbf{X}} = 0.6\%$			

5.2 Nitrogen Dioxide

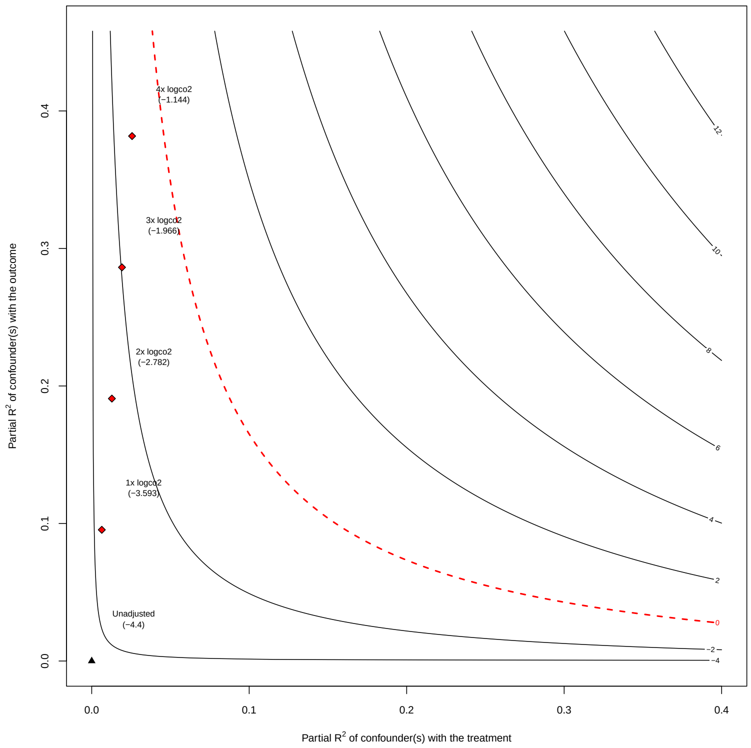

Figure S23:

Outcome: *Cases Attributable to NO_2 per 100,000*

Treatment:	Est.	S.E.	t-value	$R^2_{Y\sim D\|\mathbf{X}}$	$RV_{q=1}$	$RV_{q=1,\alpha=0.05}$
Post-Coal Unit Retirement (50KM)	-4.399	0.117	-37.723	1.8%	12.7%	12%
df = 77612			*Bound (1x Log(CO_2))*: $R^2_{Y\sim Z\|\mathbf{X},D} = 9.5\%$, $R^2_{D\sim Z\|\mathbf{X}} = 0.6\%$			

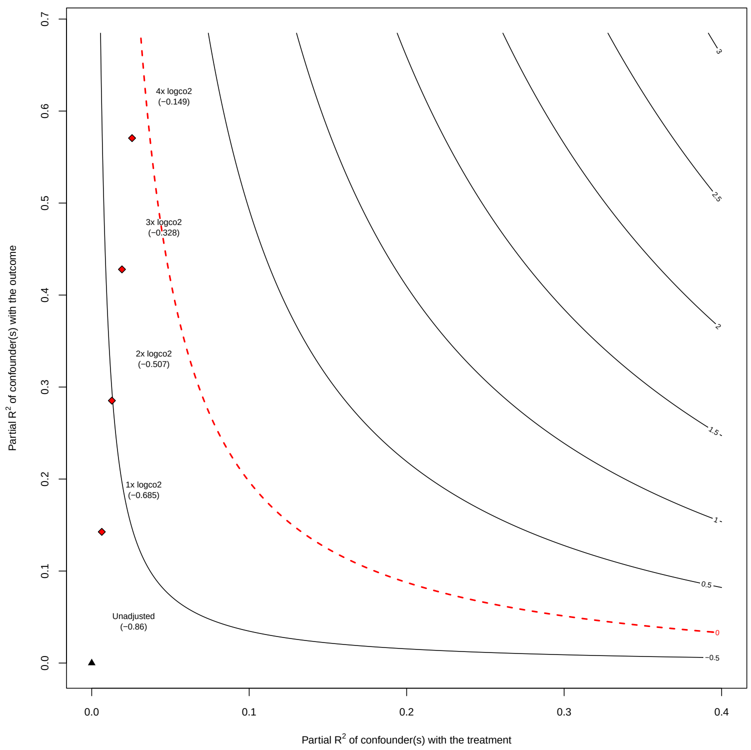

Figure S24:

Outcome: NO_2 *Emissions*

Treatment:	Est.	S.E.	t-value	$R^2_{Y\sim D\|\mathbf{X}}$	$RV_{q=1}$	$RV_{q=1,\alpha=0.05}$
Post-Coal Unit Retirement (50KM)	-0.861	0.021	-41.157	2.1%	13.7%	13.1%
df = 77308			*Bound (1x Log(CO_2))*: $R^2_{Y\sim Z\|\mathbf{X},D} = 14.3\%$, $R^2_{D\sim Z\|\mathbf{X}} = 0.6\%$			

6 Additional Figures

6.1 Maps of Fossil Fuel Infrastructure

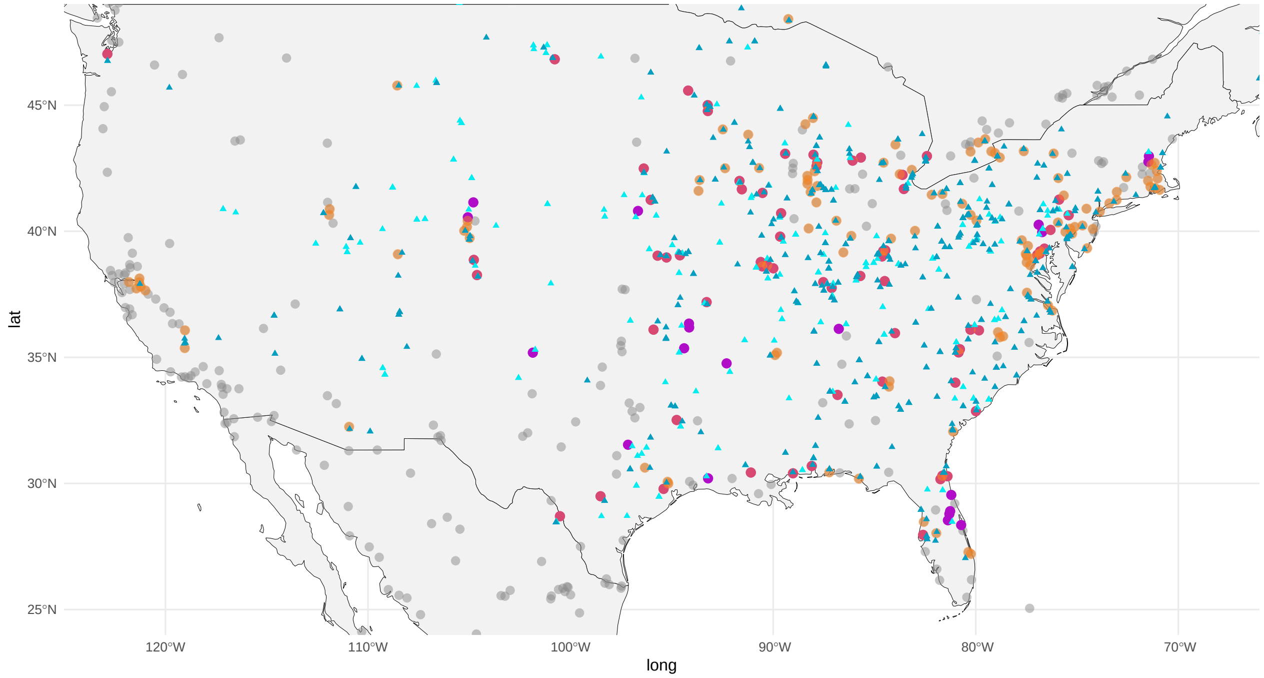

Figure S25: **Treated and Control Urban Areas**. The map above shows in light blue coal power plants operating or under construction, in dark blue coal power plants that retired during the period of analysis, in purple cities close to operating coal power plants, in orange cities close to retired coal power plants, and in pink cities close to both retired and operated coal power plants. The rest of cities (those farther away from coal power facilities) are shown in grey.

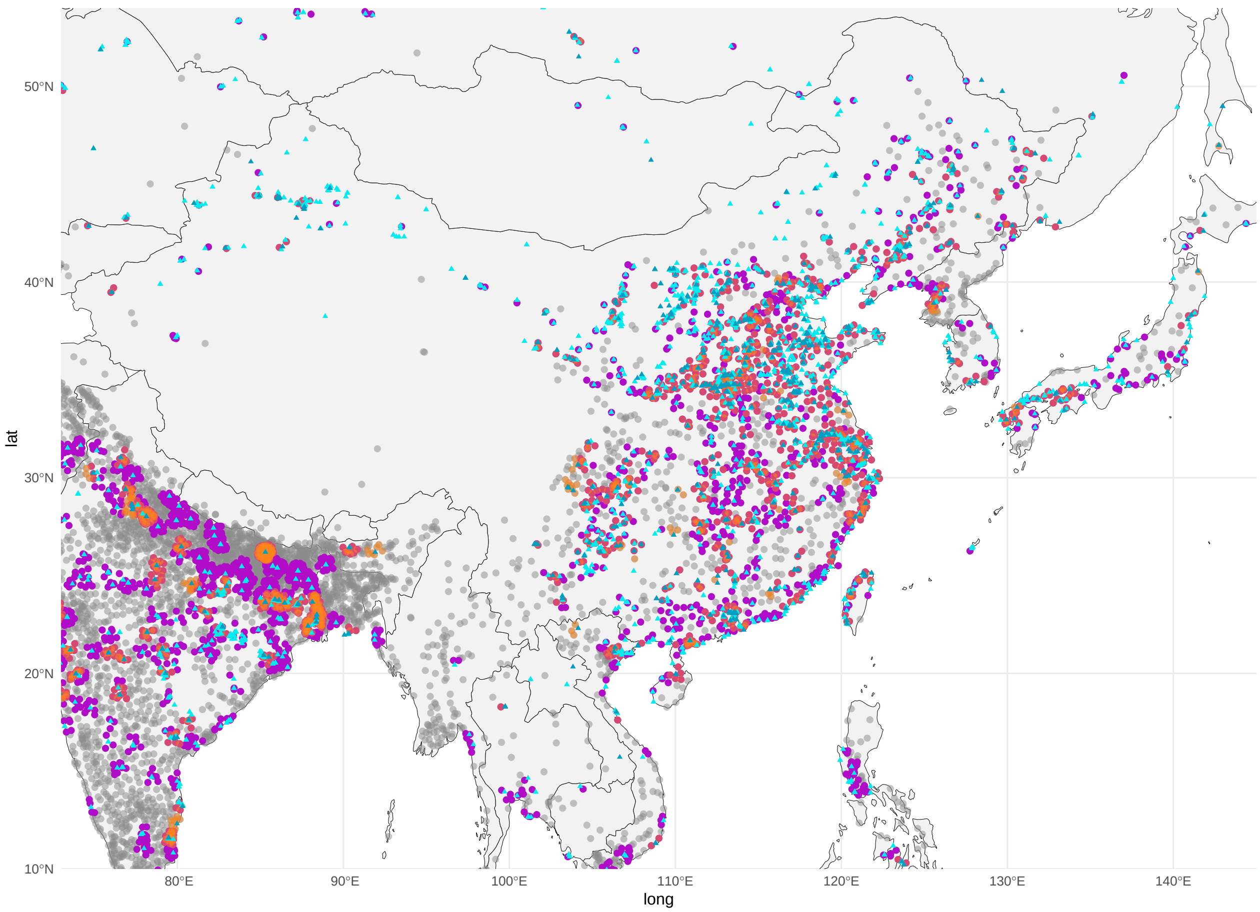

Figure S26: **Treated and Control Urban Areas**. The map above shows in light blue coal power plants operating or under construction, in dark blue coal power plants that retired during the period of analysis, in purple cities close to operating coal power plants, in orange cities close to retired coal power plants, and in pink cities close to both retired and operated coal power plants. The rest of cities (those farther away from coal power facilities) are shown in grey.

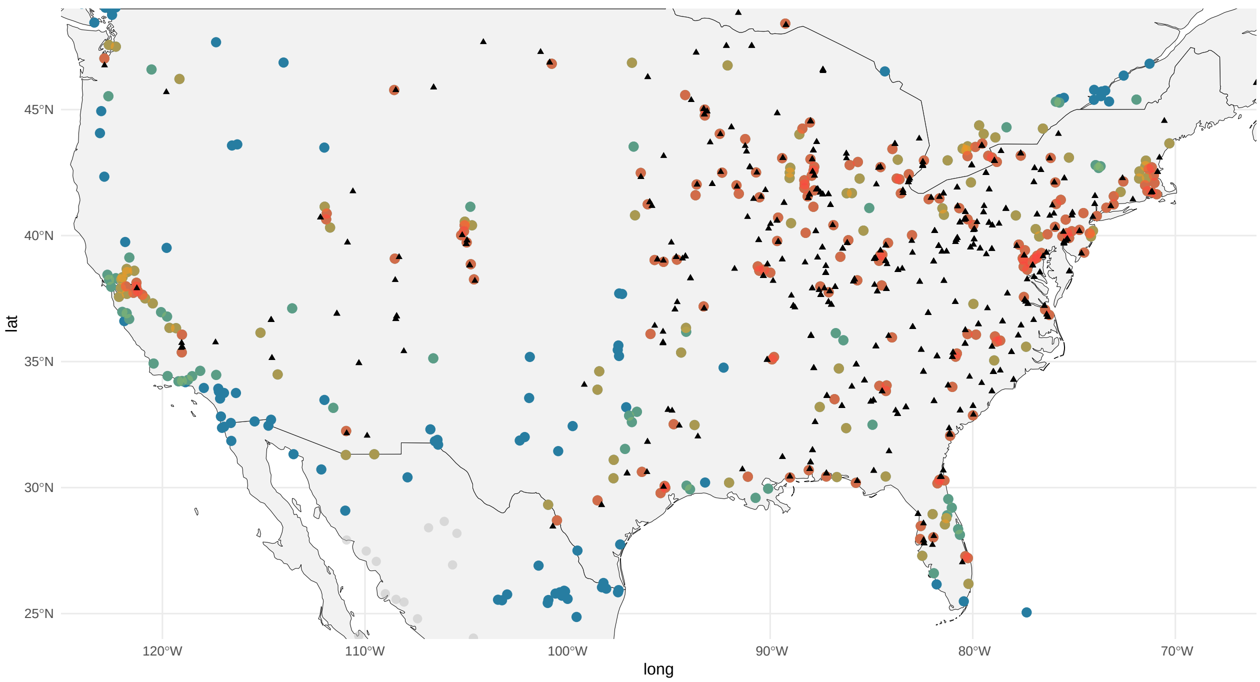

Figure S27: **North American Cities by Distance to Retired Coal Power Plants**. The map above shows in red cities within 50KM from a retired coal power unit, in orange cities within 100KM from a retired coal power unit, in green cities within 150 kilometers, and in blue cities within 450 kilometers. The rest of cities (more than 450 kilometers from a retired coal power plant) are shown in grey. Retired coal power plants are shown in black triangles.

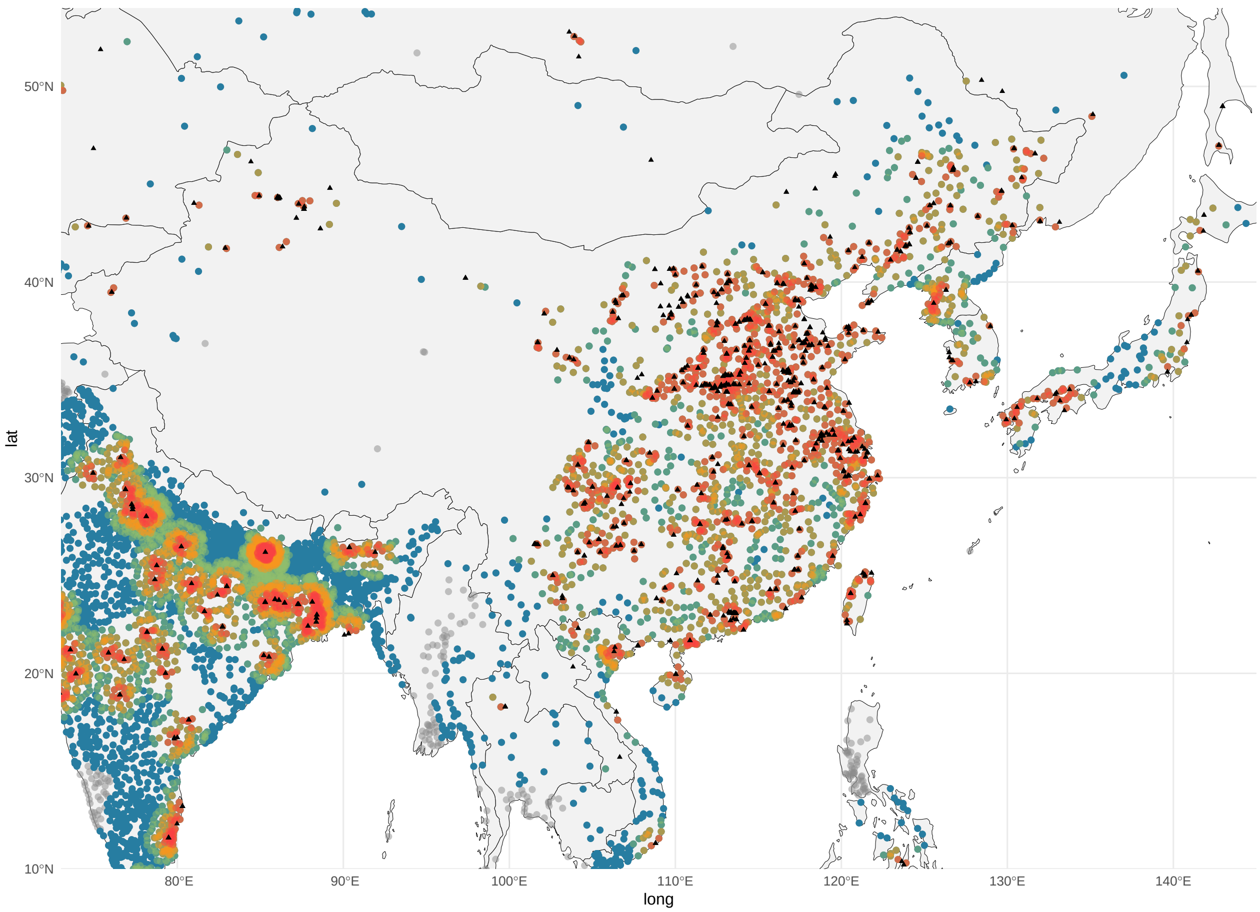

Figure S28: **East, South, and Southeast Asian Cities by Distance to Retired Coal Power Plants**. The map above shows in red cities within 50KM from a retired coal power unit, in orange cities within 100KM from a retired coal power unit, in green cities within 150 kilometers, and in blue cities within 450 kilometers. The rest of cities (more than 450 kilometers from a retired coal power plant) are shown in grey. Retired coal power plants are shown in black triangles.

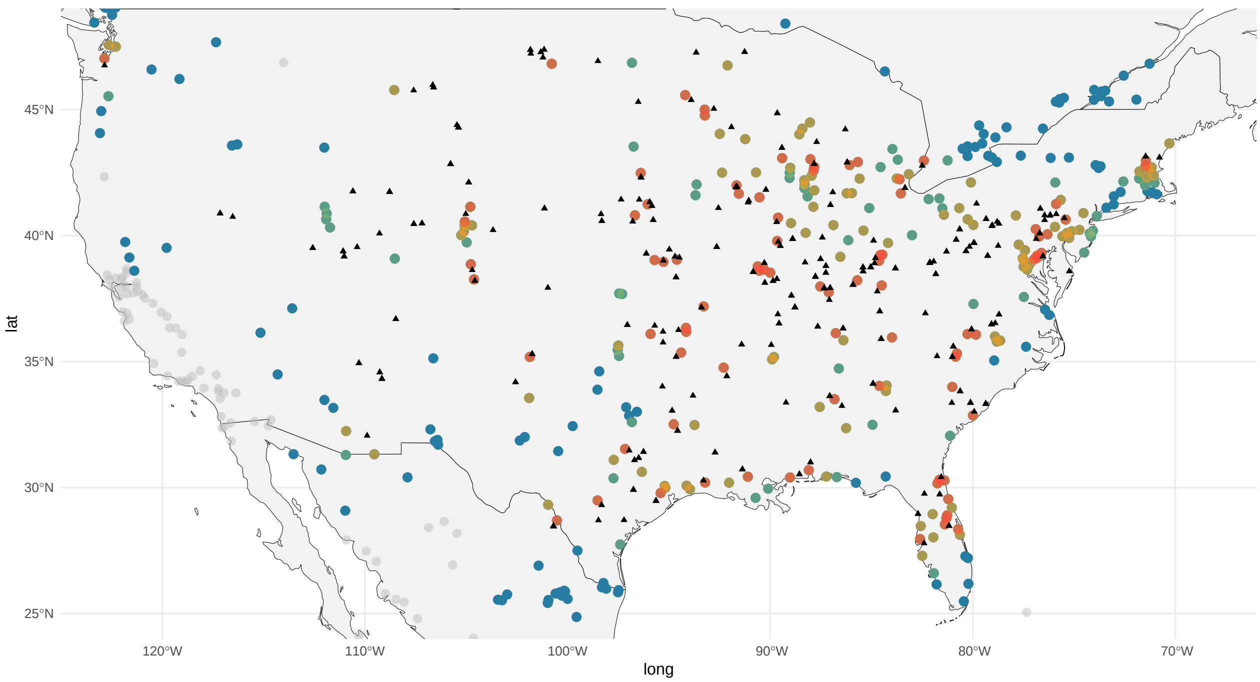

Figure S29: **North American Cities by Distance to Operating Coal Power Plants**. The map above shows in red cities within 50KM from an operating coal power unit, in orange cities within 100KM from an operating coal power unit, in green cities within 150 kilometers, and in blue cities within 450 kilometers. The rest of cities (more than 450 kilometers from an operating coal power plant) are shown in grey. Operating coal power plants are shown in black triangles.

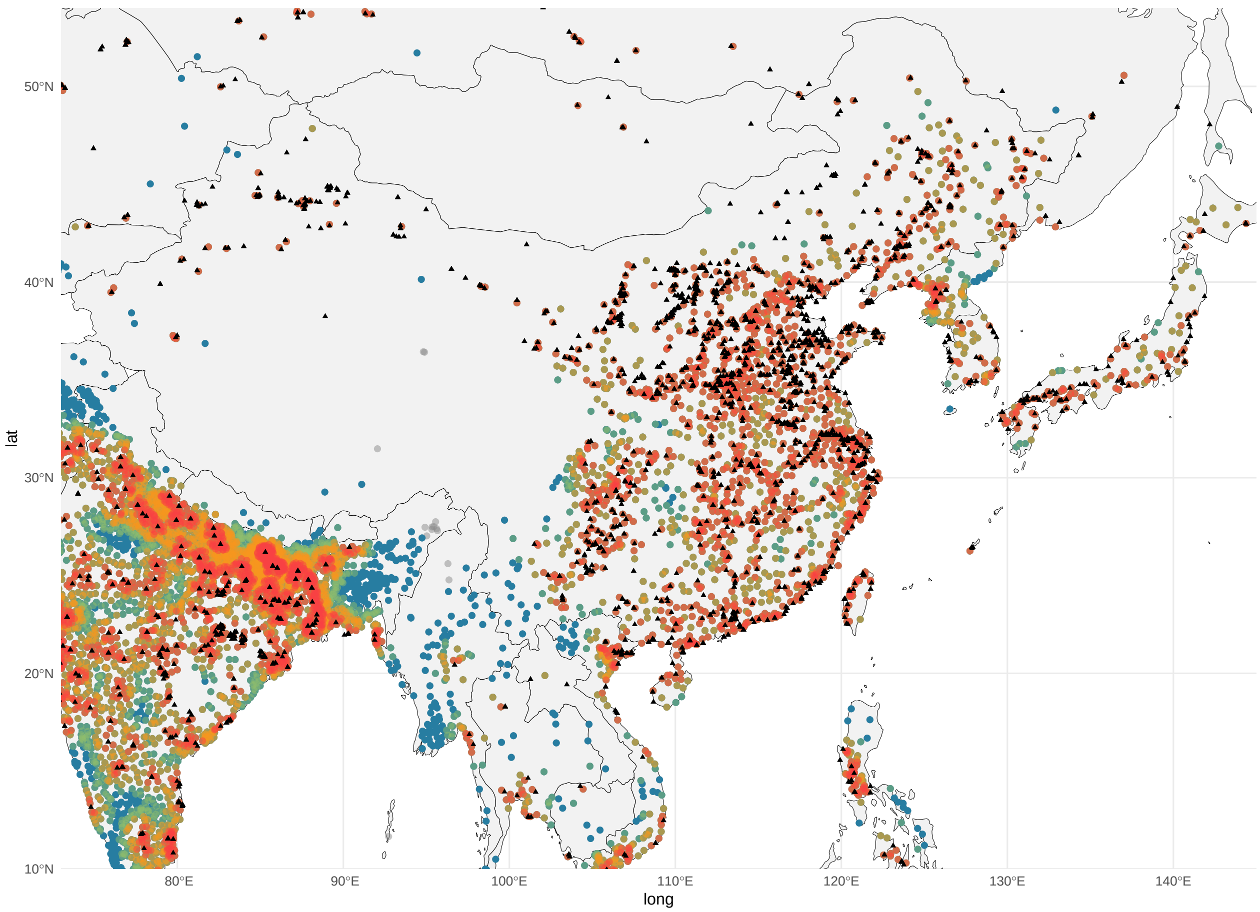

Figure S30: **East, South, and Southeast Asian Cities by Distance to Operating Coal Power Plants**. The map above shows in red cities within 50KM from an operating coal power unit, in orange cities within 100KM from an operating coal power unit, in green cities within 150 kilometers, and in blue cities within 450 kilometers. The rest of cities (more than 450 kilometers from an operating coal power plant) are shown in grey. Operating coal power plants are shown in black triangles.

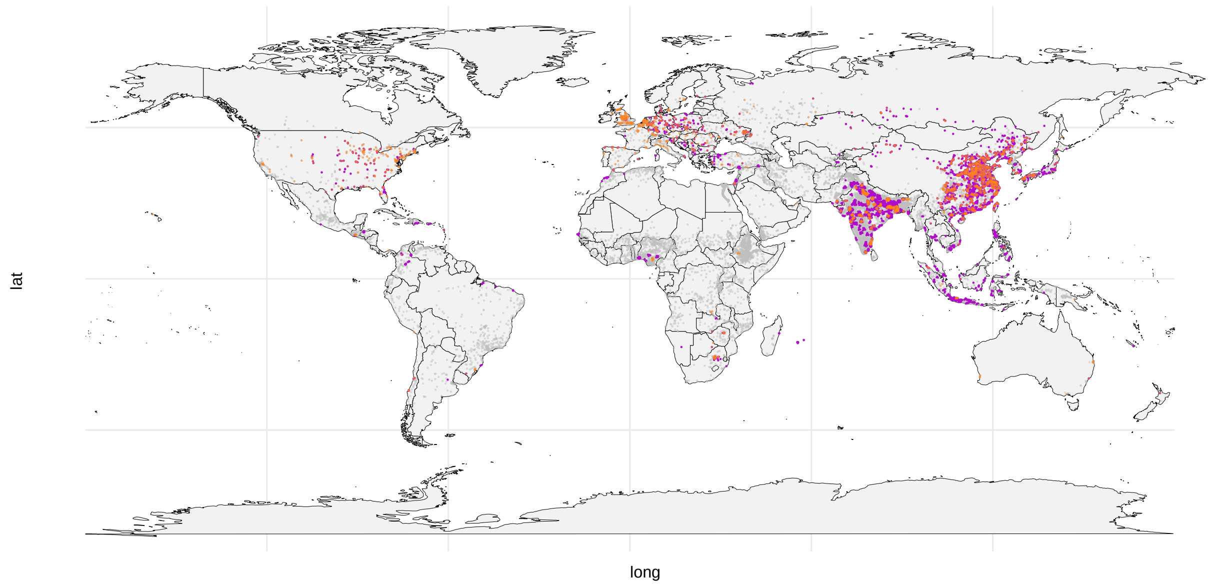

Figure S31: **Treated and Control Urban Areas (Global)**. The map above shows in purple cities close to operating coal power plants, in orange cities close to retired coal power plants, and in pink cities close to both retired and operated coal power plants. The rest of cities (those farther away from coal power facilities) are shown in grey.

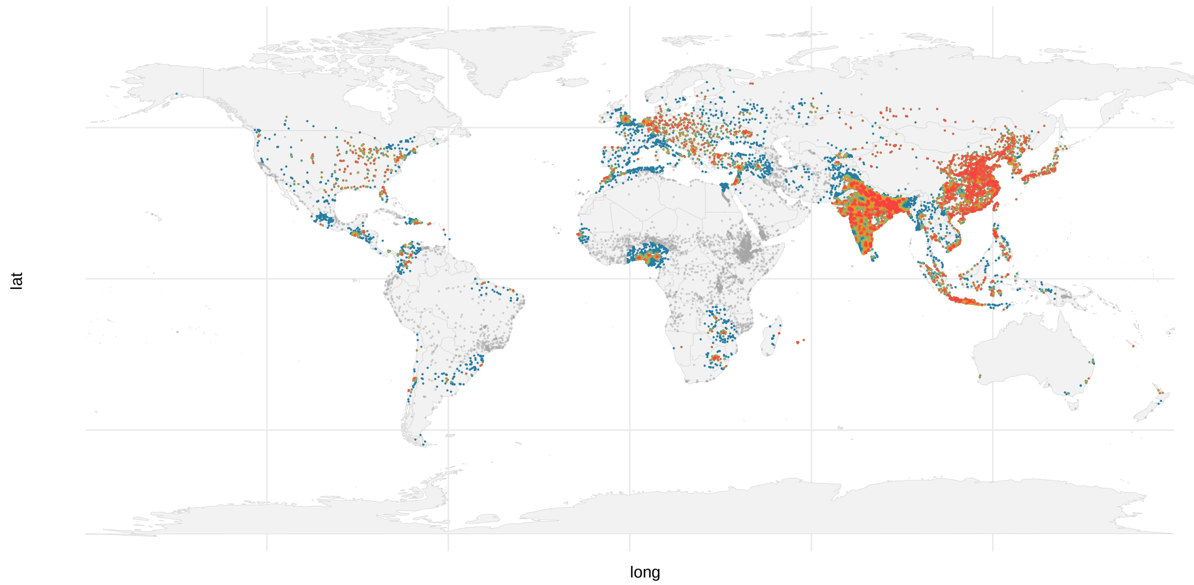

Figure S32: **World Cities by Distance to Operating Coal Power Plants**. The map above shows in red cities within 50KM from an operating coal power unit, in orange cities within 100KM from an operating coal power unit, in green cities within 150 kilometers, and in blue cities within 450 kilometers. The rest of cities (more than 450 kilometers from an operating coal power plant) are shown in grey.

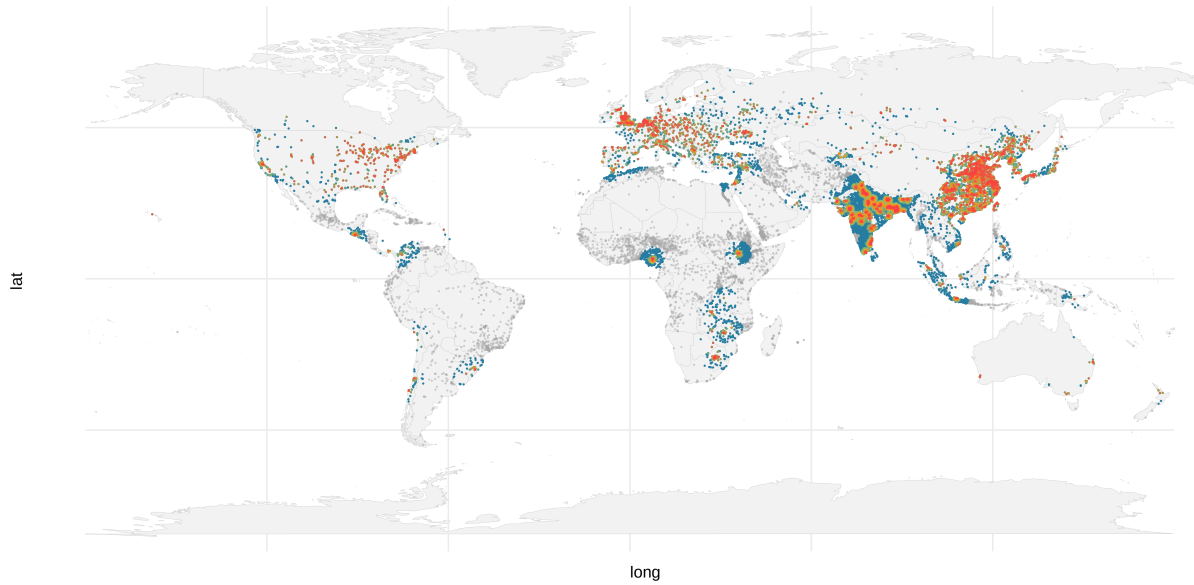

Figure S33: **World Cities by Distance to Retired Coal Power Plants**. The map above shows in red cities within 50KM from a retired coal power unit, in orange cities within 100KM from a retired coal power unit, in green cities within 150 kilometers, and in blue cities within 450 kilometers. The rest of cities (more than 450 kilometers from a retired coal power plant) are shown in grey.

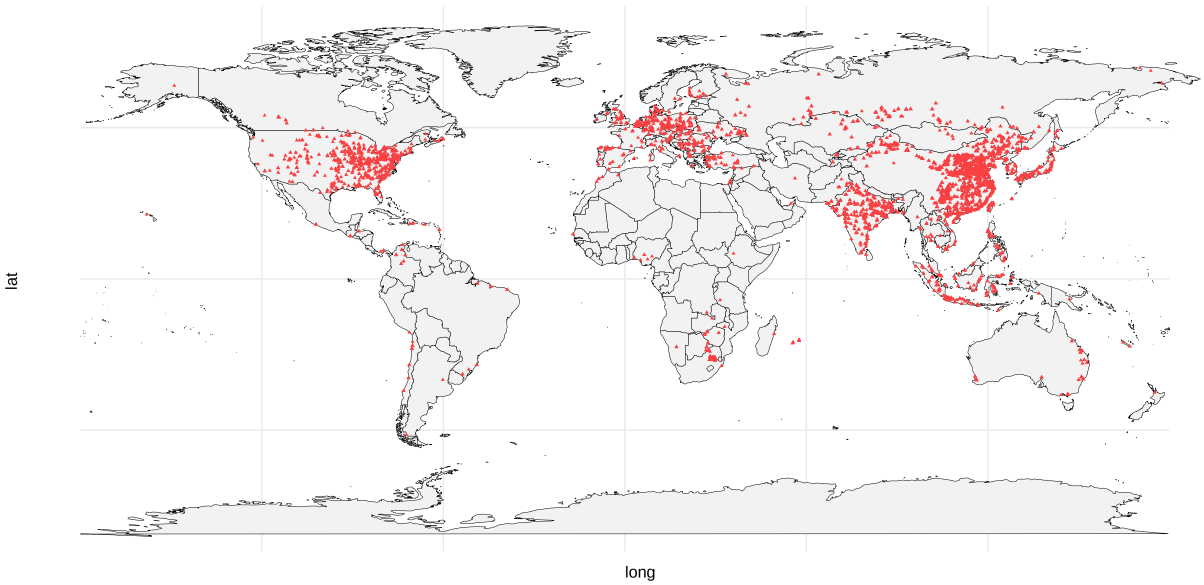

Figure S34: **Global Fleet of Coal Power Plants**. The map above shows all operating, in construction, retired, shelved, and mothballed coal power plants (*Global Coal Plant Tracker*, 2024).

6.2 Cities in Countries Experiencing Significant Macro-Level Institutional Change

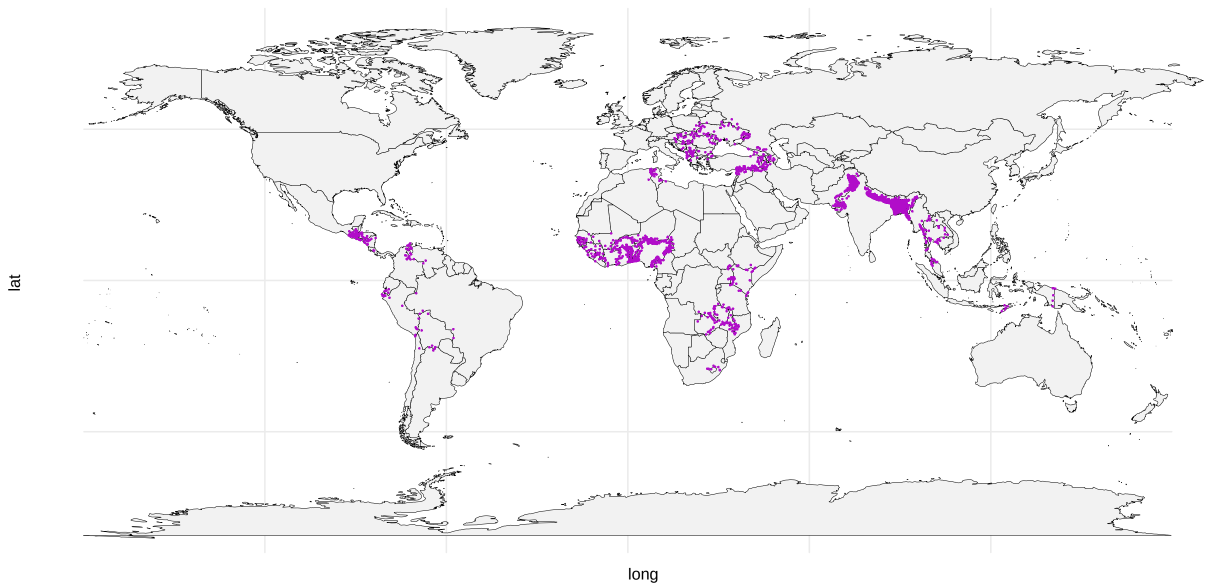

Figure S35: **Cities in Countries Experiencing Significant Macro-Level Institutional Change**, This version of the map employs version 1 as described in the main text.

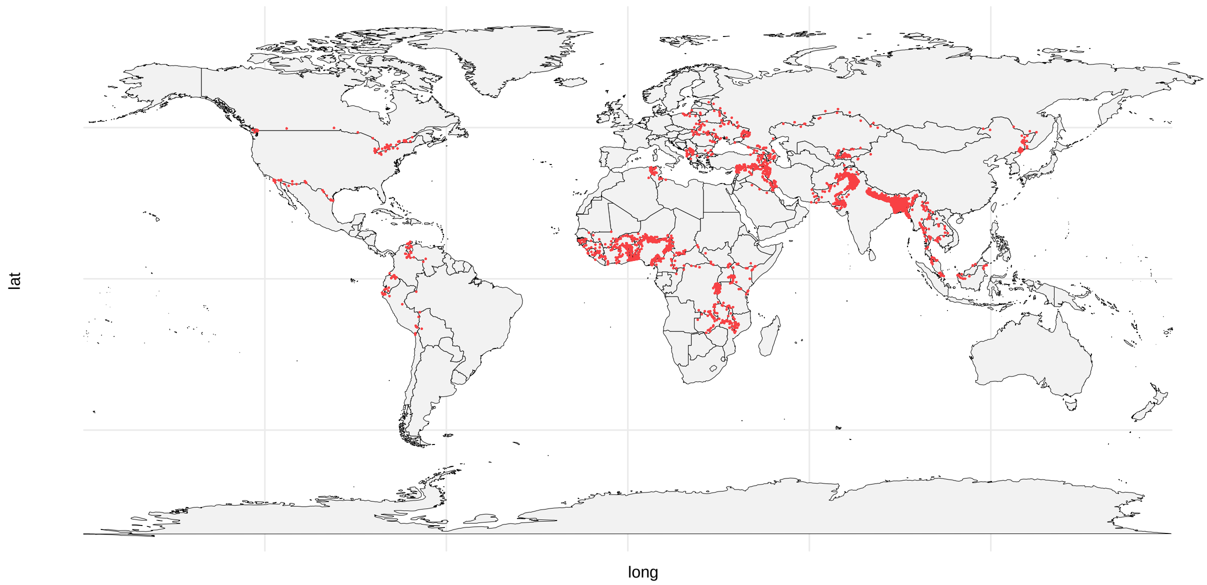

Figure S36: **Cities in Countries Experiencing Significant Macro-Level Institutional Change**. This version of the map employs version 2 as described in the main text.

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