The Impact of Germany's Coal Phase-Out on Local Property Values

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Motivation

- Energy transition central to achieving German climate goals as 34% of greenhouse gasses originated from the energy sector in 2022
- Coal-fired generation accounts for the largest share of carbon emissions within the energy sector
- Coal Phase-Out Act (*Kohleausstiegsgesetz*): complete phase out by 2038
- Coal plant closures represent regional economic shocks
- Decommissioning reduces externalities such as airborne pollution
- Local economic and environmental impacts capitalize into property values

This Paper

Research Question

How do coal-fired power plant closures impact local property values?

Identification:

- **Identification:** Spatial and temporal variations of coal-fired power plant closures between 2007 and 2023 in Germany
- **Two spatial variations:** Distance cut-offs and average wind direction at power plant locations

Preview of main findings:

- Negative impact on nearby house prices of around 9%
- Positive impact on downwind house prices of around 8%

Potential Channels

- Decline in municipal tax revenues (Reitzenstein et al. 2022; Oei, Brauers, et al. 2019)
  - Decline in local amenities, in particular cultural and leisure offerings
- Migration outflows (Oei, Hermann, et al. 2020; Heinisch, Holtemöller, and Schult 2021)
- Direct and indirect job loss (Heinisch, Holtemöller, and Schult 2021)
  - In 2018: 22,500 to 26,500 directly and 38,100 to 42,900 indirectly employed (Oei, Brauers, et al. 2019)
- Decline in real wages of affected workers (Haywood, Janser, and Koch 2024)
- Improved environmental and associated health outcomes (Oei, Brauers, et al. 2019), (Li and Jin 2024)
  - Airborne emissions: nitrogen oxide, ultra-fine particulate, mercury, and sulfur dioxide emissions
  - Respiratory illness, cardiovascular illness, and chronic effects on the nervous system

Impact on Property Values

Following the spatial equilibrium model by Rosen (1979) and Roback (1982), changes in regional earnings and amenities capitalize into property values.

- Decline in municipal tax revenues
- Migration outflows
- Direct and indirect job loss
- Decline in real wages of affected workers
+ Improved environmental and associated health outcomes

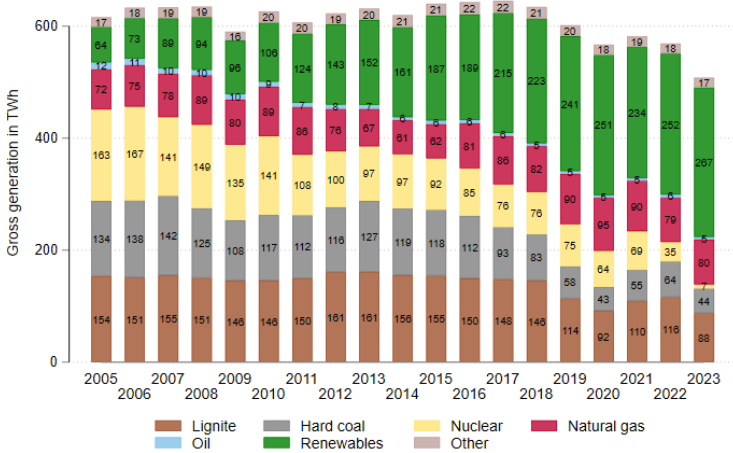
Literature on Coal Plant Closures and Housing Prices

Study	Location	Period	# closures	Emp. str.	Distance cut-off	Result	Attributed channel
Deng, Hernandez, and Xu (2020)	China	2005-2009	2	DID	5km	+13%	air quality
Mei et al. (2021)	China	2011-2015	3	DDD	1.5km	+4%	information
Rivera and Loveridge (2022)	US	2009-2018	14	DID	1.6km	+12%	air quality
Fraenkel, Zivin, and Krumholz (2022)	US	2005-2020	383 (units)	ES	24km	+5%	health risks
Caballero et al. (2023)	Germany	2008-2019	17	DID	2km	−7.8%	unemployment
Bauer, Braun, and Kvasnicka (2017)	Germany	2007-2013	Nuclear PP closures	DID	5km	−5%	local economic shocks
Eichholtz et al. (2023)	Netherlands	1985-2015	19	DID	2.5km	insignificant	

Institutional Background German Coal Phase-Out

- In 2023, the German energy sector reduced greenhouse emissions by 20.1% compared to 2022
- 69 coal generation unit closures between 2011 and 2023
- Coal Phase-Out Act (*Kohleausstiegsgesetz*) of 2020 regulates remaining closures until 2038 at the latest
  - Hard-coal plants: competitive tendering until 2027
  - Afterward, regulatory policy determines closures until 2038
  - Lignite-fired power plants: fixed closure road map until 2038
- Coal Regions Structural Strengthening Act of 2020 (*Strukturstärkungsgesetz Kohleregionen*) supports coal regions with 41 billion euros until 2038
  - Addressing a diverse set of areas ranging from education to health and culture
  - So far, focus on regional economic growth
  - Only small share of allocated budget disbursed (Brachert et al. 2025)

Gross electricity generation by generation type, Germany



Notes: Own depiction. The bar plot shows the total electricity generated in TWh by generation type. The amounts for 2023 are preliminary.
Sources: Original data from Destatis; BMWK; BDEW; ZSW; Statistik der Kohlenwirtschaft e.V.; AG Energiebilanzen and compiled by bdew

Real Estate Information

- House price data from Germany's leading online property broker (provided by *FDZ Ruhr*)
- Individual advertisements
- Location at km^2-grid-level
- Available sample period: 2007 to 2023
- Excluding properties with extraordinary characteristics

Summary Statistics Houses for Sale

	Mean	SD
Price (€)	309,403.90	276,955.26
Log price	12.45	0.59
Distance nearest coal plant (m)	4,943.88	1,927.77
Age	37.39	35.65
Living space (m^2)	153.12	58.25
# rooms	5.45	1.76
Base area (m^2)	576.06	439.16
Share in construction (%)	17.02	37.58
Share detached house (%)	39.82	48.95
Share multi-family home (%)	25.27	43.46
# observations	266,006	

Notes: The table includes all housing advertisements in the estimation sample of our proximity design (e.g., houses up to an eight km distance to treated plants).

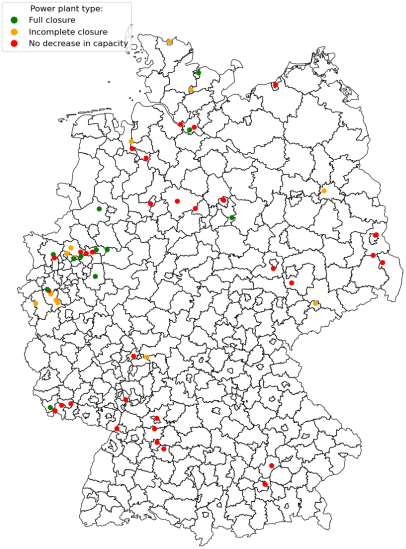
Coal-Fired Power Plants

- Individual electricity generation unit (EGU) data from
  1. Core energy market data register (*Marktstammdatenregister*)
  2. List of power plants by the federal network agency (*Kraftwerksliste der Bundesnetzagentur*)
- EGU point-locations given
- 25 of 57 coal-fired power plants close at least one unit within sample period

Summary Statistics Treated Power Plants

Power plant name	Max total cap. [GW]
Panel A. Fully Decommissioned Power Plants.	
KW Shamrock	132
Gemeinschaftskraftwerk Kiel	323
KW Gustav Knepper	345
KW Buschhaus	352
KW Ensdorf	389
KW Werdohl-Elverlingsen	692
KW Ibbenbüren	794
KW Moorburg	1,638
KW Westfalen	1,813
KW Frimmersdorf	2,008
KW Gersteinwerk	2,011
KW Voerde	2,030
Panel B. Partially Decommissioned Power Plants.	
KW Neumünster	34
KW Frechen	176
KW Chemnitz	238
KW Marl	250
KW Flensburg	269
HKW Reuter West	812
KW Herne	1,117
KW Knapsacker Hügel	1,532
KW Staudinger	1,644
KW Scholven	2,126
KW Wilhelmshaven	2,370
KW Weisweiler	2,619
KW Niederaußem	3,671

Coal-Fired Power Plant Locations

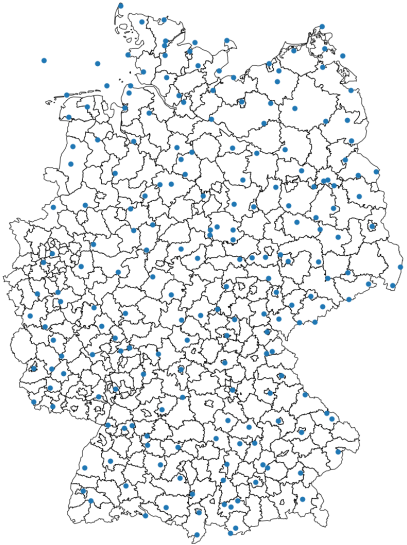


Notes: The figure shows the geographical distribution of coal-fired power plants.
Sources: Marktstammdatenregister, *Bundesnetzagentur*

Average Wind Direction

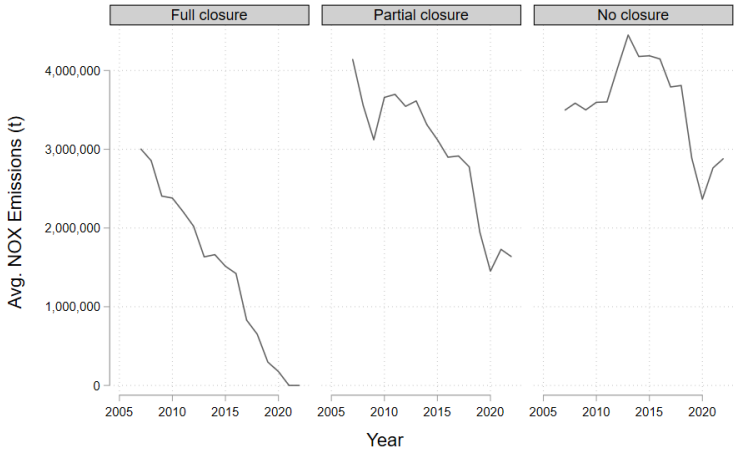
- Sub-daily (three times a day), station-level data of wind speed and wind direction
- Matching nearest weather station to power plant locations
- For calculating the average wind direction we follow Li and Jin (2024)

Weather Station Locations



Source: German National Meteorological Service (DWD)

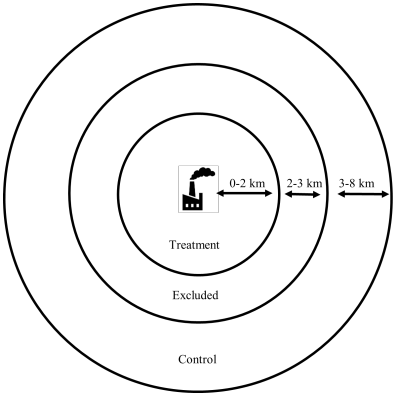
NO_x Emissions by power plant type



Notes: Own depiction based on Rivera and Loveridge (2022). Emissions data given at facility level.
Source: European Pollutant Release and Transfer Register (E-PRTR) (*thermal power stations and other combustion installations*), *Bundesnetzagentur*, *Marktstammdatenregister*

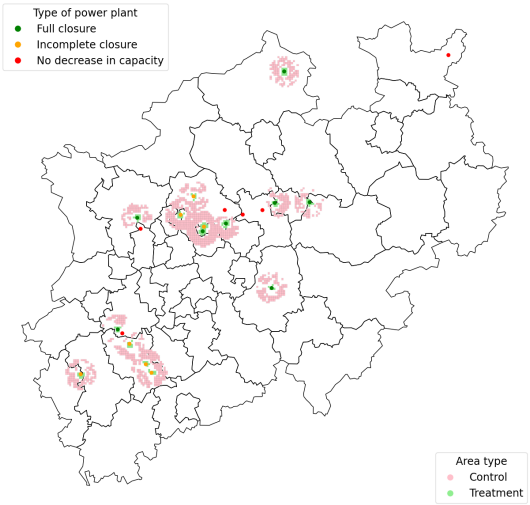
Proximity Difference-in-Differences Design

Schematic Representation of Treamtent and Control Areas



Notes: Own depiction based on Rivera and Loveridge (2022).

Exemplary Treatment and Control Areas in NRW - Proximity



Notes: Own depiction. Exemplary treatment and control areas in the German state of North Rhine-Westphalia. Blank spaces represent missing or omitted observations.
Sources: Marktstammdatenregister, Bundesnetzagentur

Empirical Model – Proximity Design

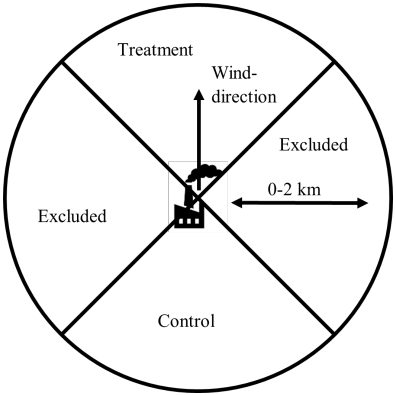
$$log(y_{ijt}) = \beta + \theta treat_{ijt} + \gamma near_{ijt} + X'_{ijt}\beta + \alpha_j + \delta_t + \epsilon_{ijt}, \quad (1)$$

where i refers to individual properties, j to the municipality and t to quarter-of-year.

- y_{ijt}: individual house price
- $treat_{ijt}$: within 0-2km $\times$ 1st unit closure
- $near_{ijt}$: within 0-2km
- X'_{ijt}: property characteristics
- α_j: municipality fixed effect
- δ_t: quarter-of-year fixed effect
- ϵ_{ijt}: standard errors clustered at the local labor market level

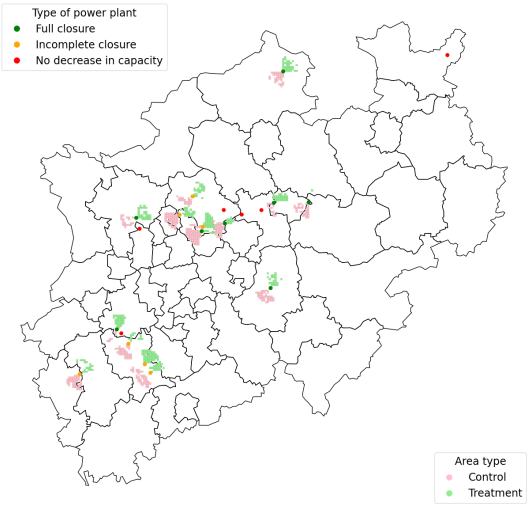
Wind Direction Difference-in-Differences Design

Figure: Schematic Representation of Treamtent and Control Areas



Notes: Own depiction based on Rivera and Loveridge (2022).

Exemplary Treatment and Control Areas in NRW - Wind Direction



Notes: Own depiction. Exemplary treatment and control areas in the German state of North Rhine-Westphalia. Blank spaces represent missing or omitted observations.
Sources: Marktstammdatenregister, Bundesnetzagentur

Empirical Model – Wind Direction Design

$$log(y_{ijt}) = \beta + \theta treat_{ijt} + \gamma downwind_{ijt} + X'_{ijt}\beta + \alpha_j + \delta_t + \epsilon_{ijt}, \quad (2)$$

where i refers to individual properties, j to the municipality and t to quarter-of-year.

- y_{ijt}: individual house price
- $treat_{ijt}$: downwind $\times$ 1st unit closure
- $downwind_{ijt}$: downwind
- X'_{ijt}: property characteristics
- α_j: municipality fixed effect
- δ_t: quarter-of-year fixed effect
- ϵ_{ijt}: standard errors clustered at the local labor market level

Robust Event Study Specification (Sun and Abraham 2021)

$$log(y_{ijt}) = \beta + \sum_{e \notin C} \sum_{l \neq -1} \theta^{e,l}(1\{E_{ij} = e\} \times treat^{l}_{ijt}) + \gamma area_{ijt} + X'_{ijt}\beta + \alpha_j + \delta_t + \epsilon_{ijt}, \quad (3)$$

- y_{ijt}: individual house price
- $treat_{ijt}$: treatment
- $area_{ijt}$: area dummy
- l: yearly leads and lags from -3 to 3 (omitting year before treatment)
- X'_{ijt}: property characteristics
- α_j: municipality fixed effect
- δ_t: quarter-of-year fixed effect

- Estimate cohort-specific ATT
- Cohort e represents houses treated in the same period
- Control group: never-treated units (e.g., located farther away or upwind)
- Reported ATT is a weighted average of cohort-specific effects, with weights based on cohort sample shares

Plausability of Identification Assumptions

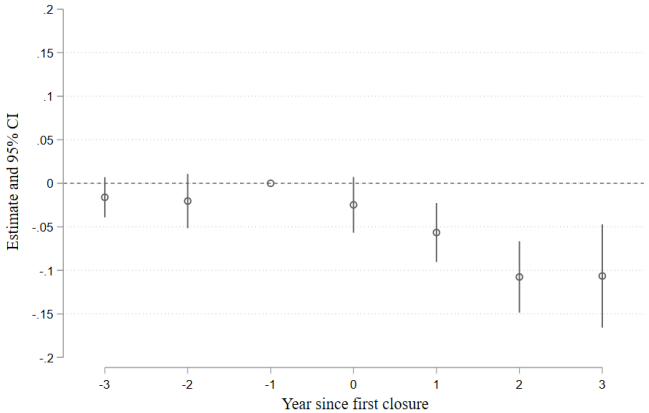
1. Parallel-trend assumption
   - Corroborate by investigation of pre-treatment differences in trends
2. No-anticipation assumption
   - Corroborate by omitting pre-treatment periods
3. No spillover assumption
   - Omit observations in buffer zone between treatment and control areas and robustness check for alternative distances in treatment area specification

Coal Plant Closure Effect on Property Prices

	Log house prices
Panel A. Proximity Specification	
Within 0-2km × 1st unit closure	-0.0899***
	(0.0297)
N	183,200
R^2	0.658
Panel B. Wind direction Specification	
Downwind × 1st unit closure	0.0846***
	(0.0191)
N	7,794
R^2	0.660

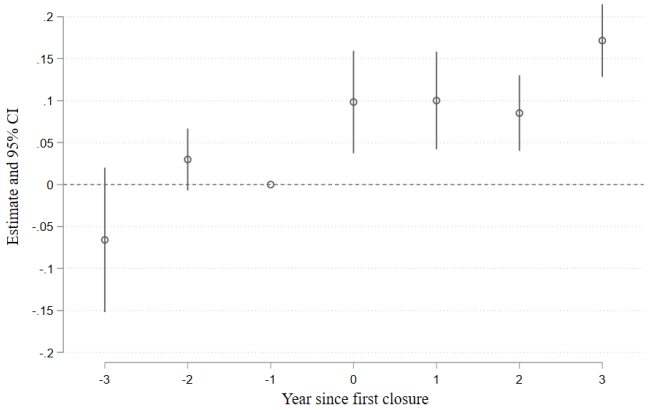
Notes: The independent variable for both specifications is the log of individual house prices. The estimation sample for the proximity specification includes advertised houses located within a zero to two-kilometer distance from treated coal-fired power plants and between a distance of three to eight kilometers. The estimation sample for the wind direction specification includes advertised houses located upwind or downwind of treated coal-fired power plants up to a distance of two kilometers. Both estimations include individual housing characteristics as covariates. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Dynamic Effects - Proximity Design



Notes: The figure shows dynamic average treatment effects of a robust dynamic DID estimation following Sun and Abraham (2021). The models define the treatment area as within a zero to two km distance of coal-fired power plants. The models include municipality and quarter-of-year fixed effects and cluster standard errors at the regional labor market level. We omit the coefficient right before the treatment.

Dynamic Effects - Wind Direction Design



Notes: The figure shows dynamic average treatment effects of a robust dynamic DID estimation following Sun and Abraham (2021). The models define the treatment area to lie downwind of coal-fired power plants. The models include municipality and quarter-of-year fixed effects and cluster standard errors at the regional labor market level. We omit the coefficient right before the treatment.

Corroborate No-Anticipation Assumption

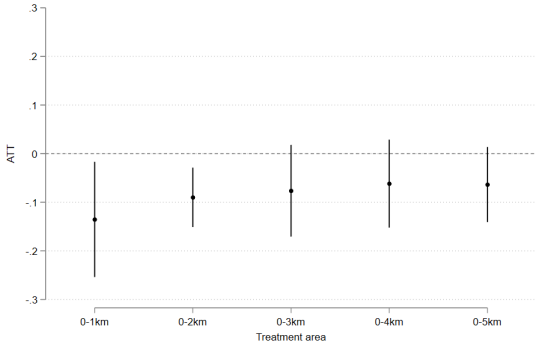
Omitting two years prior and the year of treatment:

	Log house prices
Panel A. Proximity Specification	
Within 0-2km × 1st unit closure=1	-0.1062***
	(0.0322)
N	149,257
R^2	0.658
Panel B. Wind Direction Specification	
Downwind × 1st unit closure=1	0.0728**
	(0.0274)
N	6,380
R^2	0.670

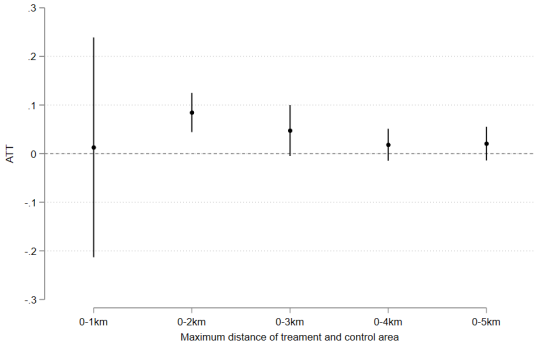
Notes: The independent variable for both specifications is the log of individual house prices. The estimation sample for the proximity specification includes advertised houses located within a zero to two-kilometer distance from treated coal-fired power plants and between a distance of three to eight kilometers. The estimation sample for the wind direction specification includes advertised houses located upwind or downwind of treated coal-fired power plants up to a distance of two kilometers. Both estimations include individual housing characteristics as covariates. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Average Treatment Effects with Increasing Distances

(a) Proximity Design



(b) Wind Direction Design



Notes: Each coefficient corresponds to treatment effects of increasing treatment area specifications in an otherwise identical model. For the proximity design, the control group remains between the one km buffer zone around the treatment area and an eight km distance. Confidence intervals represent significance at the five percent level.

Robustness

Dimensions of heterogeneity:

- Power plant characteristics
  - Power plant type (fully closing vs partially closing) part full results
  - Power plant type (hard-coal vs. lignite) pp type results
  - Power plant size pp size results
- Housing characteristics
  - Housing type (detached vs. attached) house type results
  - Living area house size results
  - House price house price results
  - Housing age house age results

Across investigated dimensions of potential heterogeneity, we find consistent effect signs.

Overall Loss in Housing Value

Table: Back-of-the-Envelope Calculation

Sample	Number of houses	ATT (%)	Mean price (€) (observed)	Individual price difference (€)	Overall price difference (billion €)
All houses within 2km distance	68,542	–9	397,155	–39,280	–2.69
Excluding downwind houses	52,815	–12	383,190	–52,253	–2.76

Notes: Prices and number of houses obtained from 2021 observations (available year for GRID dataset). We include all residential houses within two kilometers of treated coal-fired power plants.

Results omitting wind direction

Conclusion

- We find an 8.99% decrease in housing prices following coal-fired power plant closures close to plants
- We find an 8.46% increase in housing prices following coal-fired power plant closures located downwind of plants
- Support of negative economic and mitigating positive environmental channel
- Contributing to the literature on adverse impacts on local property values from the energy transition in Germany
- Ultra-fine particulate, mercury emissions, and sulfur dioxide emissions are not part of the emissions trading system or the energy tax.
- Substantial loss in property value should be taken into account for regional support measures

Bibliography I

- Bauer, T. K., S. T. Braun, et al. (May 2017). "Nuclear power plant closures and local housing values: Evidence from Fukushima and the German housing market". In: *Journal of Urban Economics* 99, pp. 94–106. ISSN: 0094-1190. DOI: 10.1016/j.jue.2017.02.002. URL: https://www.sciencedirect.com/science/article/pii/S0094119017300074 (visited on 10/25/2023).
- Brachert, M., K. Heinisch, et al. (2025). "Begleitende Evaluierung des Investitionsgesetzes Kohleregionen (InvKG) und des STARK-Bundesprogramms. Zweiter Zwischenbericht vom 31.10.2024". In: *IWH Studies* 1/2025. DOI: https://doi.org/10.18717/pngrt7-xv77.
- Caballero, N., M. Frondel, et al. (Nov. 2023). *Local Costs and Benefits of Power Installations: Hedonic Evidence from Germany*. en. SSRN Scholarly Paper. Rochester, NY. DOI: 10.2139/ssrn.4699812. URL: https://papers.ssrn.com/abstract=4699812 (visited on 05/22/2024).

Bibliography II

- Deng, G., M. A. Hernandez, et al. (Dec. 2020). "When Power Plants Leave Town: Environmental Quality and the Housing Market in China". en. In: *Environmental and Resource Economics* 77.4, pp. 751–780. ISSN: 1573-1502. DOI: 10.1007/s10640-020-00517-x. URL: https://doi.org/10.1007/s10640-020-00517-x (visited on 04/23/2024).
- Eichholtz, P., N. Kok, et al. (May 2023). "Clean Electricity, Dirty Electricity: The Effect on Local House Prices". en. In: *The Journal of Real Estate Finance and Economics* 66.4, pp. 743–777. ISSN: 1573-045X. DOI: 10.1007/s11146-021-09878-6. URL: https://doi.org/10.1007/s11146-021-09878-6 (visited on 08/01/2024).
- Fraenkel, R., J. S. G. Zivin, et al. (2022). *The Coal Transition and Its Implications for Health and Housing Values*. Tech. rep. National Bureau of Economic Research. URL: https://www.nber.org/papers/w30801 (visited on 11/17/2023).

Bibliography III

- Haywood, L., M. Janser, et al. (May 2024). "The Welfare Costs of Job Loss and Decarbonization: Evidence from Germany's Coal Phaseout". In: *Journal of the Association of Environmental and Resource Economists* 11.3. Publisher: The University of Chicago Press, pp. 577–611. ISSN: 2333-5955. DOI: 10.1086/726425. URL: https://www.journals.uchicago.edu/doi/full/10.1086/726425 (visited on 07/17/2024).
- Heinisch, K., O. Holtemöller, et al. (Mar. 1, 2021). "Power generation and structural change: Quantifying economic effects of the coal phase-out in Germany". In: *Energy Economics* 95, p. 105008. ISSN: 0140-9883. DOI: 10.1016/j.eneco.2020.105008. URL: https://www.sciencedirect.com/science/article/pii/S0140988320303480 (visited on 10/24/2024).

Bibliography IV

- Li, Z. and B. Jin (Jan. 2024). "A breath of fresh air: Coal power plant closures and health in China". In: *Energy Economics* 129, p. 107235. ISSN: 0140-9883. DOI: 10.1016/j.eneco.2023.107235. URL: https://www.sciencedirect.com/science/article/pii/S0140988323007338 (visited on 04/24/2024).
- Mei, Y., L. Gao, et al. (Oct. 2021). "Do homeowners benefit when coal-fired power plants switch to natural gas? Evidence from Beijing, China". In: *Journal of Environmental Economics and Management* 110, p. 102566. ISSN: 0095-0696. DOI: 10.1016/j.jeem.2021.102566. URL: https://www.sciencedirect.com/science/article/pii/S0095069621001169 (visited on 04/24/2024).
- Oei, P.-Y., H. Brauers, et al. (Mar. 2019). *Phasing out Coal in the German Energy Sector*. Energy Economics. URL: https://www.ecologic.eu/15989 (visited on 08/16/2024).

Bibliography V

- Oei, P.-Y., H. Hermann, et al. (2020). "Coal phase-out in Germany – Implications and policies for affected regions". In: *Energy* 196. ISSN: 0360-5442. DOI: 10.1016/j.energy.2020.117004. URL: https://www.sciencedirect.com/science/article/pii/S0360544220301110 (visited on 08/16/2024).
- Reitzenstein, A., R. Popp, et al. (2022). *Structural change in coal regions as a process of economic and social-ecological transition – Lessons learned from structural change processes in Germany*. 33/2021. URL: https://www.umweltbundesamt.de/publikationen/structural-change-in-coal-regions-as-a-process-of (visited on 10/12/2024).
- Rivera, N. M. and S. Loveridge (2022). "Coal-to-gas fuel switching and its effects on housing prices". In: *Energy Economics* 106, p. 105733. ISSN: 0140-9883. DOI: https://doi.org/10.1016/j.eneco.2021.105733. URL: https://www.sciencedirect.com/science/article/pii/S0140988321005818.

Bibliography VI

- Roback, J. (1982). "Wages, rents, and the quality of life". In: *Journal of political Economy* 90.6, pp. 1257–1278.
- Rosen, S. (1979). "Wage-based indexes of urban, quality of life". In: *Current issues in urban economics*. Current issues in urban economics. - Baltimore [u.a.] : Johns Hopkins Univ. Pr., ISBN 0-8018-2184-3 . - 1979, S. 74-104.
- Sun, L. and S. Abraham (Dec. 2021). "Estimating dynamic treatment effects in event studies with heterogeneous treatment effects". In: *Journal of Econometrics*. Themed Issue: Treatment Effect 1 225.2, pp. 175–199. ISSN: 0304-4076. DOI: 10.1016/j.jeconom.2020.09.006. URL: https://www.sciencedirect.com/science/article/pii/S030440762030378X (visited on 06/27/2024).

Appendix

Effects by Power Plant and Property Characteristics

Table: Regression Results - Binary Sample Splits

	Housing characteristics		Power plant characteristics					
	Detached	Attached	Capacity below 1000 MW	Capacity above 1000 MW	Lignite	Hard coal	Partial closures	Full closures
A: Proximity								
Treatment	-0.0937***	-0.0864**	-0.1024**	-0.0561	-0.1029***	-0.0768*	-0.1009**	-0.0871**
	(0.0324)	(0.0312)	(0.0423)	(0.0371)	(0.0257)	(0.0386)	(0.0413)	(0.0386)
N	71,169	112,027	118,138	65,061	56,061	127,139	116,059	67,139
R^2	0.674	0.641	0.654	0.672	0.705	0.636	0.675	0.615
B: Wind								
Treatment	0.1274***	0.0475*	0.0652*	0.1392**	0.1400**	0.0719**	0.0881***	0.0727**
	(0.0403)	(0.0242)	(0.0336)	(0.0440)	(0.0461)	(0.0303)	(0.0130)	(0.0271)
N	2,994	4,796	5,475	2,315	2,317	5,470	4,671	3,118
R^2	0.643	0.692	0.648	0.718	0.691	0.658	0.699	0.626

Notes: The independent variable for all specifications is the log of individual house prices. The estimation sample for the proximity specification includes advertised houses located within a zero to two-kilometer distance from treated coal-fired power plants and between a distance of three to eight kilometers. The estimation sample for the wind direction specification includes advertised houses located upwind or downwind of treated coal-fired power plants up to a distance of two kilometers. The table splits the sample into power plant characteristics and housing characteristics. Full closures refer to power plants that decommission their entire net installed capacity across the sample period. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Heterogeneity Analysis - Power Plant Type (fully vs partially closing)

	Partial closures Log house prices	Full closures Log house prices
Panel A. Proximity specification		
Within 0-2km × 1st unit closure	-0.1009** (0.0413)	-0.0871** (0.0386)
N	116,059	67,139
R^2	0.675	0.615
Panel B. Wind direction specification		
Downwind × 1st unit closure	0.0881*** (0.0130)	0.0727** (0.0271)
N	4,671	3,118
R^2	0.699	0.626

Notes: The table splits the sample to power plants that decomissioned only parts of their capacity during the sample period and power plants that fully shut down. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

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Heterogeneity Analysis - Power Plant Type

	Lignite Log house prices	Hard Coal Log house prices
Panel A. Proximity specification		
Within 0-2km × 1st unit closure	-0.1029***	-0.0768*
	(0.0257)	(0.0386)
N	56,061	127,139
R^2	0.705	0.636
Panel B. Wind direction specification		
Downwind × 1st unit closure	0.1400**	0.0719**
	(0.0461)	(0.0303)
N	2,317	5,470
R^2	0.691	0.658

Notes: The table splits the sample to power plants that use lignite and hard coal as primary input fuel. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

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Heterogeneity Analysis - Power Plant Size

	Capacity below 1000 MW Log house prices	Capacity above 1000 MW Log house prices
Panel A. Proximity specification		
Within 0-2km × 1st unit closure	-0.1024** (0.0423)	-0.0561 (0.0371)
N	118,138	65,061
R^2	0.654	0.672
Panel B. Wind direction specification		
Downwind × 1st unit closure	0.0652* (0.0336)	0.1392** (0.0440)
N	5,475	2,315
R^2	0.648	0.718

Notes: The table splits the sample by the size of power plants. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

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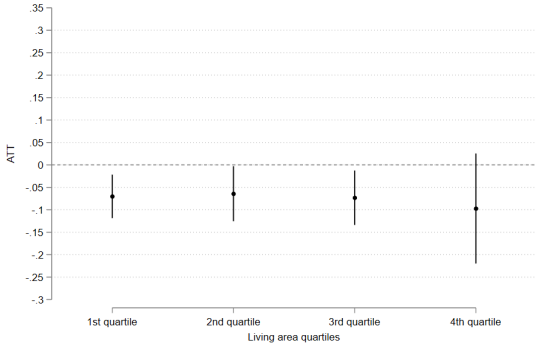
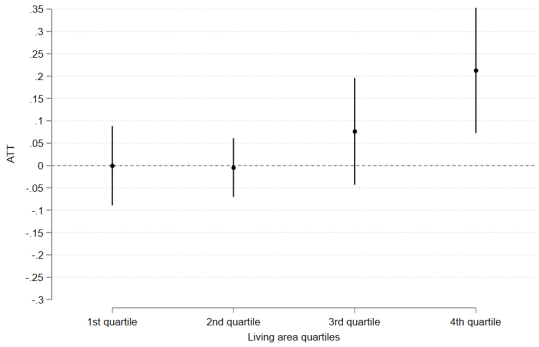
Heterogeneity Analysis - Property Size

(a) Proximity Design



(b) Wind Direction Design



Notes: The figure shows the ATT estimates corresponding to our main static specification with the sample split into quartiles according to property size.

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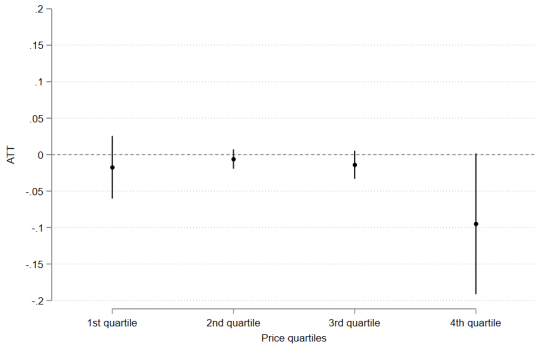
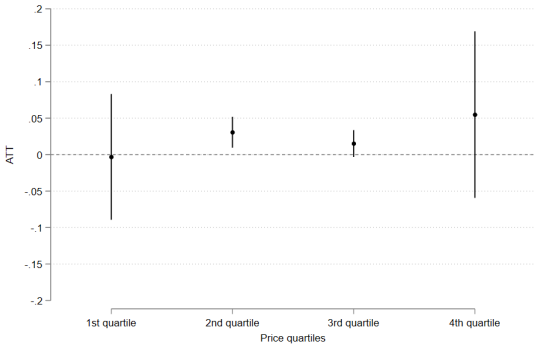
Heterogeneity Analysis - Property Price

(a) Proximity Design



(b) Wind Direction Design



Notes: The figure shows the ATT estimates corresponding to our main static specification with the sample split into quartiles according to property price.

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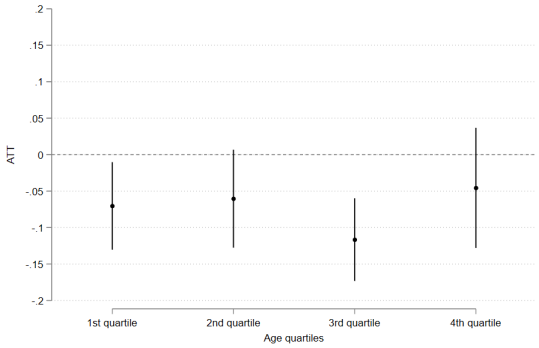
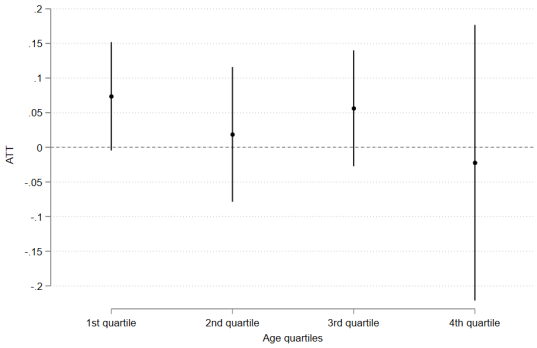
Heterogeneity Analysis - Property Age

(a) Proximity Design



(b) Wind Direction Design



Notes: The figure shows the ATT estimates corresponding to our main static specification with the sample split into quartiles according to property age.

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Heterogeneity Analysis - Property Type

	Detached Log house prices	Non-detached Log house prices
Panel A. Proximity specification		
Within 0-2km × 1st unit closure	-0.0937*** (0.0324)	-0.0864** (0.0312)
N	71,169	112,027
R^2	0.674	0.641
Panel B. Wind direction specification		
treat	0.1274*** (0.0403)	0.0475* (0.0242)
N	2,994	4,796
R^2	0.643	0.692

Notes: The table splits the sample by property type. Clustered standard errors at the local labor market level are in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

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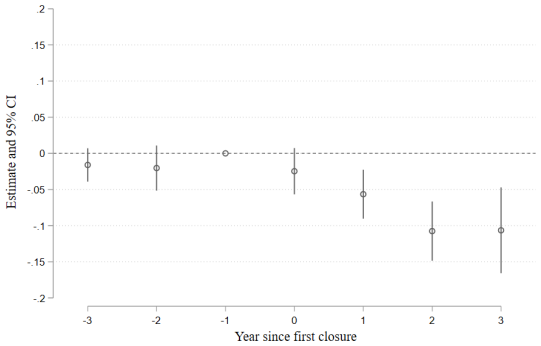
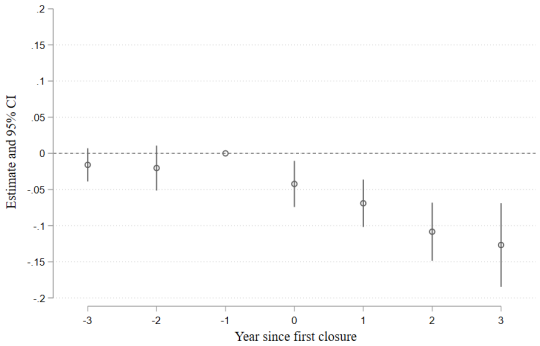
Heterogeneity Analysis - Omitting Properties in Wind Direction

(a) Main Specification



(b) Omitting Properties in Wind Direction



Notes: The figure shows the ATT estimates corresponding to our main static specification. In (b) we omit all properties located in wind direction of treated power plants and within a 2 km radius.

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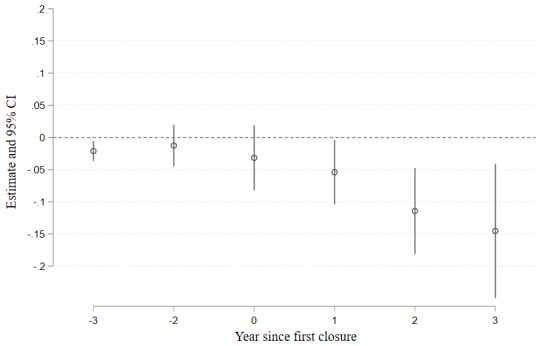
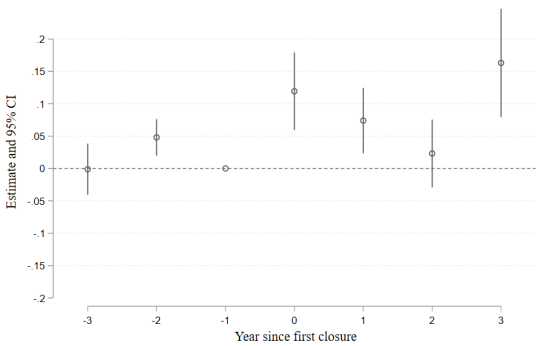
Heterogeneity Analysis - Binning

(a) Proximity Design



(b) Wind Direction Design



Notes: The figure shows the ATT estimates corresponding to our main static specification, but with binned periods.

Pre-Treatment Balanace: Property Characteristics

	N	Mean (SD)	N	Mean (SD)	N	Difference in Means
Panel A. Proximity specification.						
		(1) Far		(2) Near		(1)-(2) Pairwise t-test
Purchasing price in EUR	63686	252,964.88 (630.82)	5357	221,977.47 (1,528.12)	69043	30,987.41***
Age	63686	28.96 (0.12)	5357	36.87 (0.45)	69043	-7.91***
Living area	63686	146.80 (0.21)	5357	147.59 (0.73)	69043	-0.79
Number of rooms	63686	5.29 (0.01)	5357	5.52 (0.02)	69043	-0.23***
Plot area	63686	543.47 (1.60)	5357	511.96 (5.55)	69043	31.51***
Unfinished	63686	0.08 (0.00)	5357	0.08 (0.00)	69043	0.01
Detached	63686	0.32 (0.00)	5357	0.27 (0.01)	69043	0.05***
Multi-unit property	63686	0.18 (0.00)	5357	0.24 (0.01)	69043	-0.06***

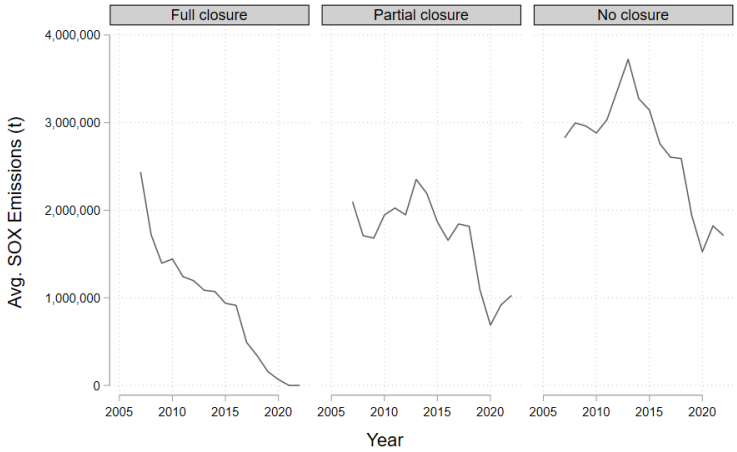
Notes: Considered pre-treatment period: 2007 to 2011. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.
Sources: Marktstammdatenregister, Bundesnetzagentur

Pre-Treatment Balanace: Property Characteristics

	N	Mean (SD)	N	Mean (SD)	N	Difference in Means
Panel B. Wind direction specification.						
		(1)		(2)		(1)-(2)
		Upwind		Downwind		Pairwise t-test
Purchasing price in EUR	1035	234,801.91	1783	226,591.98	2818	8,209.92*
		(4,520.09)		(2,426.31)		
Age	1035	43.70	1783	30.06	2818	13.64***
		(1.04)		(0.78)		
Living area	1035	157.78	1783	142.32	2818	15.46***
		(1.90)		(1.05)		
Number of rooms	1035	5.72	1783	5.40	2818	0.32***
		(0.06)		(0.04)		
Plot area	1035	561.56	1783	445.79	2818	115.77***
		(15.07)		(8.32)		
Unfinished	1035	0.02	1783	0.14	2818	-0.12***
		(0.00)		(0.01)		
Detached	1035	0.28	1783	0.28	2818	-0.01
		(0.01)		(0.01)		
Multi-unit property	1035	0.23	1783	0.26	2818	-0.03*
		(0.01)		(0.01)		

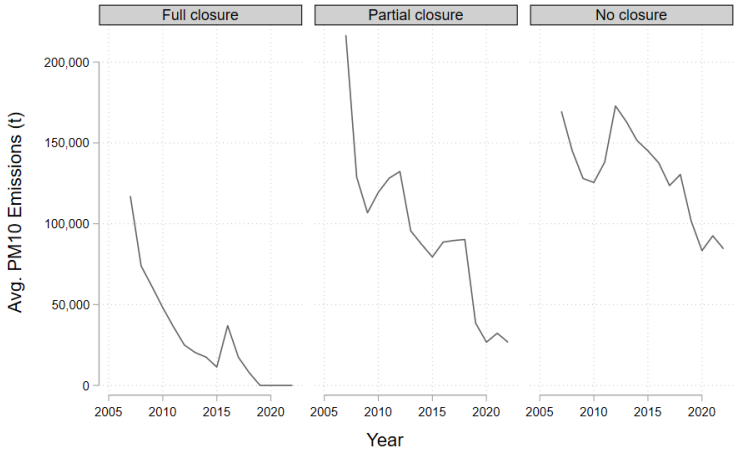
Notes: Considered pre-treatment period: 2007 to 2011. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.
Sources: Marktstammdatenregister, Bundesnetzagentur

SO_x Emissions by power plant type



Notes: Own depiction based on Rivera and Loveridge (2022). Emissions data given at facility level.
Source: European Pollutant Release and Transfer Register (E-PRTR) (*thermal power stations and other combustion installations*), *Bundesnetzagentur*, *Marktstammdatenregister*

PM10 Emissions by power plant type



Notes: Own depiction based on Rivera and Loveridge (2022). Emissions data given at facility level.
Source: European Pollutant Release and Transfer Register (E-PRTR) (*thermal power stations and other combustion installations*), *Bundesnetzagentur*, *Marktstammdatenregister*