

The Effect of Emission Information on Housing Prices in Germany

Daniel Römer, Alex Rohlf & Kathrine von Graevenitz

A Toxa, 26 June, 2014

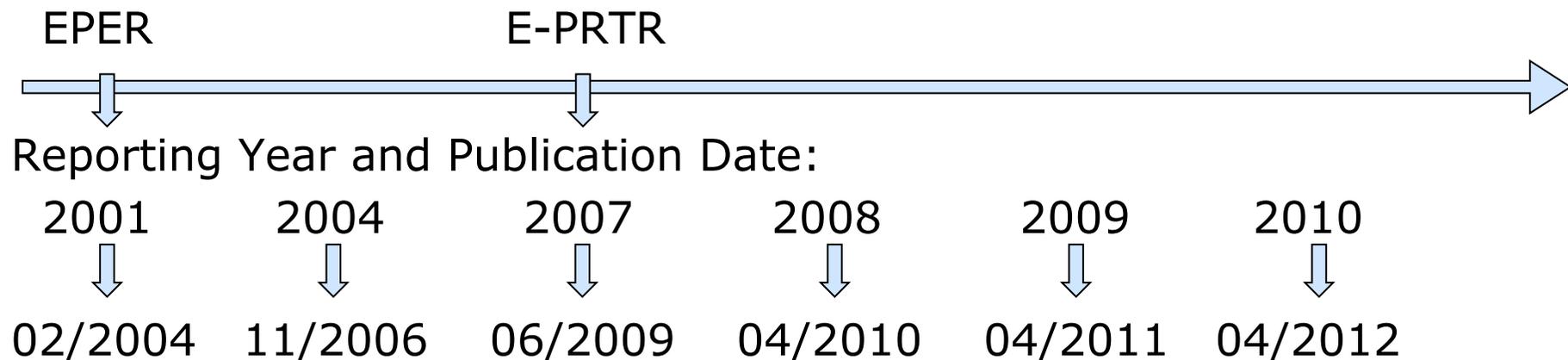
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Motivation

- Environmental regulation
 - Command and control
 - Market based instruments
 - Information provision (“Right to know”)
- Based on hypothesis that the mere provision of information is an effective way of environmental regulation through community pressure
- Aim: Test if publication of E-PRTR (‘German TRI’) had an effect on housing prices in zip code areas with emissions

E-PRTR: European Pollutant Release and Transfer Register (<http://prtr.ec.europa.eu/>)

Register:



- German Data published on E-PRTR Website on q2/2009
- Opening ceremony in Berlin on 06/03/2009
- Over 30 Lexis Nexis Hits for keyword „[E-]PRTR“ in 2009

E-PRTR (ctd)

E-PRTR
The European Pollutant Release and Transfer Register

Download E-PRTR Dataset

The *full dataset* of E-PRTR is hosted by the European Agency (EEA) in its Data Service. The EEA Data Access to databases generated under several reports such as E-PRTR.

The following links provide you with access to the published on the EEA data service website: point releases to air.

E-PRTR is Linked Open Data
In order to facilitate combination of E-PRTR data with the E-PRTR database has been made available as stakeholder who are interested in only a subset dataset has been partitioned into several files:

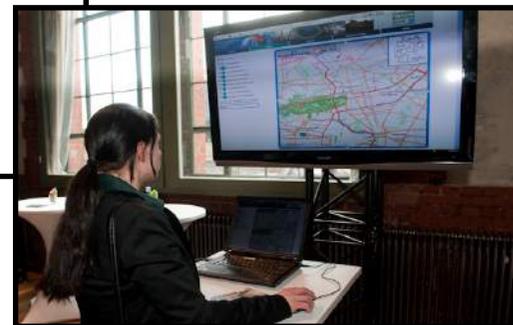
- Facilities - Production facilities that releases or transfers
- Activities - List of activities that each facility is involved in
- Competent authorities - Government authority responsible for the facility report
- Facility reports - Yearly reports from facilities. Includes facility name, activity etc.
- Facility ID changes - Used to connect year-to-year reporting to one global facility identifier
- Lookup tables - Country, region, activity, etc.
- Pollutant releases - Total releases per facility
- Pollutant releases per facility
- Pollutant release method - Method used to release per facility
- Pollutant transfers - Total transfers per facility
- Pollutant transfers per facility

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Abfrage_07_30_PLZ_Facility_Pollutant_Codes_AG_SLR : Auswahlabfrage

PollutantRelease	Facility	Release	FacilityName	PollutantCode	PollutantName	CO2Dq	Weight	ManualThresh	TotalQuantity	AccidentalQuar	ReleaseMec
1	18025	WATER									
2	18025	WATER	MVV Heizkraftwerk Nord	NOX	Nitrogen oxides	0	1	0	171000	0	AIR
3	18025	WATER	Daimler AG Produktionszentrum	HCN	Hydrogen cyanide	0	1	0	805	0	AIR
4	18025	WATER									
5	18077	WATER	Kläranlage Mannheim-Sandhofen	CHLORIDES	Chlorides (as total chlorine)	0	1	0	5480000	0	WATER
6	18077	WATER	GKM Grosskraftwerk Mannheim AG	HG AND COMPOUNDS	Mercury and compounds	0	1	0	158	0	AIR
7	18077	WATER	Kläranlage Mannheim-Sandhofen	DIURON	Diuron	0	1	0	2	0	WATER
8	18077	WATER	Kläranlage Mannheim-Sandhofen	TOTAL - PHOSPHORUS	Total phosphorus	0	1	0	8210	0	WATER
9	18097	WATER	Kläranlage Mannheim-Sandhofen	ZN AND COMPOUNDS	Zinc and compounds	0	1	0	1910	0	WATER
10	18097	WATER	Kläranlage Mannheim-Sandhofen	DEHP	Di-2-ethyl hexyl phthalate	0	1	0	34	0	WATER
11	18097	WATER	Roche Diagnostics GmbH Chem.Pharm.Produkte Herstell	CFCS	Chlorofluorocarbon	0	1	0	22,5	0	AIR
12	18174	WATER	Roche Diagnostics GmbH Chem.Pharm.Produkte Herstell	HCFCs	Hydrochlorofluorocarbon	0	1	0	20,5	0	AIR
13	18177	WATER	BASF SE Werksteil Friesenheimer Insel	BENZENE	Benzene	0	1	0	2430	0	AIR
14	18177	WATER	Roche Diagnostics GmbH Chem.Pharm.Produkte Herstell	TRICHLOROMETHANE	Trichloromethane	0	1	0	2850	0	AIR
15	18191	WATER	Kläranlage Mannheim-Sandhofen	HALOGENATED PARTICULATE MATTER	Halogenated particulate matter	0	1	0	1900	0	WATER
16	18503	WATER	MVV BMKW Mannheim GmbH Biomassekraftwerk	PM10	Particulate matter	0	1	0	185000	0	AIR
17	18523	WATER									
18	18523	WATER									
19	18523	WATER									
20	18523	WATER	Water	NI AND COMPOUNDS	Nickel and compounds (as Ni)	HEVMET					Heavy metals
21	18523	WATER	Water	PB AND COMPOUNDS	Lead and compounds (as Pb)	HEVMET					Heavy metals
22	18523	WATER	Water	PHENOLS	Phenols (as total C)	OTHORG					Other organic
23	18523	WATER	Water	TOTAL - NITROGEN	Total nitrogen	INORG					Inorganic sub
24	18523	WATER	Water	TOTAL ORGANIC CARBON	Total organic carbon (TOC)	OTHORG					Other organic
25	18526	WATER	Water	CD AND COMPOUNDS	Cadmium and compounds (as Cd)	HEVMET					Heavy metals
26	18526	WATER	Water	CHLORIDES	Chlorides (as total Cl)	INORG					Inorganic sub
27	18526	WATER	Water	CR AND COMPOUNDS	Chromium and compounds (as Cr)	HEVMET					Heavy metals
28	18526	WATER	Water	CU AND COMPOUNDS	Copper and compounds (as Cu)	HEVMET					Heavy metals
29	18526	WATER	Water	HG AND COMPOUNDS	Mercury and compounds (as Hg)	HEVMET					Heavy metals
30	18526	WATER	Water	FLUORINE AND COMPOUNDS	Fluorine and compounds (as F)	HEVMET					Heavy metals
31	18526	WATER	Water	FLUORINE AND COMPOUNDS	Fluorine and compounds (as F)	HEVMET					Heavy metals



Literature

- Studies on the US Toxics Release Inventory (TRI) and housing prices
 - Bui & Mayer (2003) use 231 zip codes in one US state, no consistent effects identified
 - Oberholzer-Gee & Mitsunari (2006) analyze 5 counties
 - Currie et al (2013) look at opening and closing of plants across US
 - Both find negative effects on house prices only within moderate distances of a polluting facility
 - Sanders (2013) analyzes 1000 zip codes from multiple states, negative effect for ZIP codes with large emissions
- Little evidence outside US

Data

- E-PRTR: Site level substance reports
 - Quantity [t]
 - Substance name (grouped) and threshold
 - Release medium (Air, water, soil)
 - Gauss-Krüger Coordinates of the emitter site
- House price index (WPI)
 - Hedonic Price Index: Supply data and observed transactions
 - Aggregated on PLZ Level (German zip codes)
 - Quarterly Data, set to 100 in Q2/2004
 - Acquired from F+B GmbH, Hamburg

Regressions

□ Panel Regression in the spirit of Sanders (2013)

□ Dummies:

$$T_i = \begin{cases} 1 & \text{if } E_i(2009) > 0 \\ 0 & \text{if } E_i(2009) = 0 \end{cases}$$

$$\text{Post}_{i,t} = \begin{cases} 1 & \text{if } t \geq q2 / 2009 \\ 0 & \text{if } t < q2 / 2009 \end{cases}$$

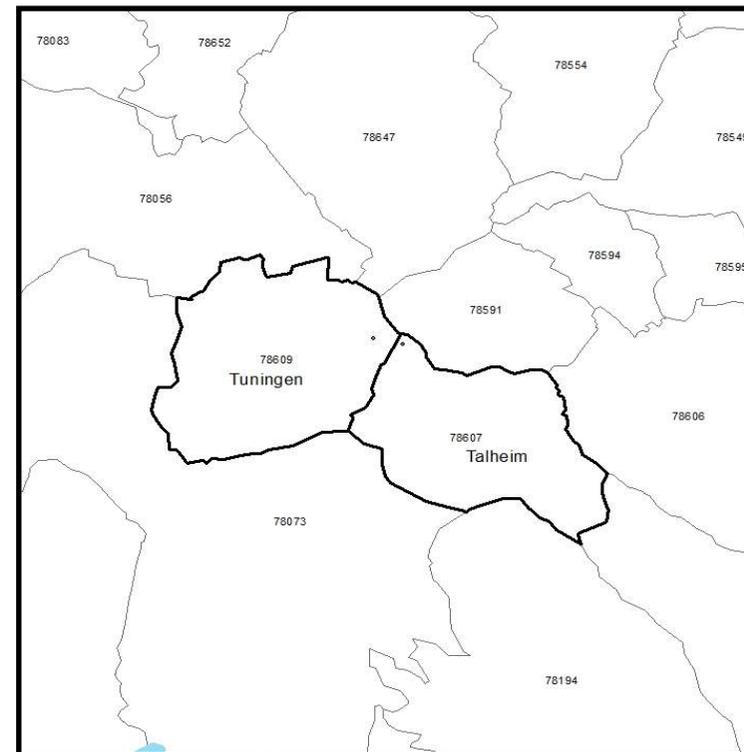
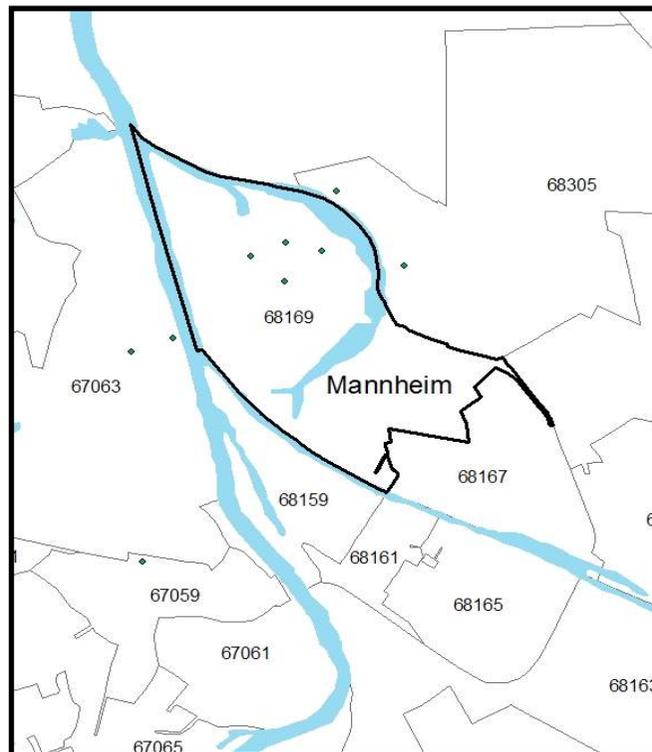
□ Fixed Effects (zip,t) Regression Model:

$$Y_{its} = \alpha^0 + \alpha_s^1 \text{Post}_{it} \text{State}_s + \alpha^2 T_i + \alpha^3 \text{Post}_{it} T_i + \alpha_i^4 + \alpha_{ts}^5 \text{State}_s + \varepsilon_{its}$$

□ Coefficient of Main Interest is α^3 !

Definition of treatment

Define treatment as „Presence of emissions“



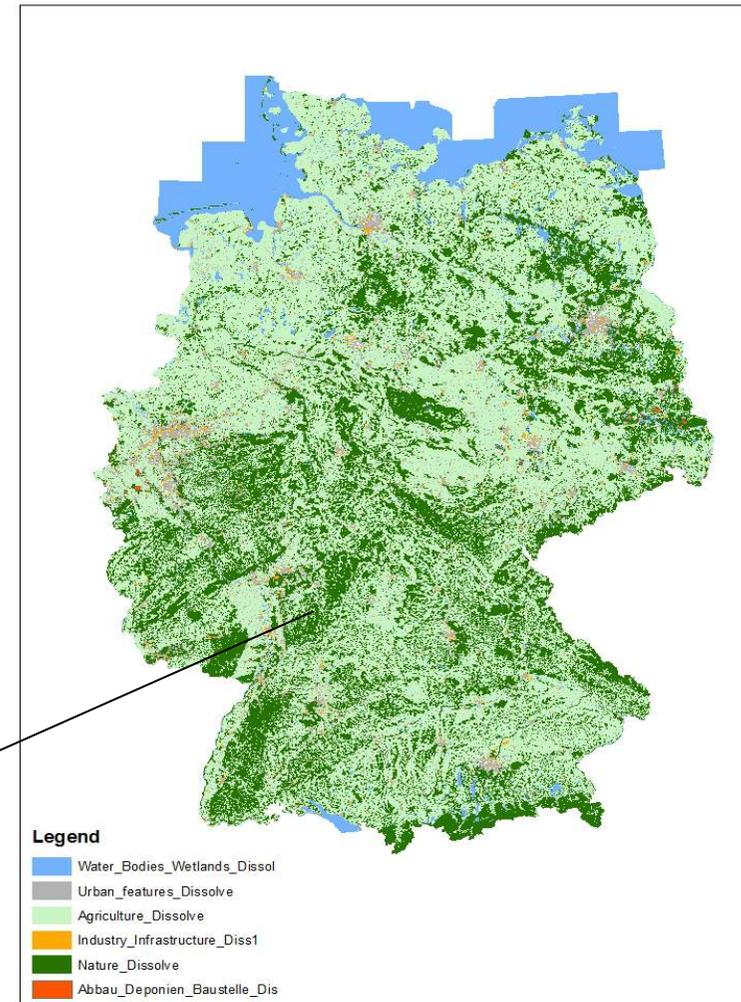
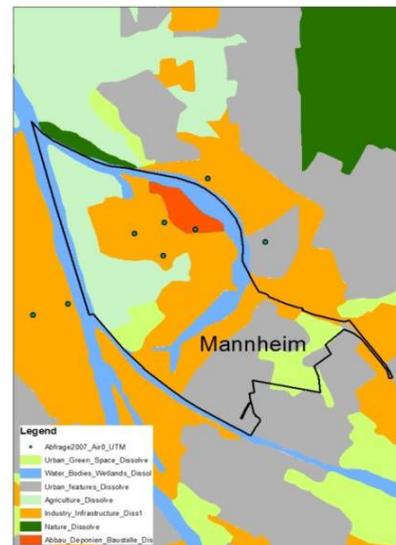
Treatment and control group comparable?

Descriptive characteristics from
INKAR:

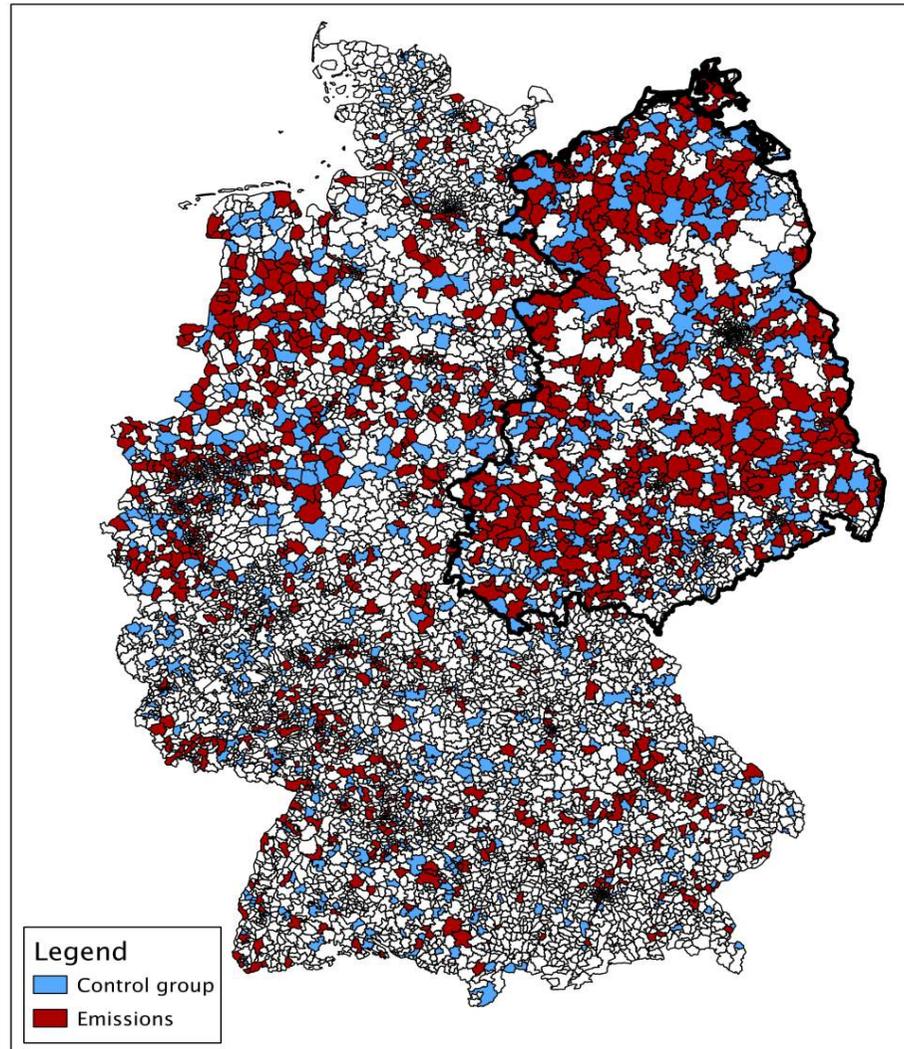
- Unemployment rate
- Tax revenues
- Type of housing
- Commuters
- Etc...

From GIS:

- Corine Land Cover:
 - Industry
 - Urban area
 - Agriculture
 - Natural areas
 - Water bodies
 - Landfills



Overview – Treated zip codes



Results

	Western Germany		Eastern Germany	
	Full sample	Matched sample	Full sample	Matched sample
Post*T	0.237 ** (0.090)	-0.046 (0.131)	-0.399 *** (0.166)	0.170 (0.240)
Constant	95.893 *** (0.029)	96.376 *** (0.057)	95.303 *** (0.060)	94.966 *** (0.091)
Postal code FE	Yes	Yes	Yes	Yes
State-specific Post	Yes	Yes	Yes	Yes
State specific trends	Yes	Yes	Yes	Yes
R^2	0.393	0.440	0.403	0.243
Observations	6799	1319	1413	568
Treated observations (T=1)	741	739	377	350

Note. Dependent variable is house price index; clustered standard errors in parantheses.

*/**/** Significant at the 5%/1%/0,.1% level.

Alternative treatment definitions

- Aggregation bias due to the treatment definition

- Only large emissions count?

- Only emissions within 500 m of (residential) urban areas count?

- Proximity to emission source counts?

Accounting for quantities emitted

Weighted Emissions (WE)

$$WE_{zip,y} = \sum_{f=1}^{F_{zip}} \left[\sum_{p=1}^{P_f} \frac{R_{p,f}(y)}{R_p^{threshold}} \right]$$

F_{zip} = Facilities in zip

P_f = Pollutants reported by Facility f

$R_{p,f}$ = Quantity of Pollutant p, f

$R_p^{threshold}$ = Reporting threshold for Pollutant p

Example: 68169 (Mannheim):

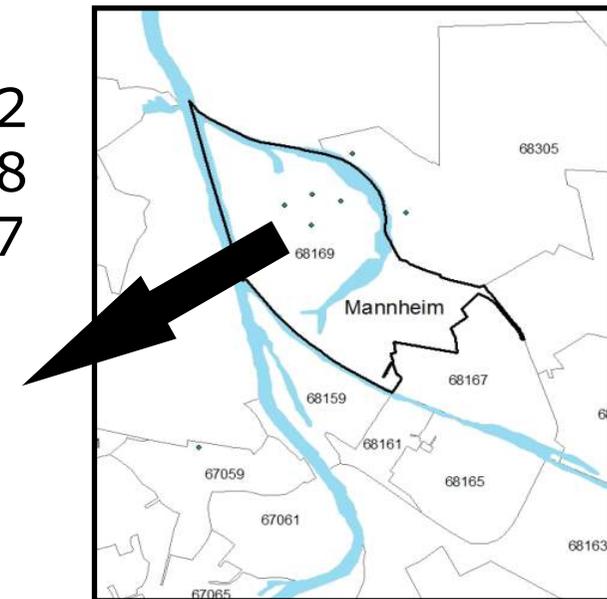
Nitrogen Oxides → $122000/100000=1.22$

Nitrogen Oxides → $148000/100000=1.48$

Methane (CH₄) → $687000/100000=6.87$

Benzene (C₆H₆) → $2420/1000 = 2.42$

$$\rightarrow WE_{68169}(2009) = 11.99$$



Quantiles of emissions

	Western Germany		Eastern Germany	
	Full sample	Matched sample	Full sample	Matched sample
Post*TQ1	0.003 (0.189)	-0.355 (0.213)	-0.438 (0.248)	0.160 (0.297)
Post*TQ2	0.038 (0.201)	-0.239 (0.222)	-0.537 * (0.246)	0.0430 (0.298)
Post*TQ3	0.442 ** (0.157)	0.133 (0.184)	-0.299 (0.305)	0.203 (0.370)
Post*TQ4	0.350 * (0.140)	0.130 (0.166)	-0.138 (0.405)	0.450 (0.449)
Constant	95.893 *** (0.029)	96.376 *** (0.057)	95.303 *** (0.059)	94.966 *** (0.091)
Postal code FE	Yes	Yes	Yes	Yes
State-specific Post	Yes	Yes	Yes	Yes
State specific trends	Yes	Yes	Yes	Yes
R^2	0.393	0.442	0.424	0.244
Observations	6799	1319	1413	568
Treated observations (T=1)	741	739	377	350

Note. Dependent variable is house price index; clustered standard errors in parantheses.

*/**/** Significant at the 5%/1%/0.1% level.

Only emissions within 500 m of urban areas

	Western Germany		Eastern Germany	
	Full	Matched	Full	Matched
Post*T	0.319 ** (0.099)	-0.110 (0.165)	-0.396 * (0.185)	-0.271 (0.269)
Constant	95.89 *** (0.029)	96.69 *** (0.066)	95.30 *** (0.059)	95.19 *** (0.110)
Postal code FE	X	X	X	X
State-specific Post	X	X	X	X
State-specific trends	X	X	X	X
Number of postal code areas	6799	995	1413	348
Treated	603	603	223	215
R^2	0.387	0.466	0.424	0.357

Note. Dependent variable is house price index; clustered standard errors in parentheses.
*/**/** Significant at the 5%/1%/0.1% level.

Conclusions

- Housing market does not seem to react to E-PRTR
 - Not even the very large emissions
 - Not even when looking only at emissions near urban areas
- Further robustness checks
 - Refine matching procedure
 - » Mahalanobis matching, radius matching

Thanks for Listening

□ Kathrine von Graevenitz

Email: vongraevenitz@zew.de

Treatment and control group comparable? (Cont.)

Western Germany

- Emissions are found in *urban* areas with
 - Higher population density
 - Larger than average share of industrial land use
 - Higher commercial tax revenues

Eastern Germany

- Emissions are found in *rural* areas with
 - Lower population density
 - Larger than average agricultural land use

- Matching improves balance of treatment and controls on observable characteristics