

The causal impact of the EU ETS on Emissions

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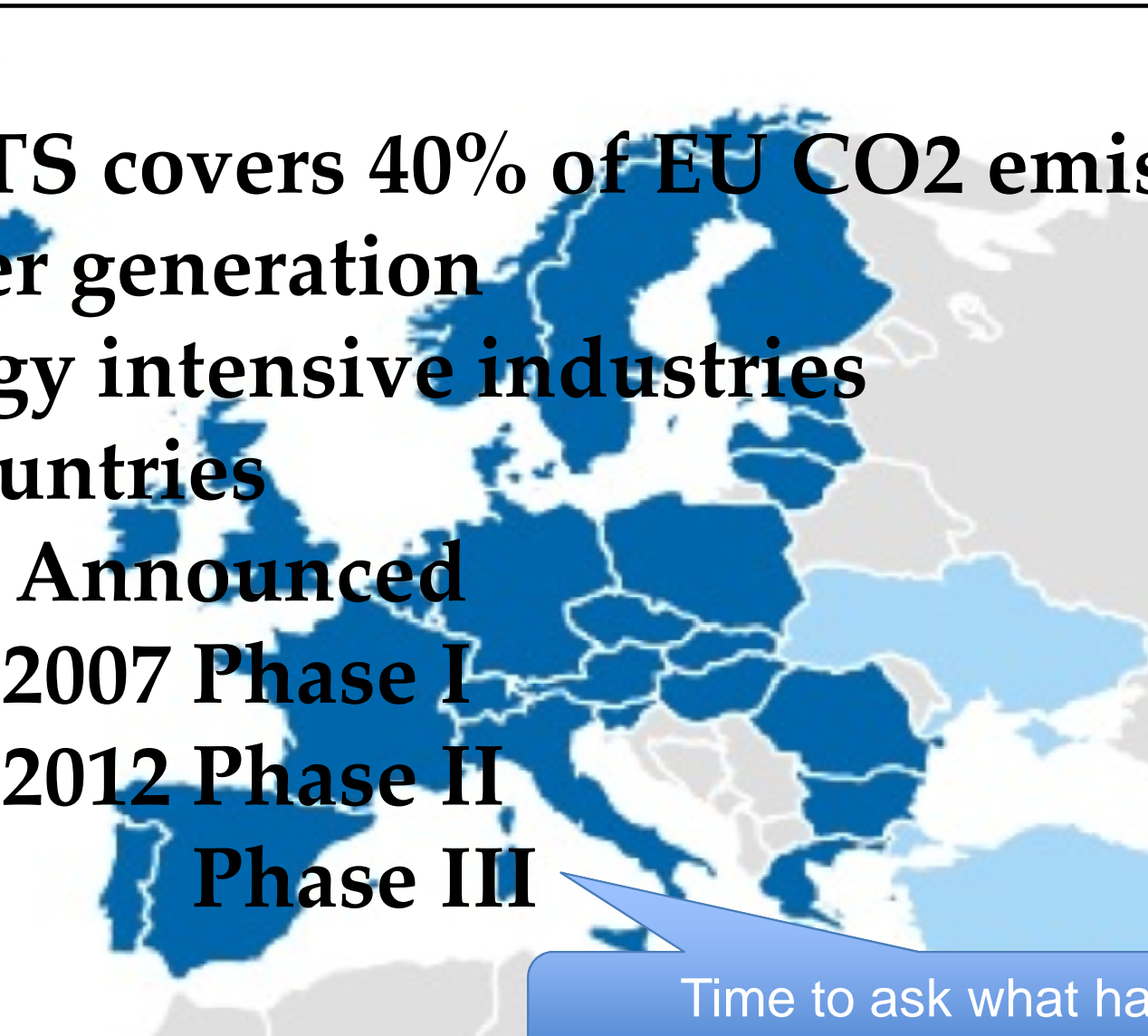
Grantham Research Institute on
Climate Change and
the Environment

CENTRE *for* ECONOMIC
P E R F O R M A N C E

From targets to instruments

- **COPs are mainly about carbon targets**
- **Targets need to be translated into policy instruments**
- **ETS: the biggest policy instrument experiment so far.**

The greatest experiment to date

- 
- EUETS covers 40% of EU CO2 emissions
 - Power generation
 - Energy intensive industries
 - 31 countries
 - 2000: Announced
 - 2005-2007 Phase I
 - 2008-2012 Phase II
 - 2013- Phase III

Time to ask what has been achieved?

Even more experiments under way



Diverging views on Carbon Trading

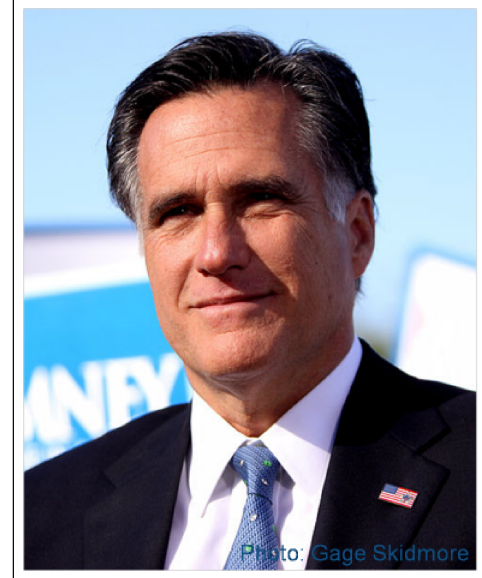
“The Administration is developing a comprehensive energy and climate change plan to (...) address the global climate crisis, and create new American jobs that cannot be outsourced. (...) This program will be implemented through a cap-and-trade system (...).”

Executive Budget Office of the President, 2009.



“I do not believe in a cap-and-trade program. (...) It loses jobs for Americans, and ultimately it won't be successful, because industries that are energy-intensive will just get up and go somewhere else.”

Mitt Romney, Business Man
Former GOP Presidential Candidate,
October 2011, Pittsburgh

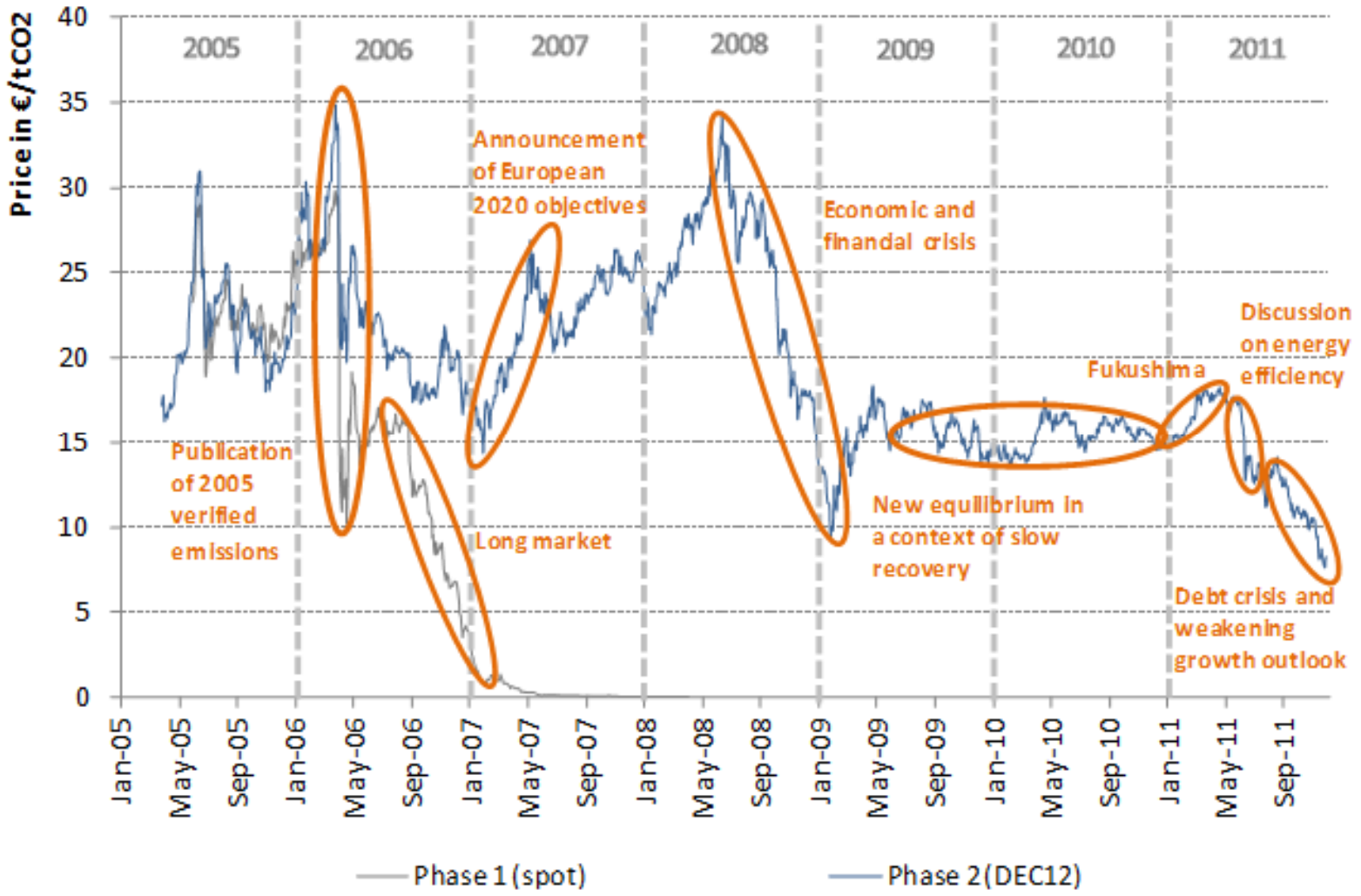


“The current proposal about Carbon Dioxide emissions would damage Germany's competitiveness in an unacceptable way and is not practicable.”

Gerhard Schröder, Gazprom
Former German Chancellor, June
2002.



ETS – much to ado about nothing?



Source: Climate Economics Chair from BlueNext and ICE ECX Futures

12-2012: €6.67 1-2013: €2.81

Is there any effect?

- On emissions?
- Employment?
- (Clean) Innovation?
- Growth?

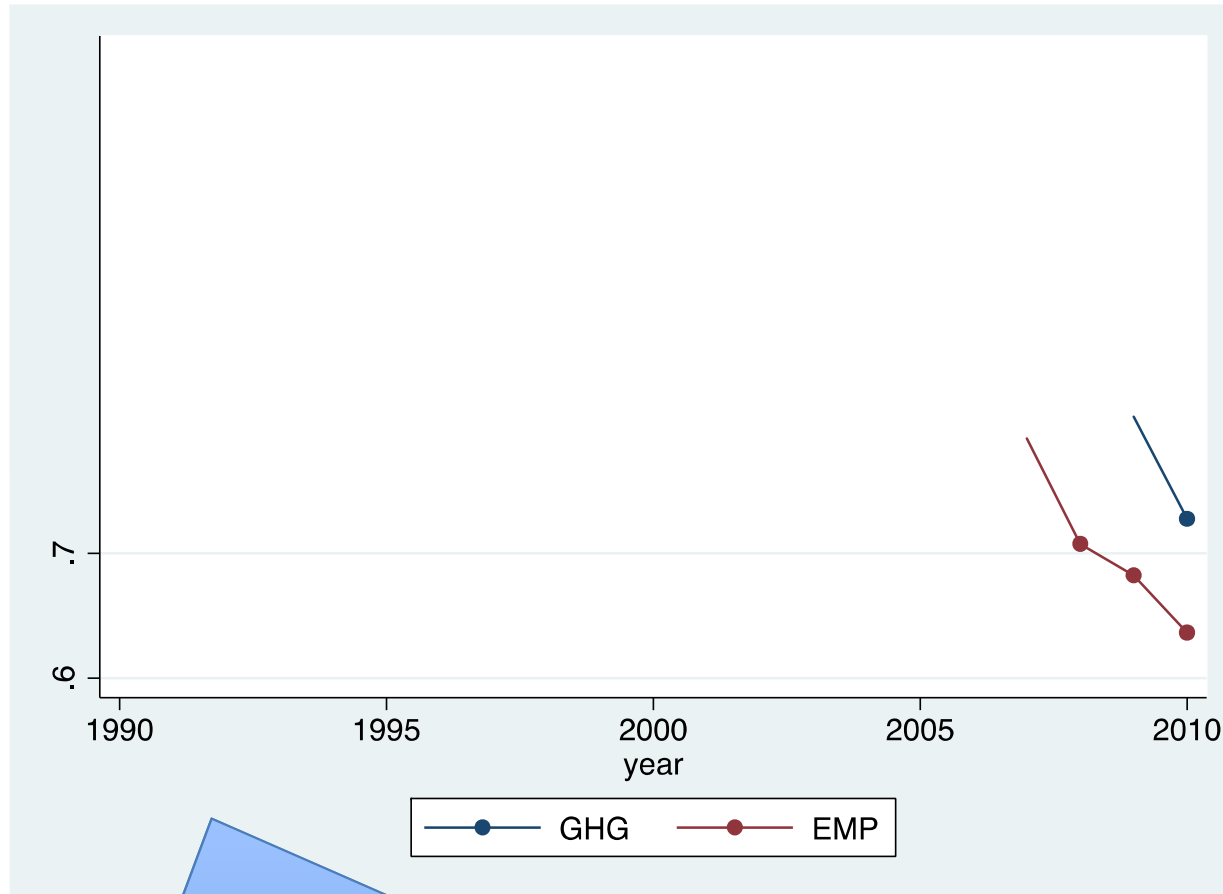
Even without currently high prices we might expect effects because

- Firms expected higher prices and made fixed investments accordingly
- Expectation of higher prices in the future + banking

ETS effect on emissions

- By definition the EU ETS ensures that emissions of regulated firms do not exceed cap
- Hence if the cap is contracting emissions must reduce
- However: this does not imply that the ETS has reduced emissions
- Emissions might have reduced anyways

Aggregate figures for France



NB: Based on authors' aggregation of micro data. Not official figures

Previous work

- Limited number of previous studies
- Aggregate data
- Baseline derived from interpolating pre policy trends
- Most work only for Phase I

- Ellerman Buchner: -2.4% to 4.7% emission reduction 2005-6
- Ellerman, Convery & de Perthuis: -3% in Phase I
- Ellerman & Feilhauer (2008) for Germany: -6.3% industrial emissions, -4.1% power sector (average -5%)
- Anderson & DiMaria (2011, *ERE*): -2.8% EU wide

This paper/project

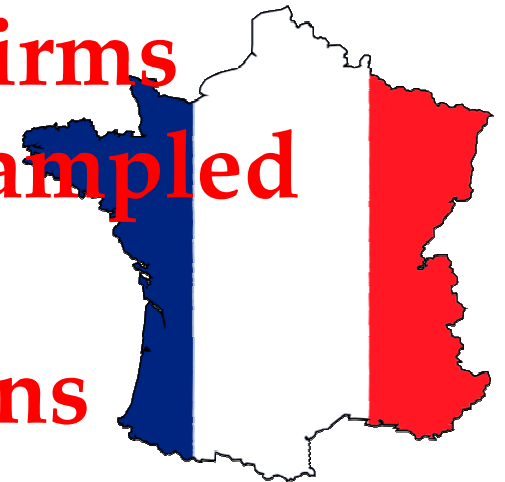
- First study to compare the change in emissions between regulated and non-regulated plants over the introduction of the ETS

Two problems

1. Data for both ETS and non ETS plants from before and after ETS
2. Are there comparable non ETS plants?
→ Size thresholds for participation

Data

- CO2/Fuel consumption data from government business census data
- Access often difficult
- We have now access to relevant data for UK, Germany, France
- **Today: Initial results for France**
 - **Unbalanced panel of ~10000 firms**
 - **Smaller firms are randomly sampled**
 - **Enquete Annuelle sur les Consommations d'Energie dans l'Industrie (EACEI)**
- ETS participation information from CITL



DiD-Matching estimator

- Plants with 20 MW fossil fuel capacity are included, various industry specific thresholds
- Nearest neighbour in terms of CO2/EMP in 2000 (ETS announced)
- Within (2 digit) sectors
- Estimation:

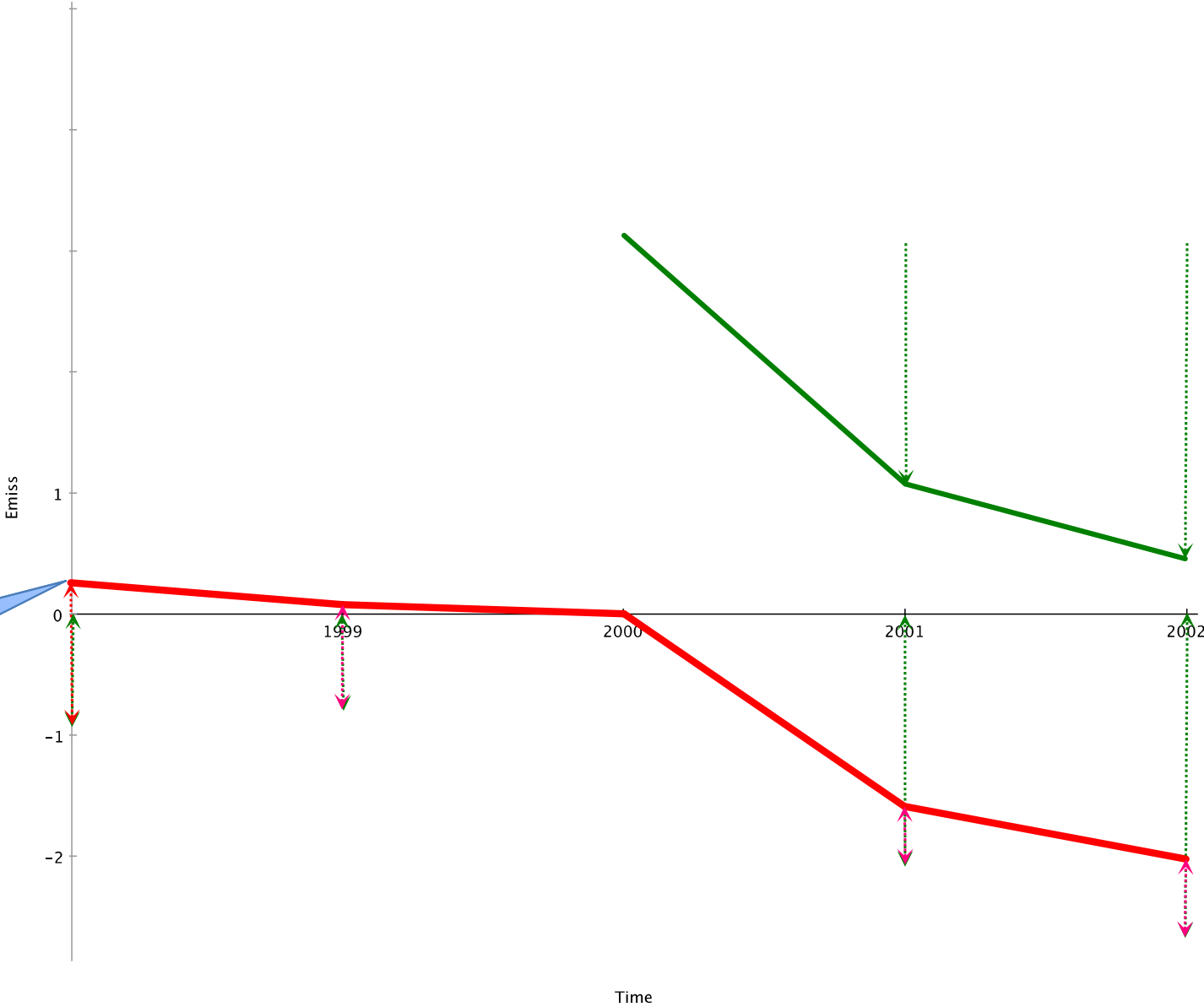
$$ATT_t = \frac{1}{\# Plants} \sum_i \left([y_{it} - y_{i2000}] - [y_{NN(i)t} - y_{NN(i)2000}] \right)$$

DiD-Matching estimator

Nearest neighbor

ETS facility

Difference in differences

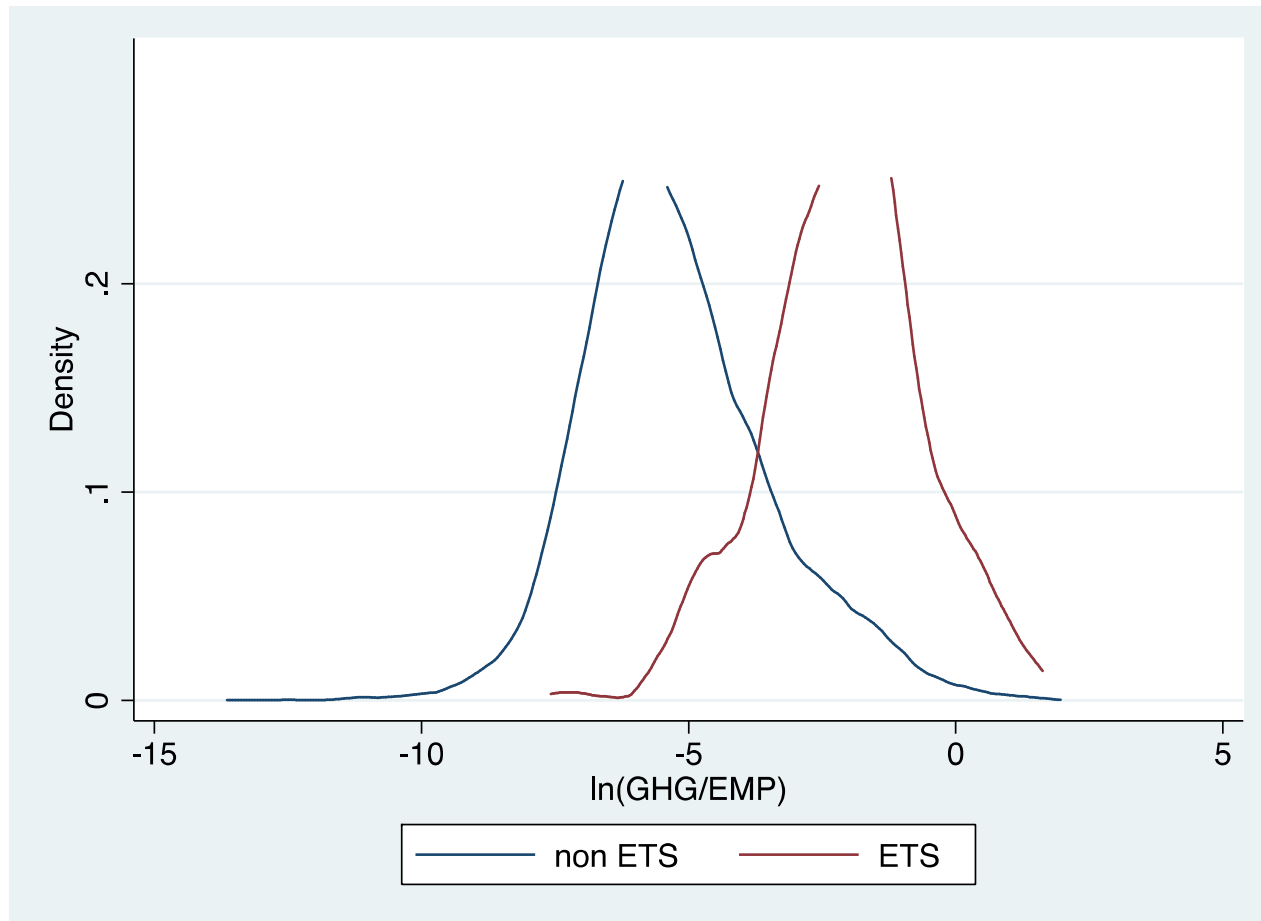


What do we identify

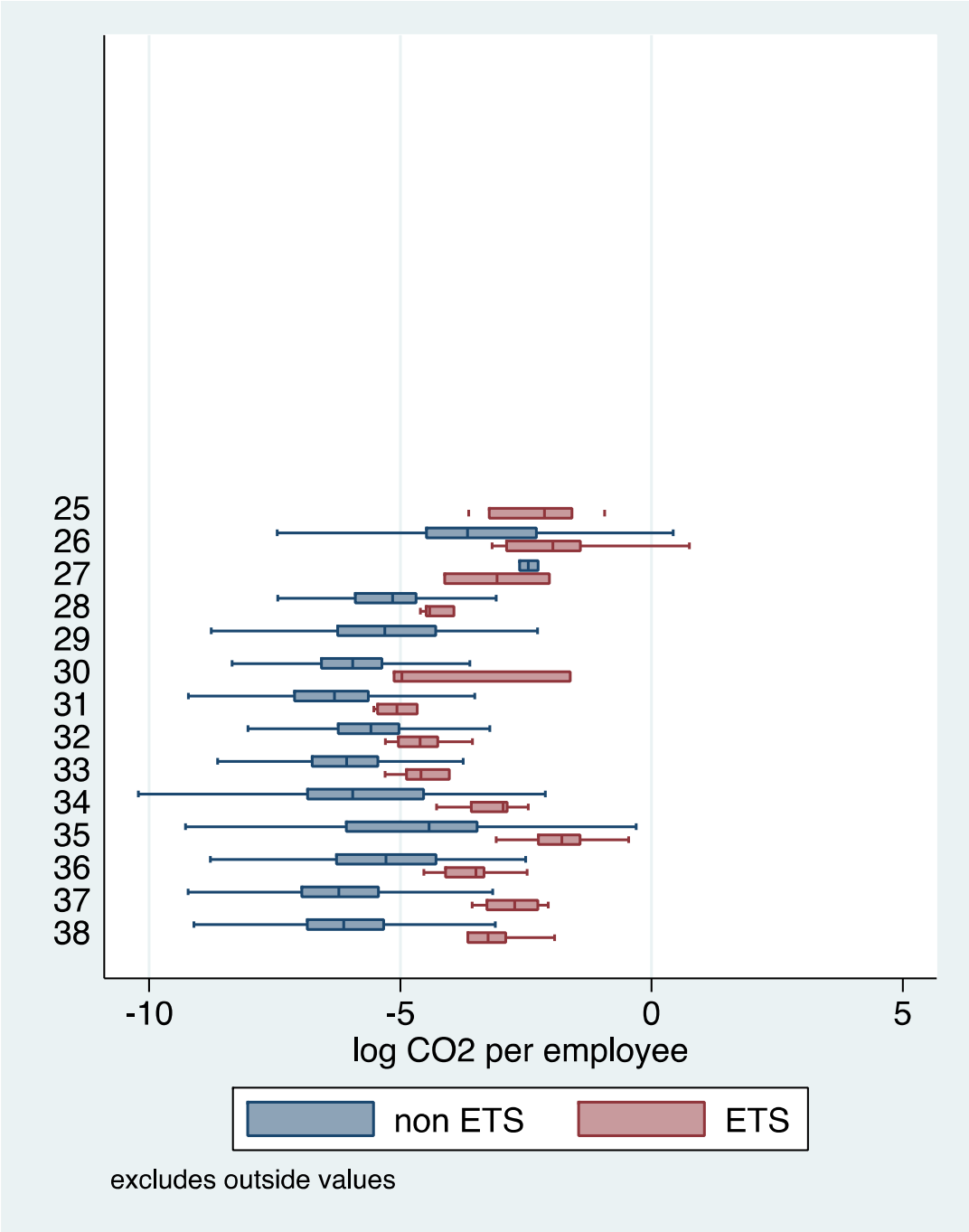
- Relative effect between ETS and non ETS
- Maybe substitution between regulated and non regulated plants?
- Maybe carbon leakage?
- We can say a little bit about that by looking at multi-plant firms with plants covered and not covered

ETS vs non ETS

- ETS plants in sample: 384
- Non ETS plants: 5,573

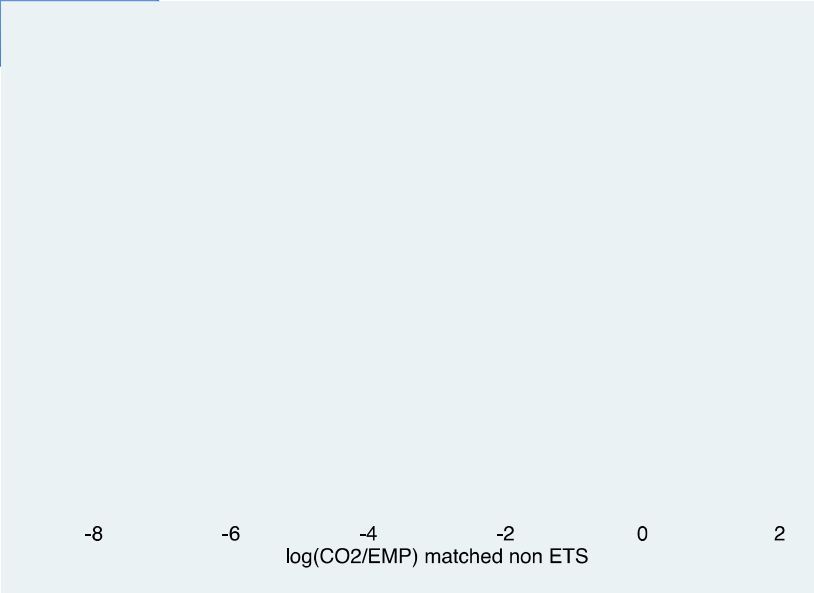
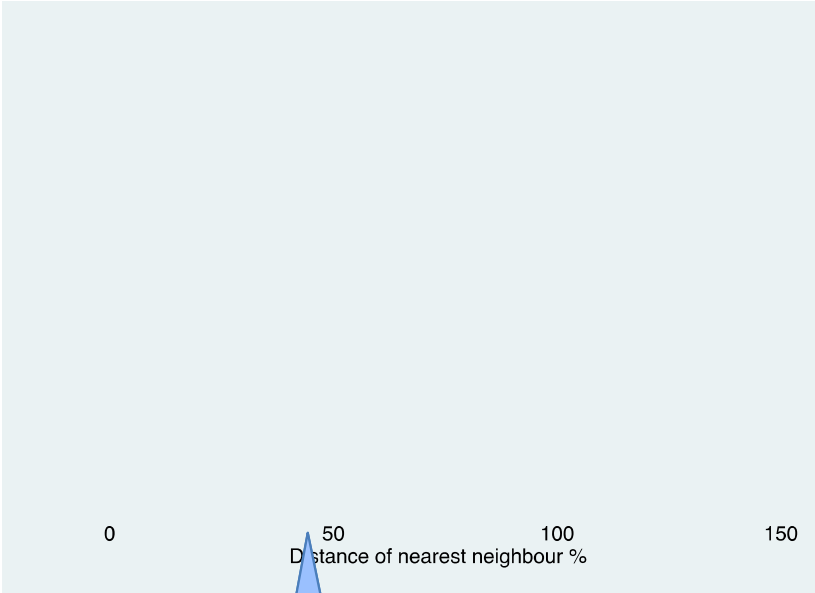


ETS vs non ETS

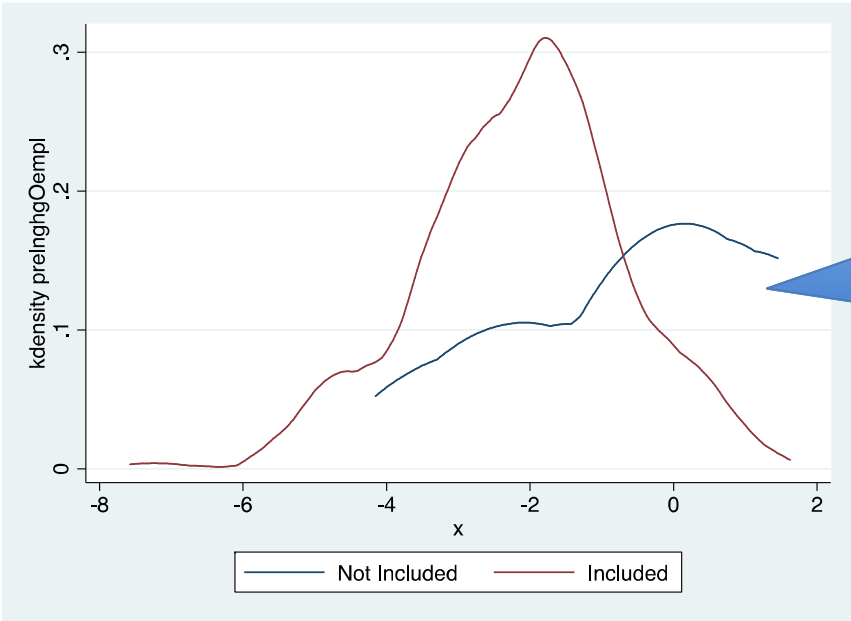


Matching

Treated vs. NN
GHG intensity

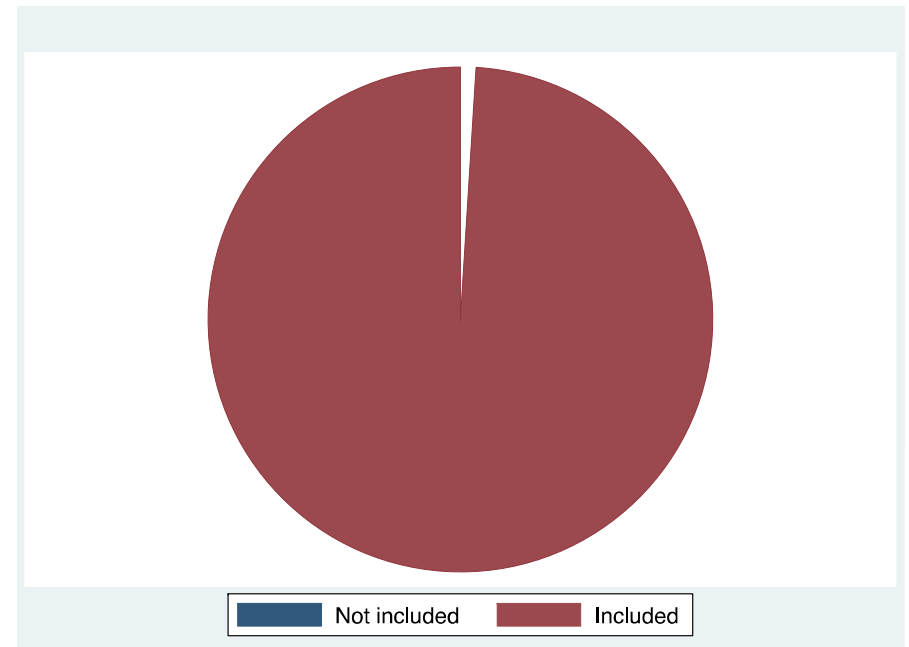
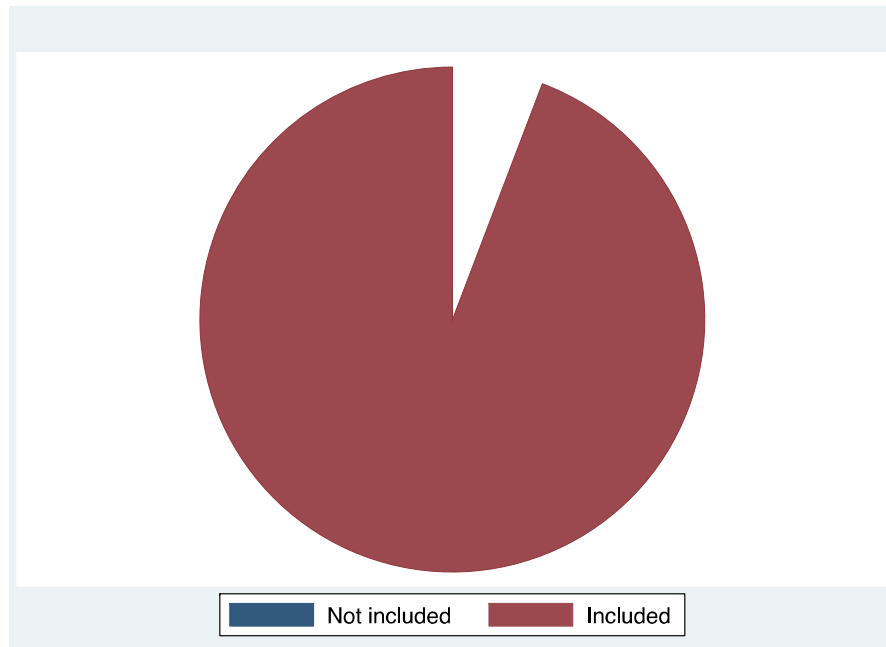


Distance to nearest neighbor:
50% cut – off
captures most of
the sample



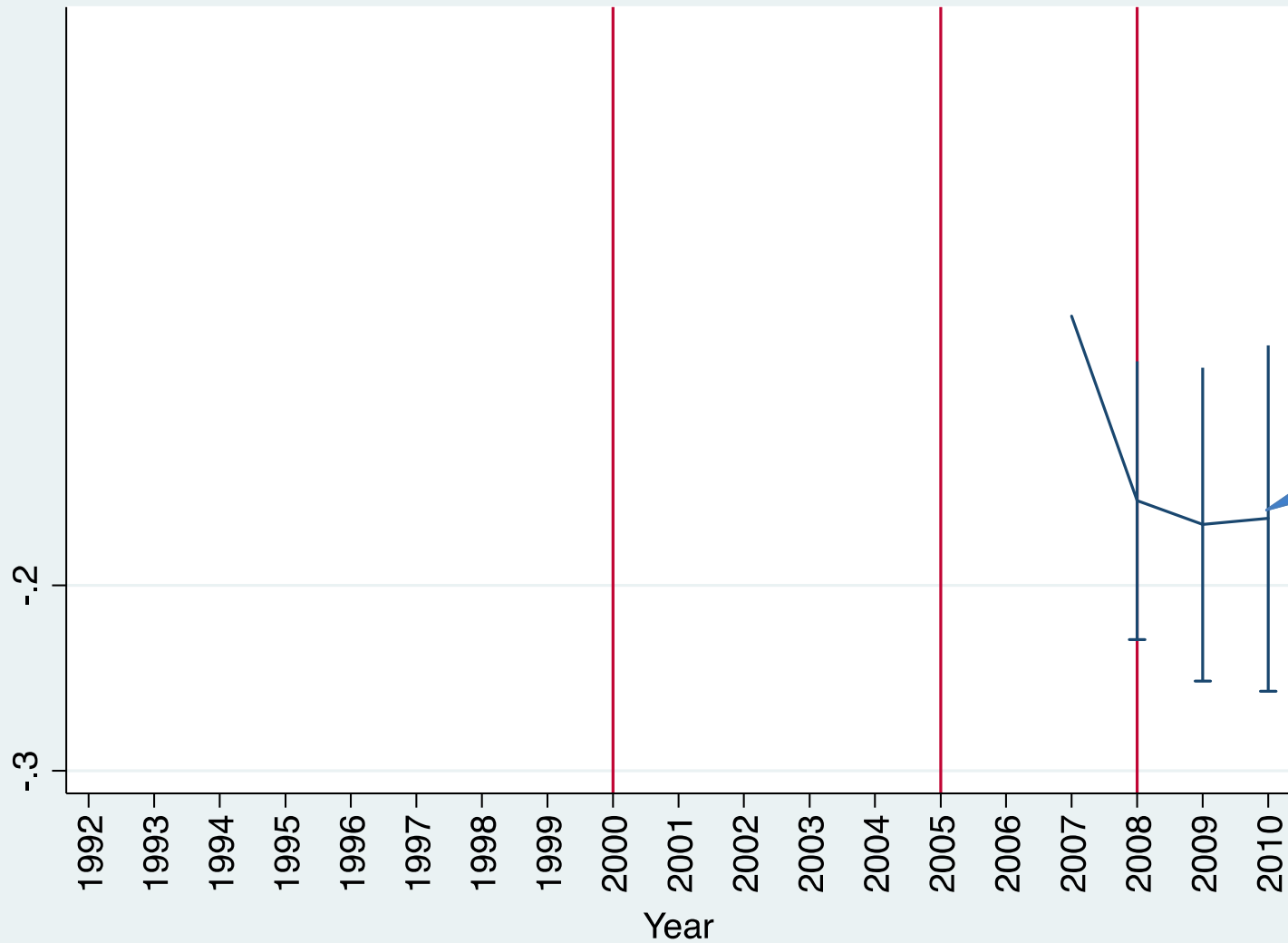
Non matched are
within the support
of matched

Share of GHG and EMP in matched sample



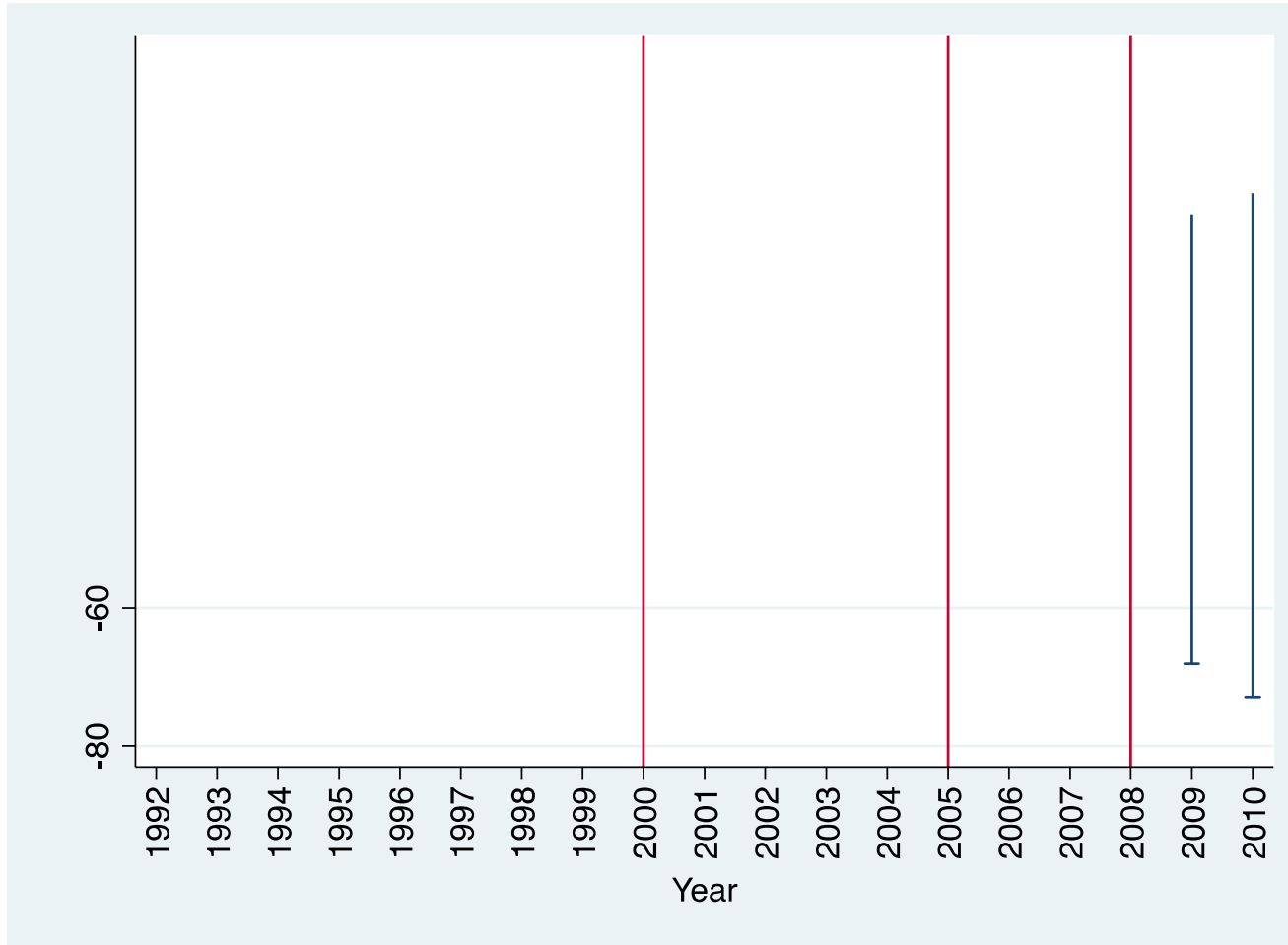
50% cut captures most
GHG and employment

Average impact: $\ln(\text{GHG})$



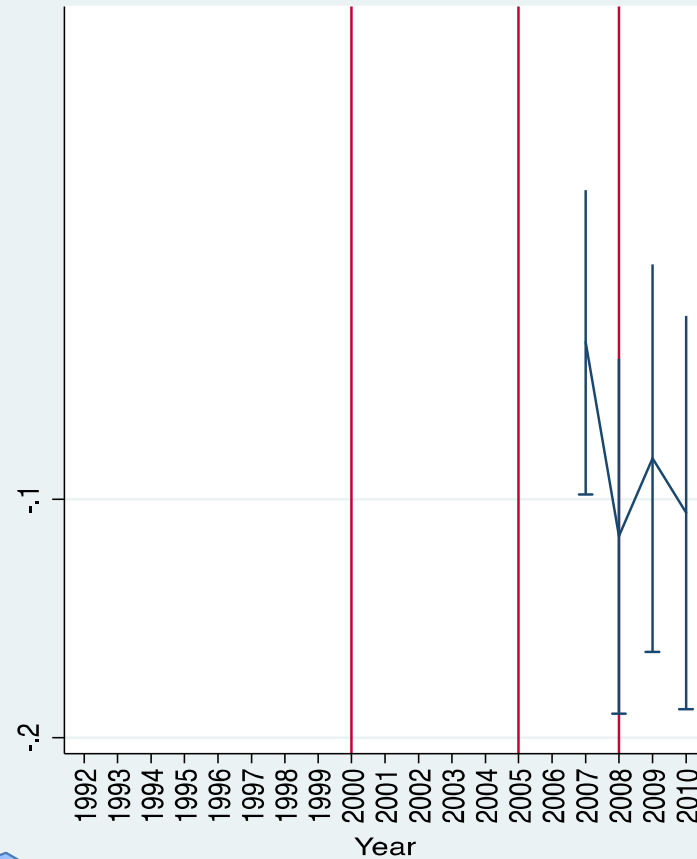
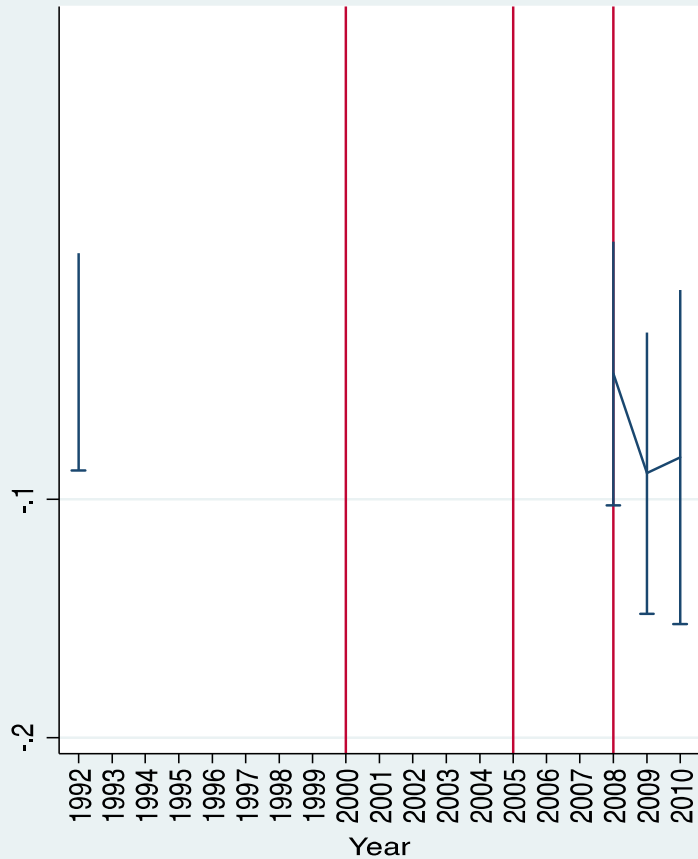
Average
reduction of
more than 15%

Average impact: GHG



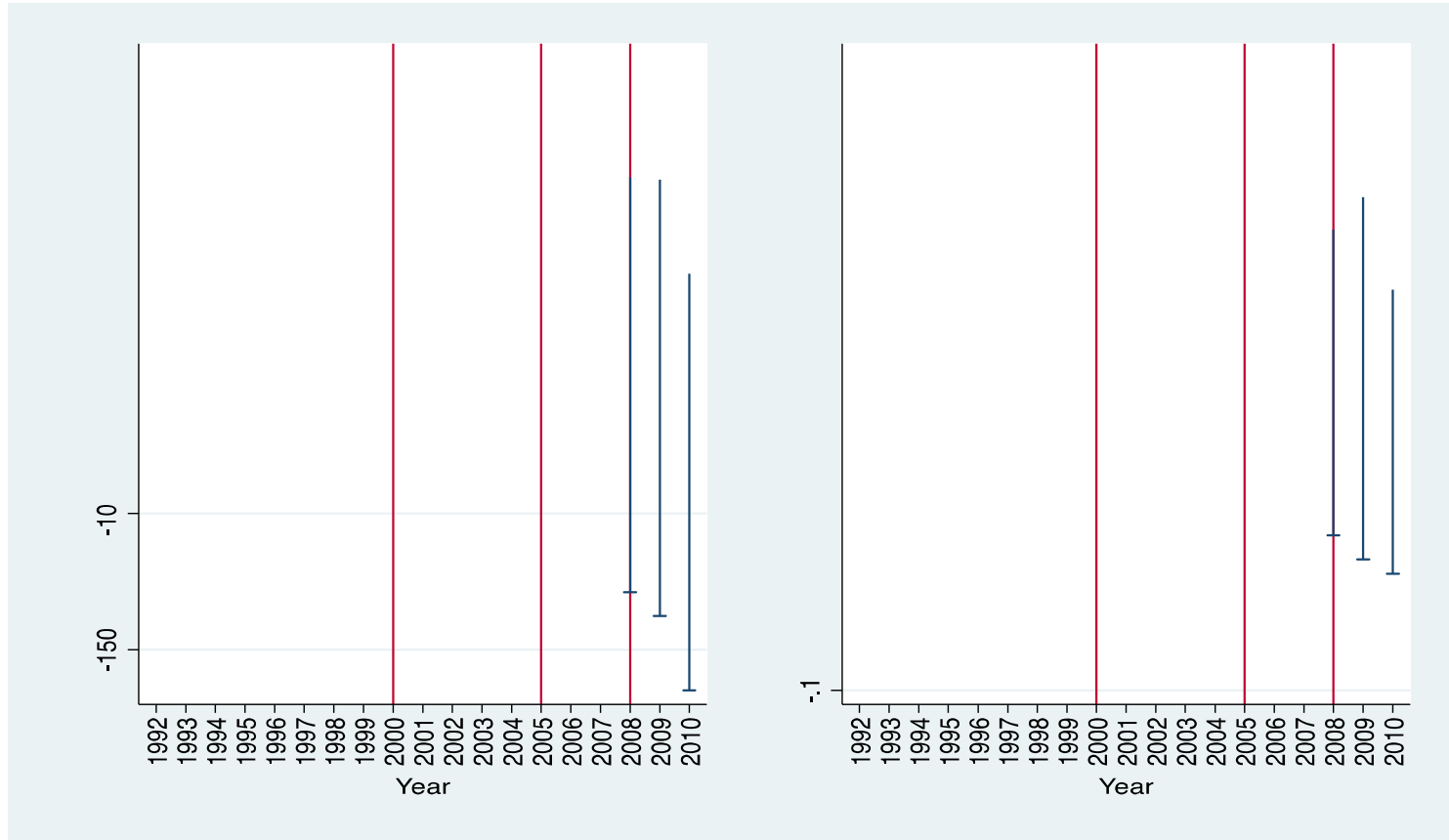
Average reduction of approx. 40,000t of CO2

$\ln(\text{EMP})$ and $\ln(\text{GHG}/\text{EMP})$



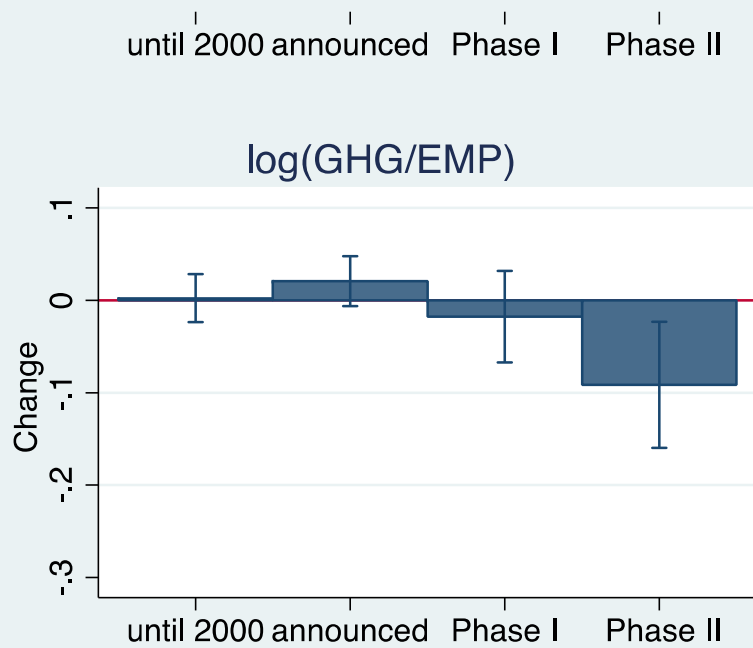
Decline in employment as well but
GHG intensity declines nevertheless

EMP and GHG/EMP



Decline in employment as well but
GHG intensity declines nevertheless

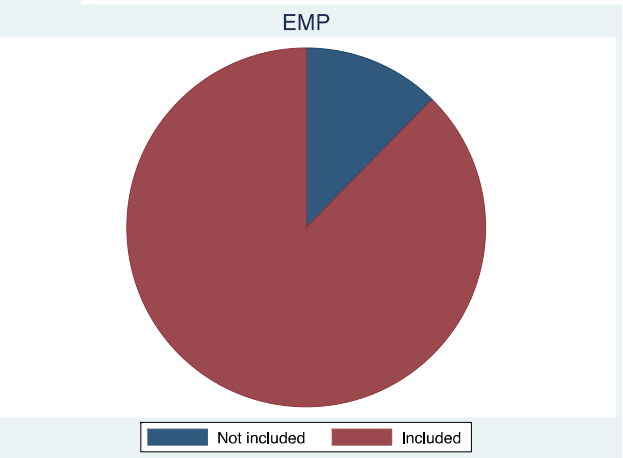
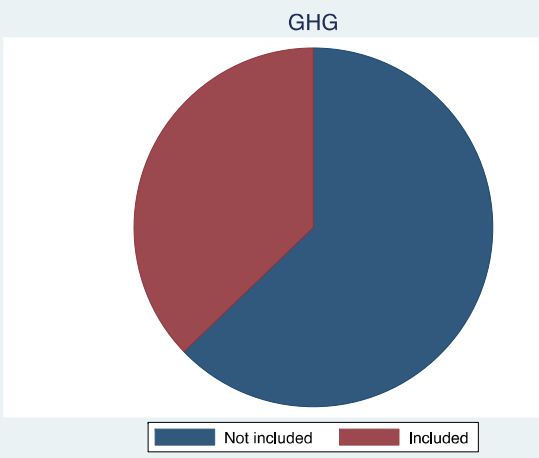
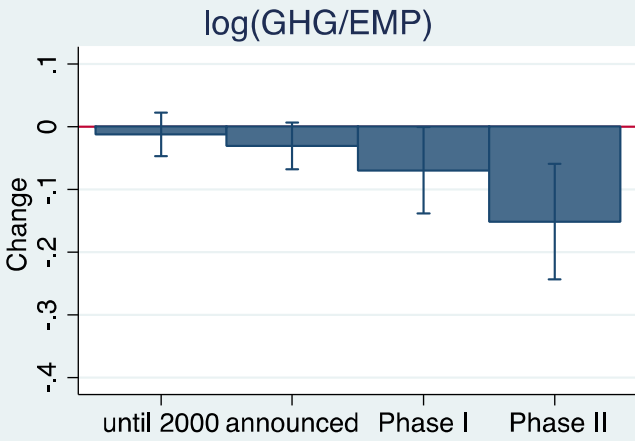
Summary %



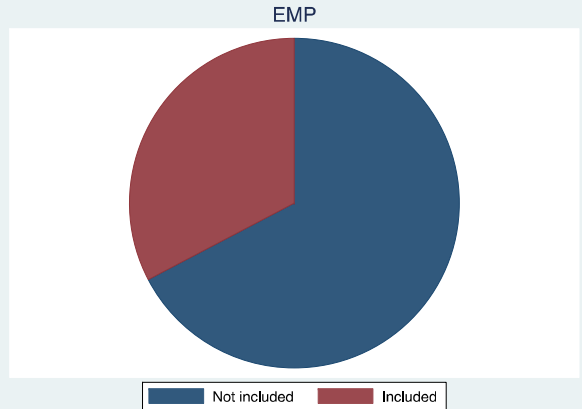
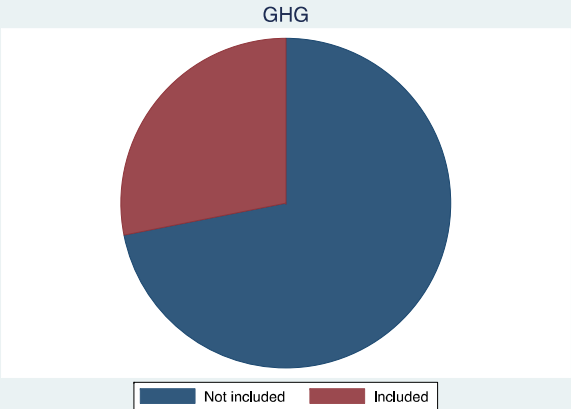
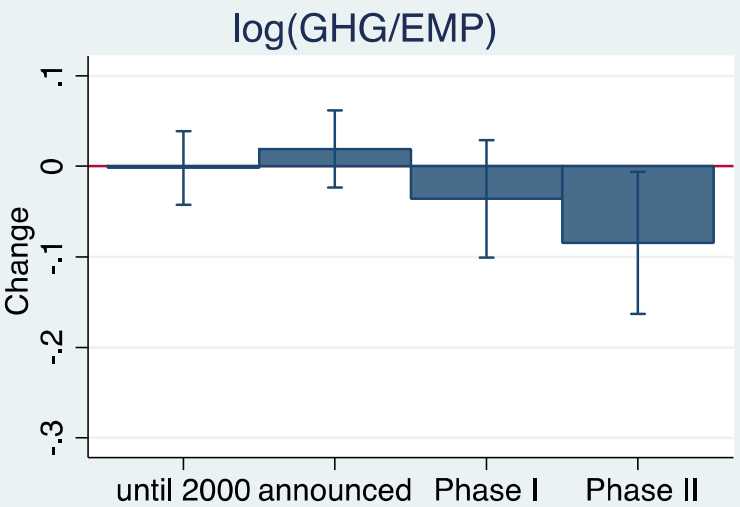
until 2000 announced Phase I Phase II

Almost 20% average reduction in GHGs

Robustness – 10% NN only



Robustness – balanced sample



Leakage?

Are our results due to

- Global net reductions?
- Or leakage?

We cannot assess directly

However we can examine within firm leakage for multi-plant firms

Leakage within plants?

	(4) (2000)	(4) (2000)
GHG emissions ($\Delta \ln(GHG)$)		
Pre-Announcement SATT	-0.028 (0.019)	0.009 (0.017)
Announcement Phase SATT	-0.009 (0.020)	-0.000 (0.016)
Phase I (2005-2007) SATT	-0.109*** (0.037)	0.004 (0.032)
Phase II (2008-2010) SATT	-0.313*** (0.073)	-0.087** (0.042)

- Effects stronger for single plant firms
- If there was within firm leakage we would expect the opposite

Single-plant firms

Multi-plant firms

Firm level

	(5) Base Year (2000)
GHG emissions ($\Delta \ln(GHG)$)	
Pre-Announcement SATT	0.008 (0.013)
Announcement Phase SATT	0.013 (0.017)
Phase I (2005-2007) SATT	-0.003 (0.032)
Phase II (2008-2010) SATT	-0.104** (0.043)

Trade?

	(1) log(Total Exports)	(2) log(Total)	(3) log(EU)	(4) log(EU)	(5) log(Non-EU)	(6) log(Non-EU)
Pre-Announcement SATT	-0.033 (0.030)	-0.034 (0.031)	-0.046 (0.030)	-0.048 (0.031)	0.007 (0.026)	0.007 (0.026)
Announcement Phase SATT	0.011 (0.008)	0.013 (0.008)	0.017** (0.008)	0.022** (0.025)	-0.000 (0.010)	-0.002 (0.011)
Phase I (2005-2007) SATT	0.017 (0.021)	0.022 (0.024)	0.028 (0.022)	0.038 (0.025)	-0.008 (0.022)	-0.012 (0.026)
Phase II (2008-2010) SATT	-0.026 (0.032)	-0.018 (0.038)	-0.007 (0.032)	0.005 (0.037)	-0.032 (0.031)	-0.030 (0.037)

Conclusion

- Evidence that ETS reduced emissions (10 to 20% on average)
- Gains come from increased carbon efficiency
- No evidence of within firm leakage
- Could be indication that there is no between firm leakage
- However: some evidence of negative employment effects

The road ahead

More outcomes

- Output, intermediates, profits, prices, productivity, entry, exit, restructuring, fuel switching etc.)

Heterogeneity?

Exploring within plant effects better

More countries

- UK
- Germany
- Belgium

A photograph of several industrial smokestacks emitting thick plumes of dark smoke against a bright, hazy sunset sky. The sun is low on the horizon, creating a strong orange and yellow glow. The smokestacks are silhouetted against the bright light.

Thanks

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