THE JOINT IMPACT OF THE EUROPEAN UNION EMISSIONS TRADING SYSTEM ON CARBON EMISSIONS AND ECONOMIC PERFORMANCE

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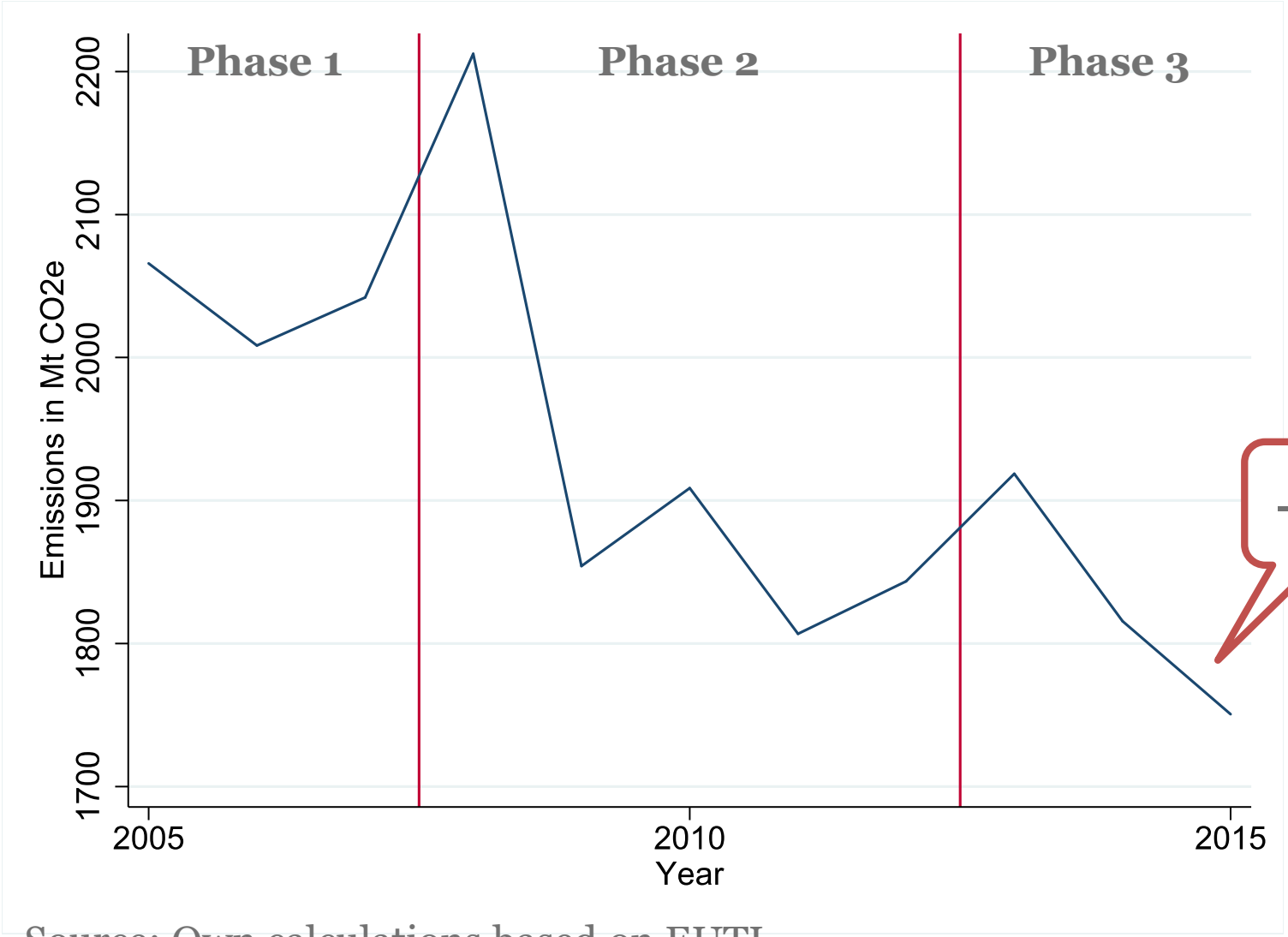
BETTER POLICIES FOR BETTER LIVES

EU ETS: background

- Running since 2005 across 31 countries
- 12,000 covered installations (~8,000 firms), 40% of European GHG emissions

- The largest carbon market in the world
  - Other markets in US, Canada, NZ, Korea, China
  - Plans in Japan, Chile, Mexico

Carbon emissions by EU ETS installations



Source: Own calculations based on EUTL

Questions

- Did the EU ETS cause the emissions decline?
- If so, did it affect the performance of regulated firms?

➢ Empirically analyse the *causal* impact of the EU ETS on carbon emissions & firm performance

  – Using firm and installation-level data

  – Across Europe

What should we expect?

- Emissions should decrease, if economics works
  - Uncertainty over the magnitude. Oil prices 25% higher 2005-2015 compared to 2005; recession
- Firm performance:
  - Basic economic theory predicts negative impact, but alternative hypotheses (e.g. Porter)
  - Empirical evidence: small but negative impacts of environmental regulation (Greenstone, 2002; Kahn and Mansur, 2010; Walker, 2011, 2013)

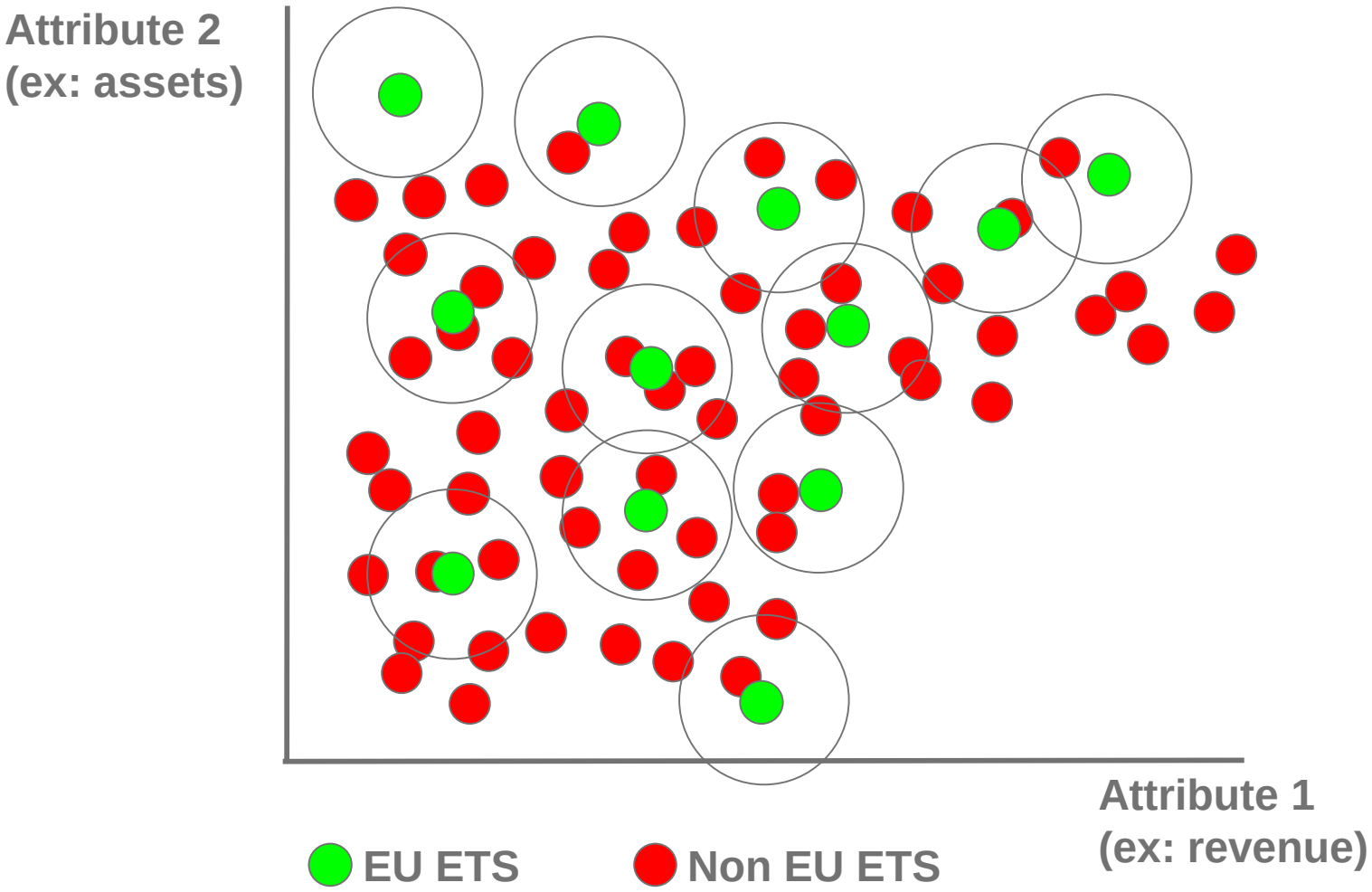
Evaluating the impact of EU ETS

- Not all carbon-emitting plants are regulated
  - Inclusion criteria at installation level related to **production capacity**
  - Combustion: thermal input > 20 MWh
  - Steel: production capacity > 2.5 tonnes per hour
  - Glass and glass fibre: melting capacity > 20 tonnes/day
- Establishing the policy's causal effect
  - A **natural experiment**: possible to use matching methods

A matching method

- Identify regulated installations & companies
- Construct a control group of similar but unregulated entities and compare with regulated entities
- Control group:
  - Same country, same sector, similar pre-2005 characteristics (carbon emissions, financials) but below threshold
- Note: theoretically less clean at installation level but production capacity unobserved

Matching for dummies



What we are comparing

Hammer GmbH

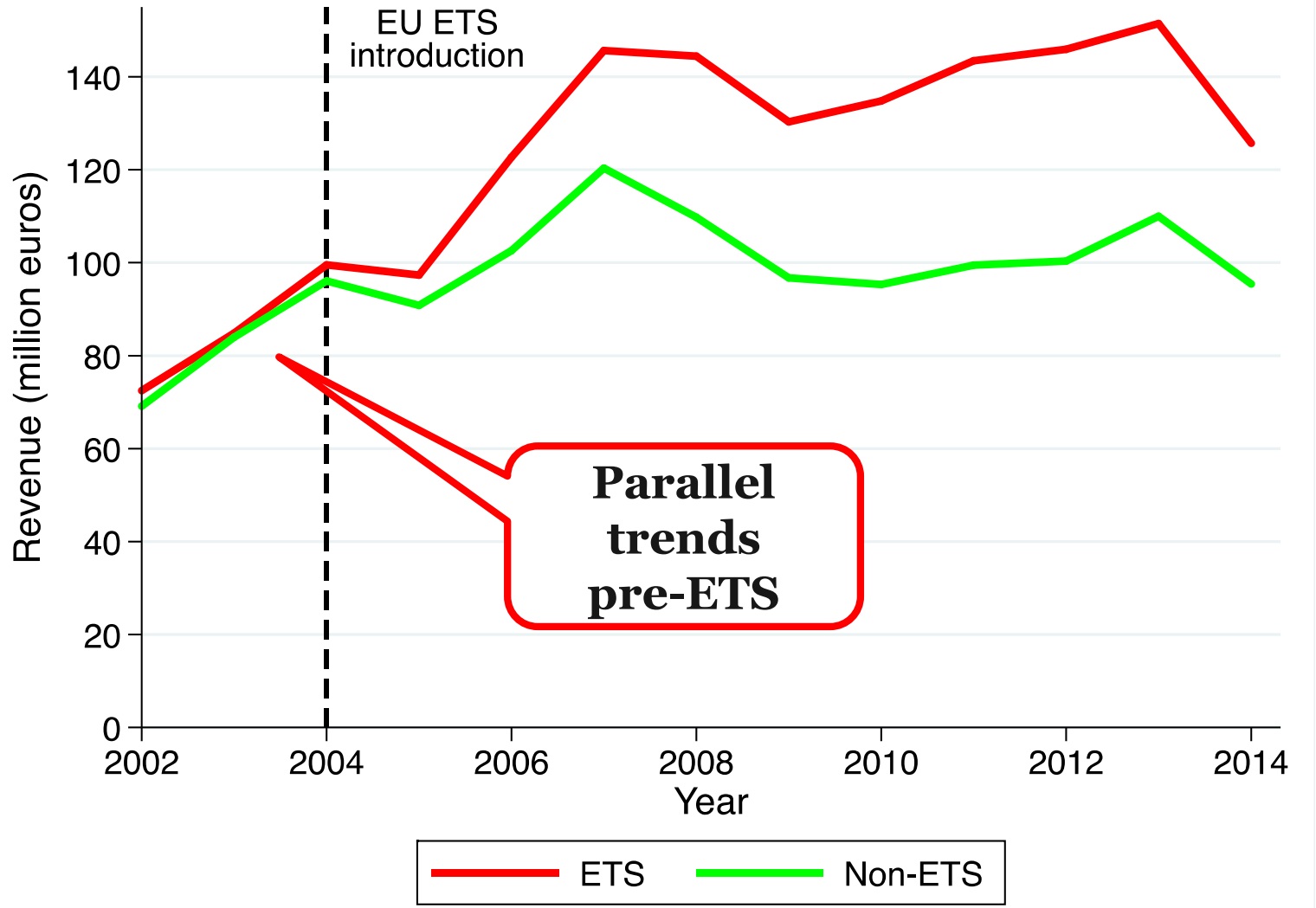
- NACE 1712 (Manufacture of paper and paperboard)
- 150 employees
- Turnover 26.9M
- Fixed assets 7.9M

Papierfabrik Hainsberg GmbH

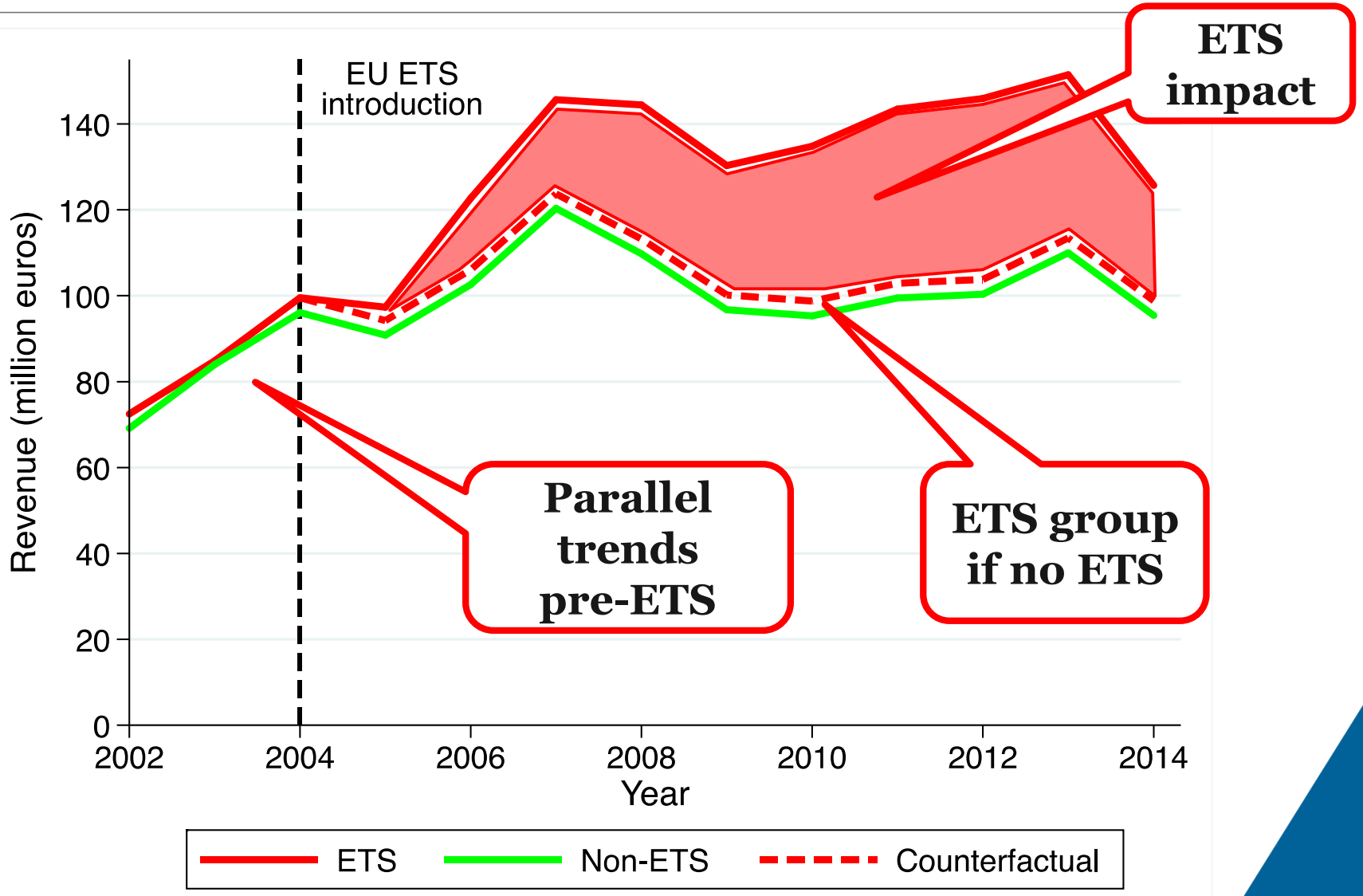
- NACE 1712 (Manufacture of paper and paperboard)
- 152 employees
- Turnover 25.9M
- Fixed assets 9.7M

EU ETS impact?

ETS effect: ex. firms' revenue



ETS effect : ex. firms' revenue



Complications

- **Direct spillovers**: If firm A is regulated and suffers from carbon price, this should benefit its competitors
  - Competitors operating in the same market also provide the best comparators
- **Indirect treatment** through higher electricity prices (general equilibrium effects)

➢ We can only capture the **net effect** of the EU ETS (ie, competitiveness effect)

IMPACT ON CARBON EMISSIONS

Emissions Data

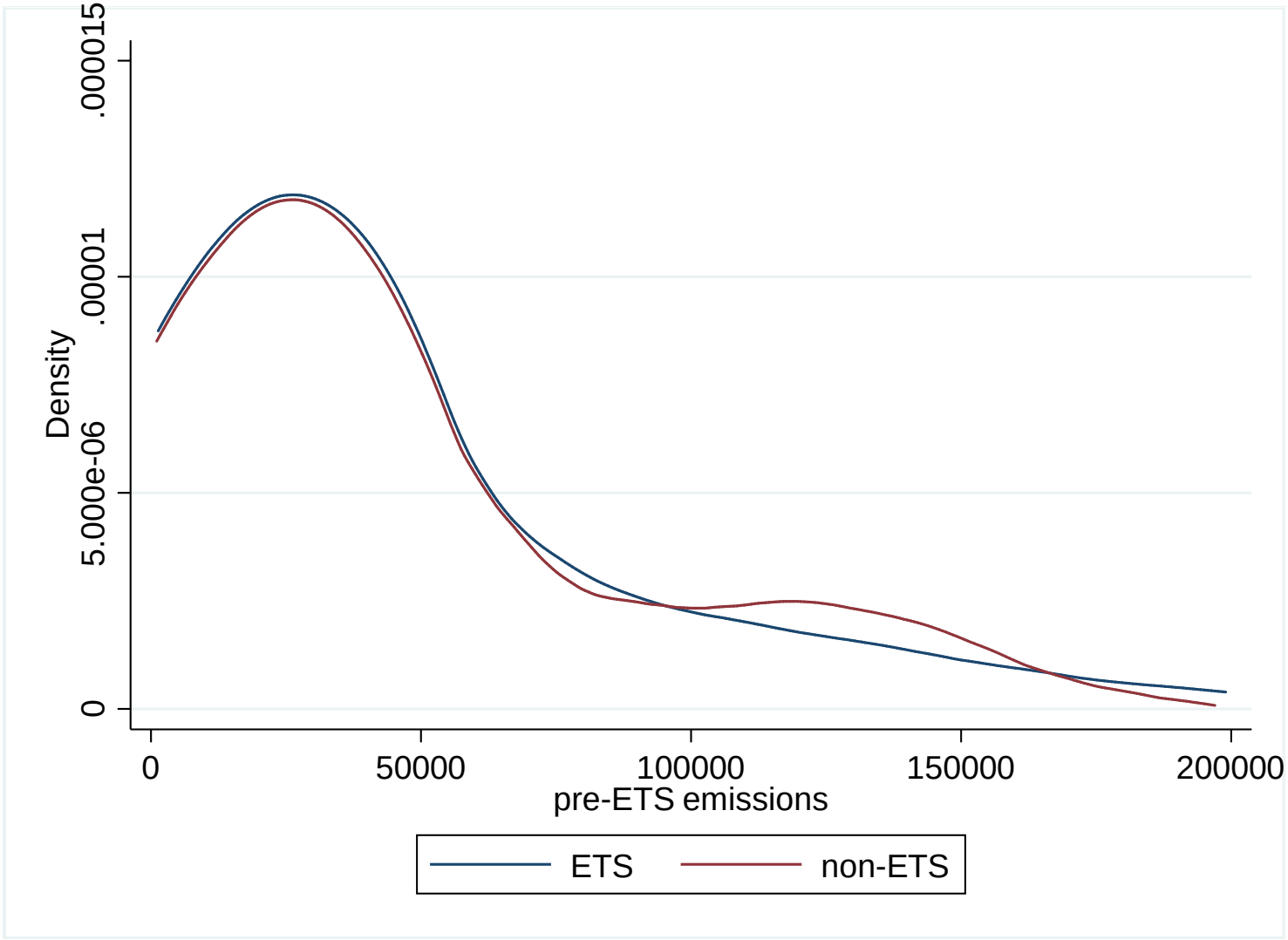
- National Pollution Release and Transfer Registries (PRTR)
  - At installation level (pre and post ETS)
  - Small enough reporting threshold in France, Netherlands, Norway, UK

Country	France	Netherlands	Norway	UK
Coverage since	2003	1990	1997	1998
Reporting threshold CO2	10 kt	<1 kt	<1 kt	10 kt
# installations	14797	1849	1447	5500
- with CO2 emissions	1671	1596	499	1024
- covered by EU ETS	912	294	113	509

Matching

- Nearest neighbour matching on
  - Country
  - Economic sector
  - Pre-ETS emissions
  - Pre-ETS emissions growth rate
- Focus on manufacturing

After matching: Emissions distribution

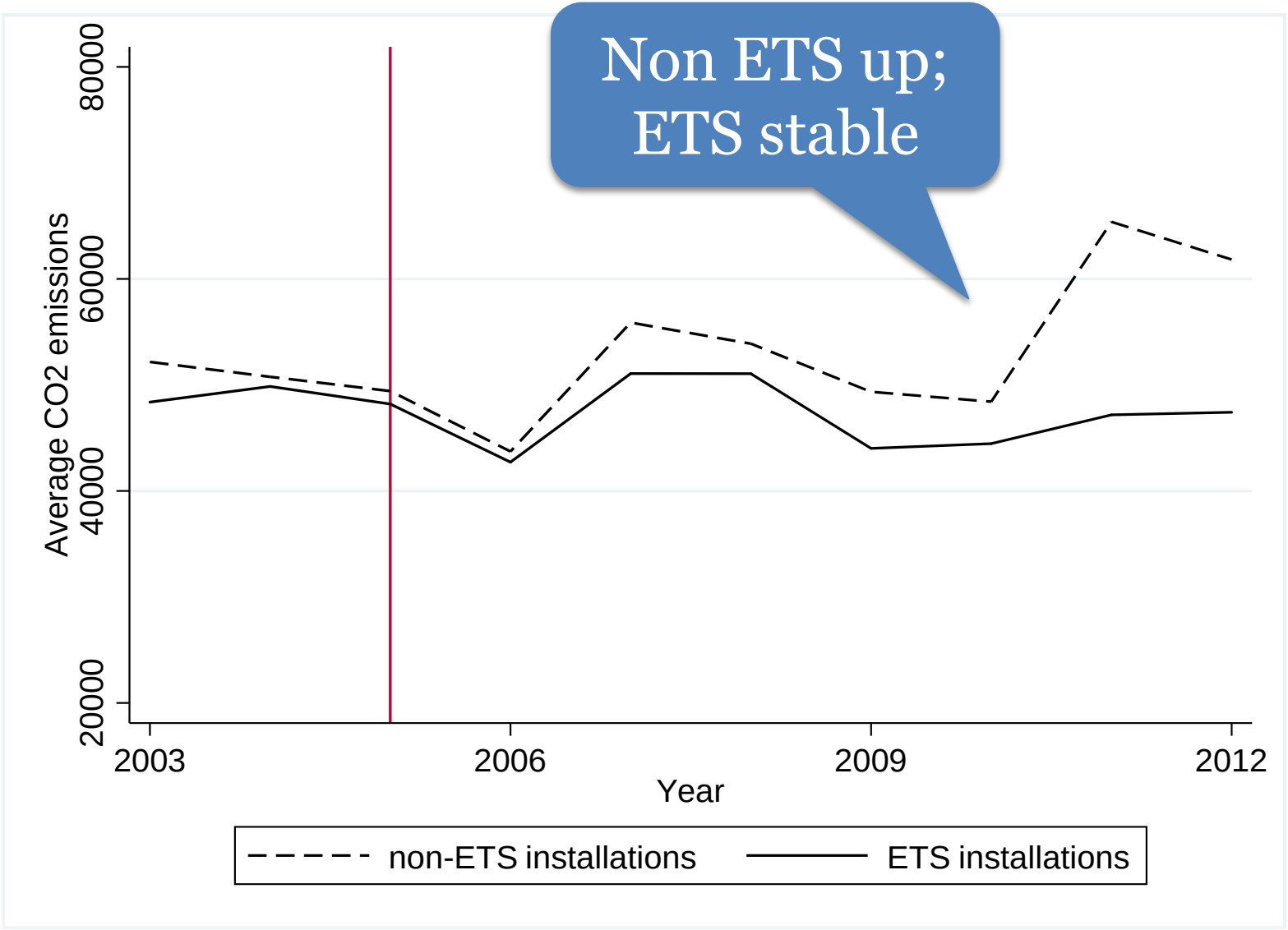


Limited sample

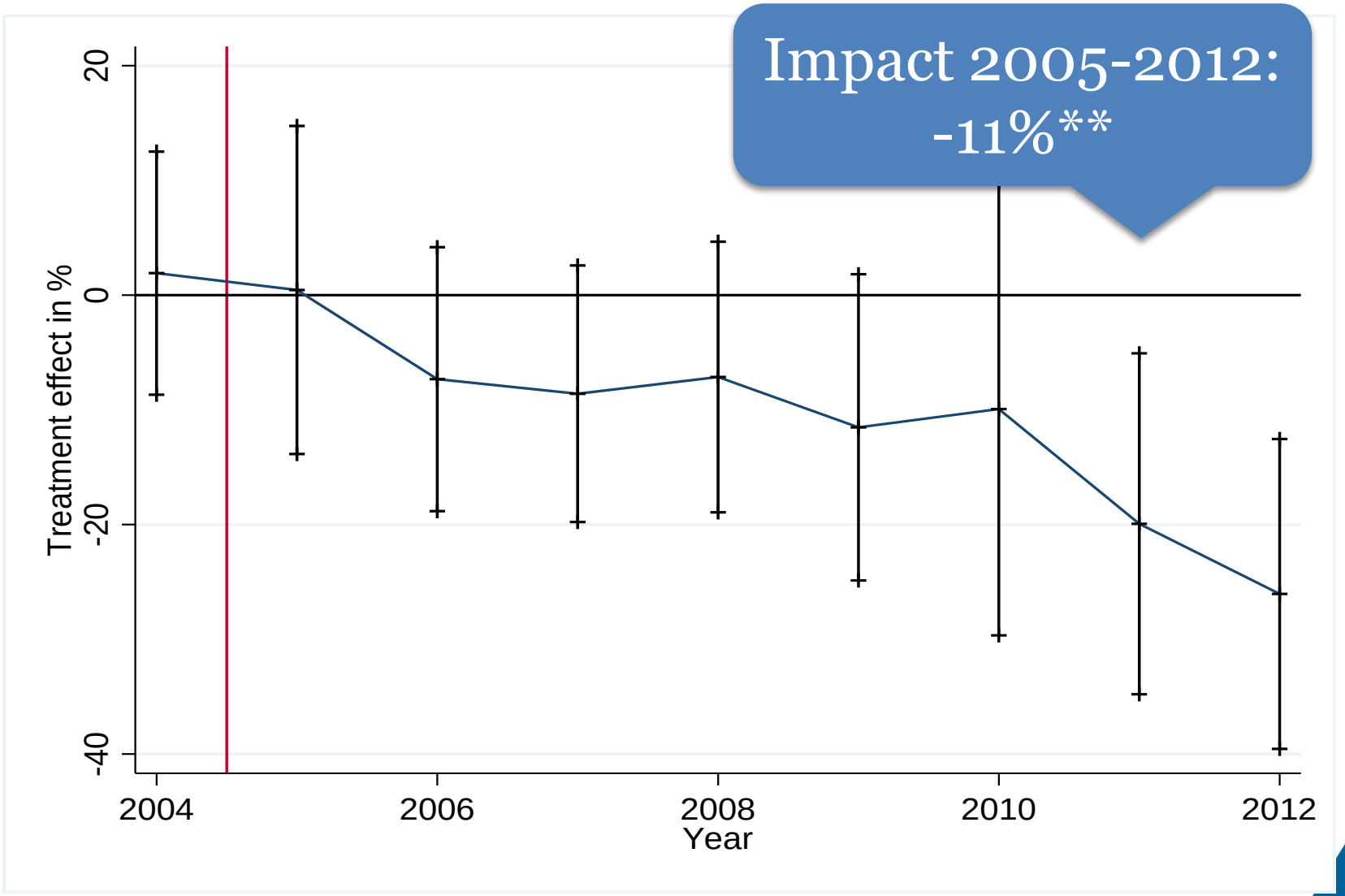
- Small sample: 400 installations
  - But unbiased
- Explore sensitivity

	# installations		# observations	
Country	ETS	non-ETS	ETS	non-ETS
France	169	96	1352	768
Netherlands	38	45	190	181
Norway	7	5	84	55
United Kingdom	26	22	305	219
Total	240	168	1931	1223

Emissions after matching



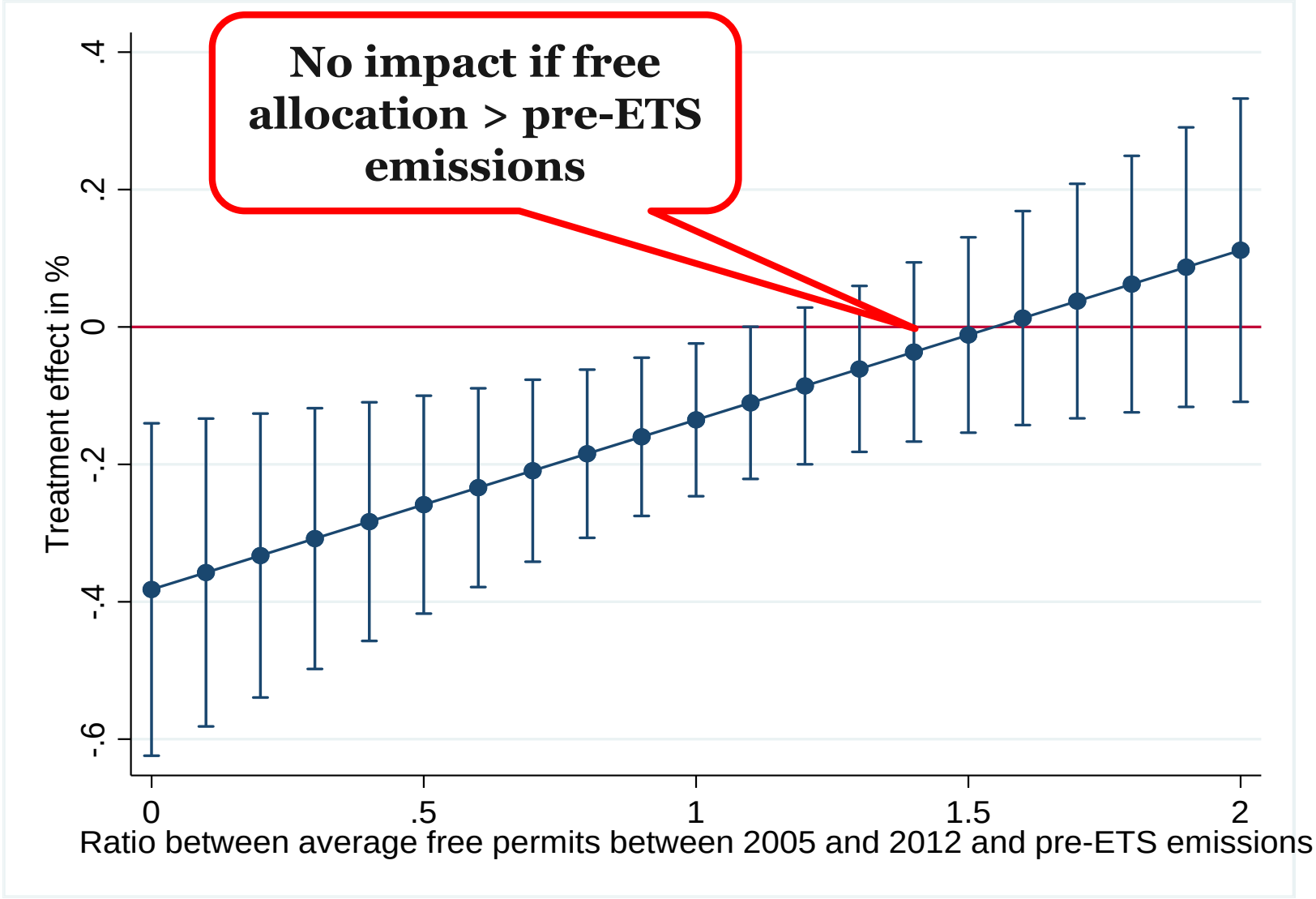
ETS impact on emissions by year



Robustness

Robustness check	Point estimate	# Inst.	# Obs.
Remove 1% largest installations	-0.08**	403	3124
	(0.04)		
Remove most influential installations	-0.06*	393	3040
	(0.03)		
Not subtract emissions from biofuels	-0.11*	407	3153
	(0.06)		
Remove unbalanced installations	-0.11	185	1818
	(0.07)		
Add verified emissions from EUTL	-0.16**	407	3490
	(0.07)		
only if matched control is non-missing	-0.12*	407	3262
	(0.06)		
Add zero emissions for exiting installations	-0.12**	407	3288
	(0.06)		
Match on NACE 2-digit code	-0.07*	673	5393
	(0.04)		

Impact of free allowances on ETS effect



IMPACT ON FIRM PERFORMANCE

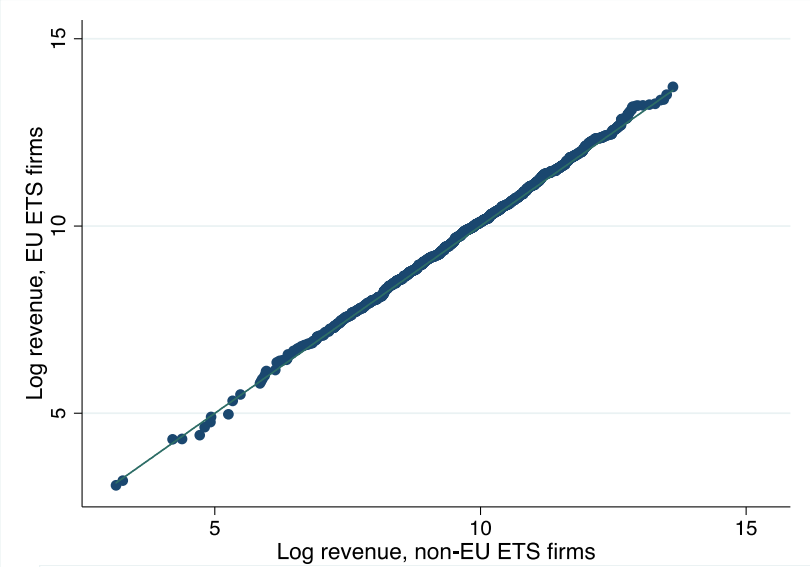
Firm performance data

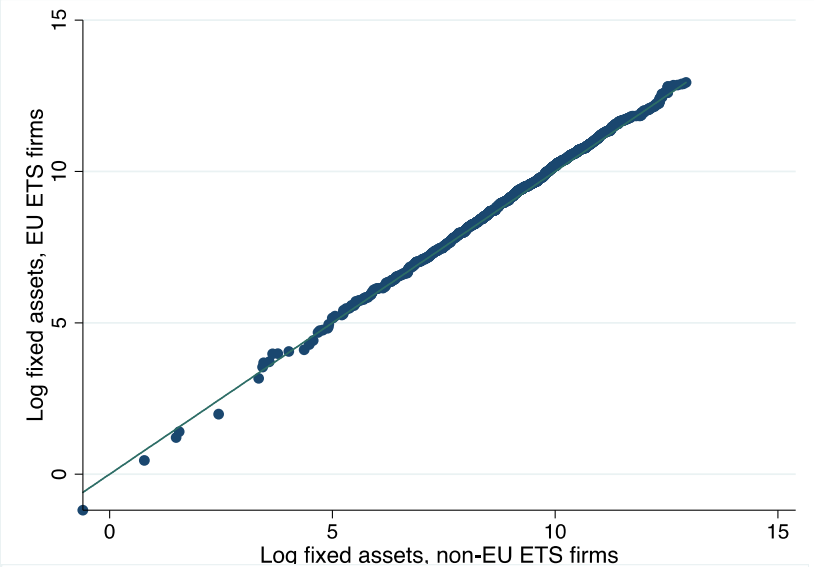
- Orbis global financial database
  - At firm level (pre and post ETS)
  - **All EU ETS countries**
- EU ETS companies: own at least one EU ETS installation
  - Match with installations using EU ETS-Orbis link from EUI FSR Climate

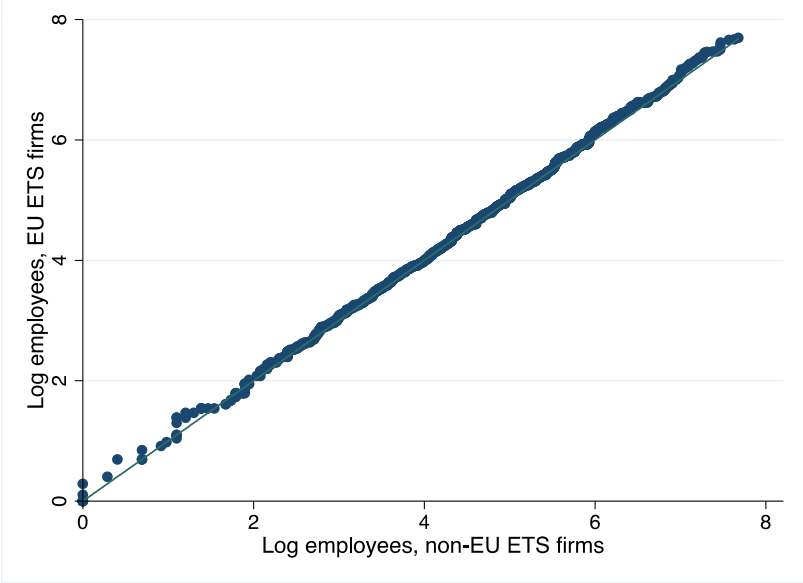
Matching

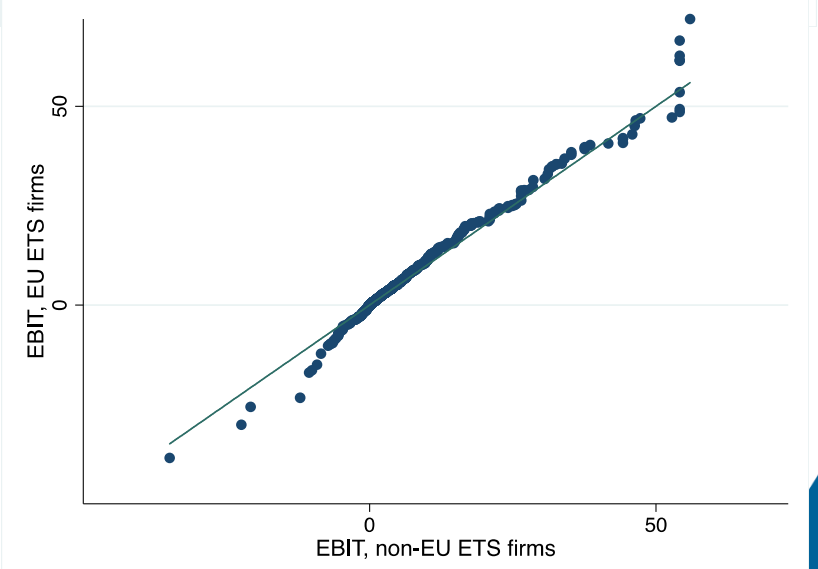
- Matching on:
  - Country
  - Sector
  - Turnover, fixed assets, employment and profit before 2005
- Good comparators for 2,217 EU ETS firms
  - Pre-2005 data not always available
  - No comparators for very large firms (ex.: EDF)

A good control group

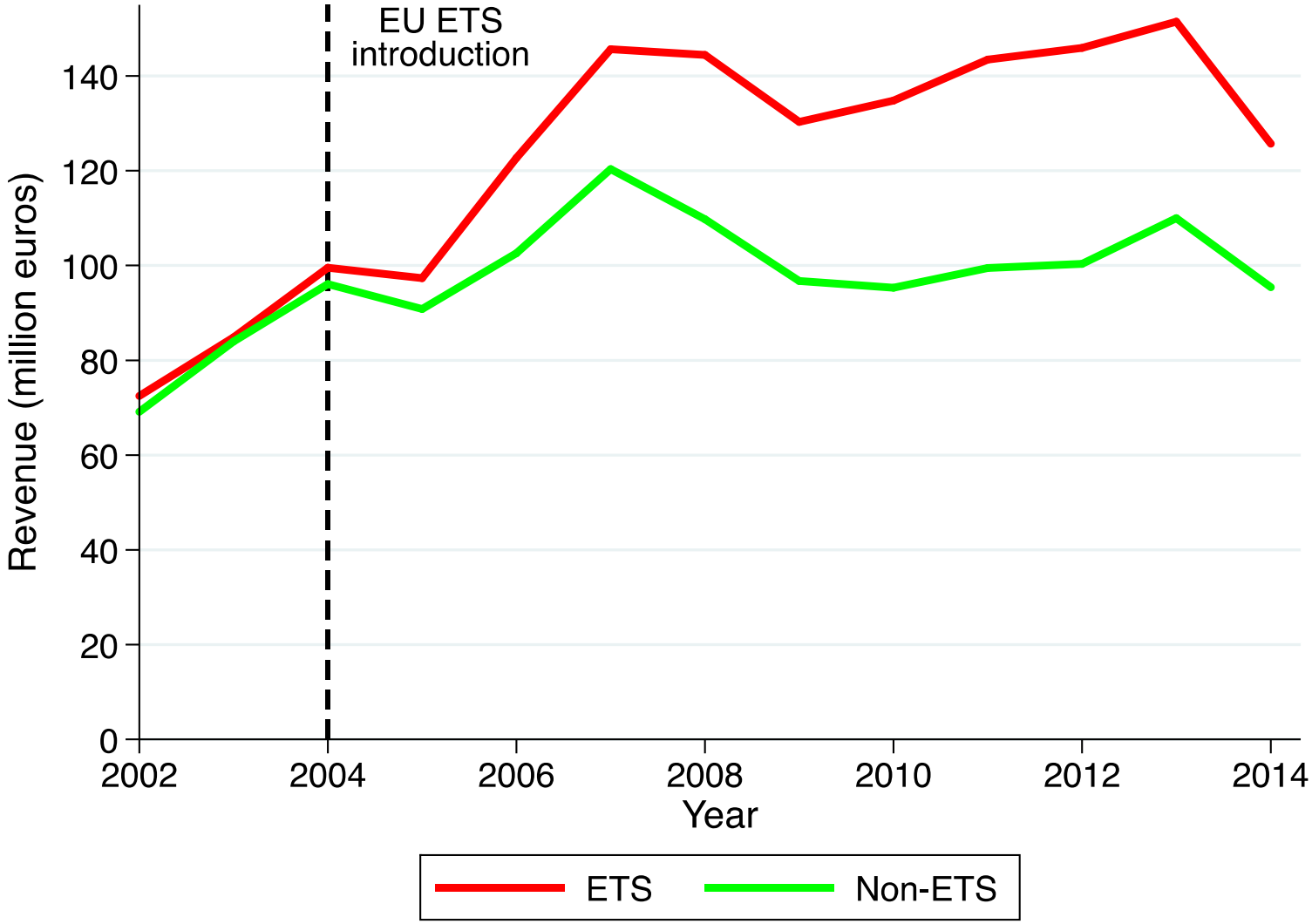




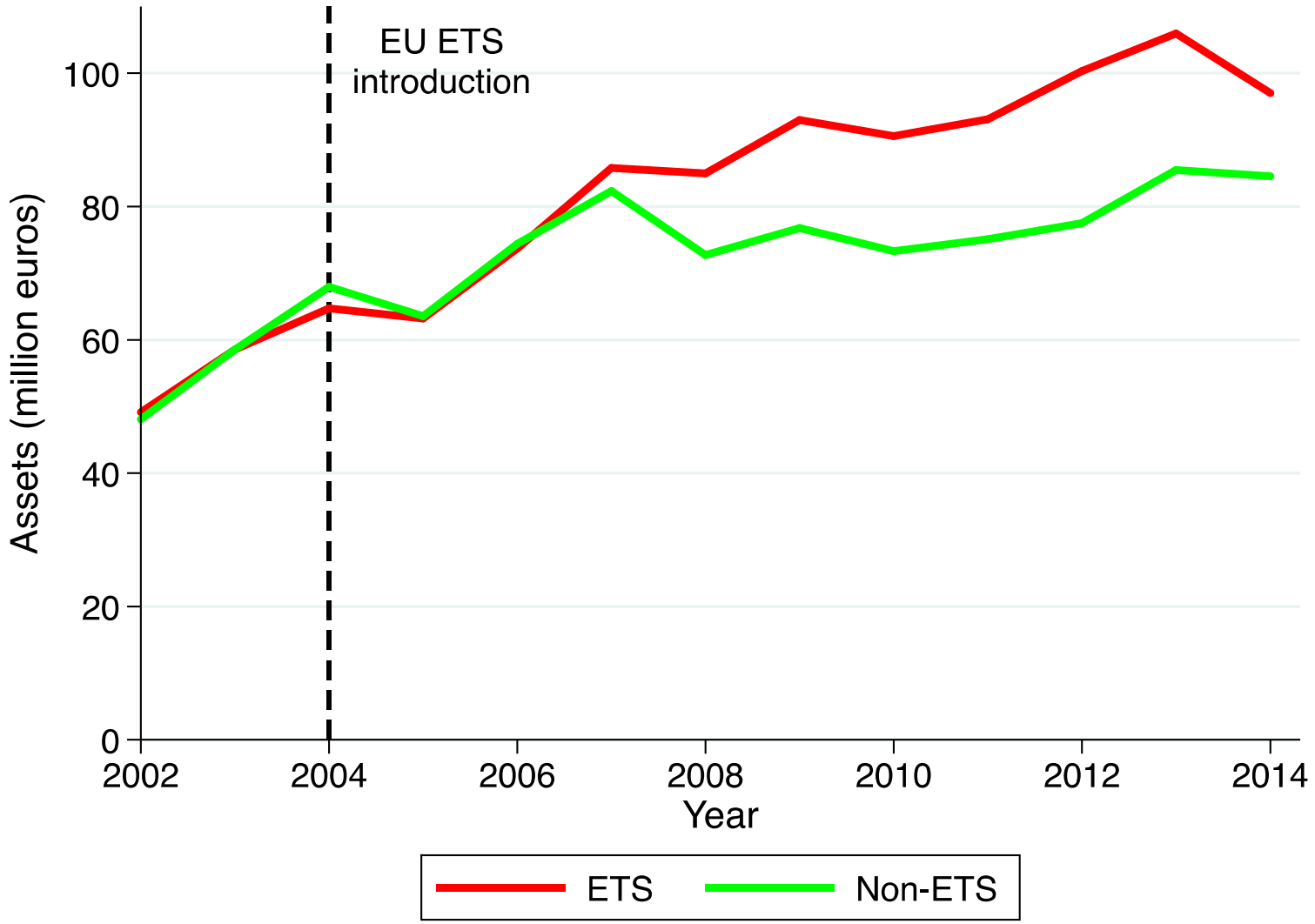




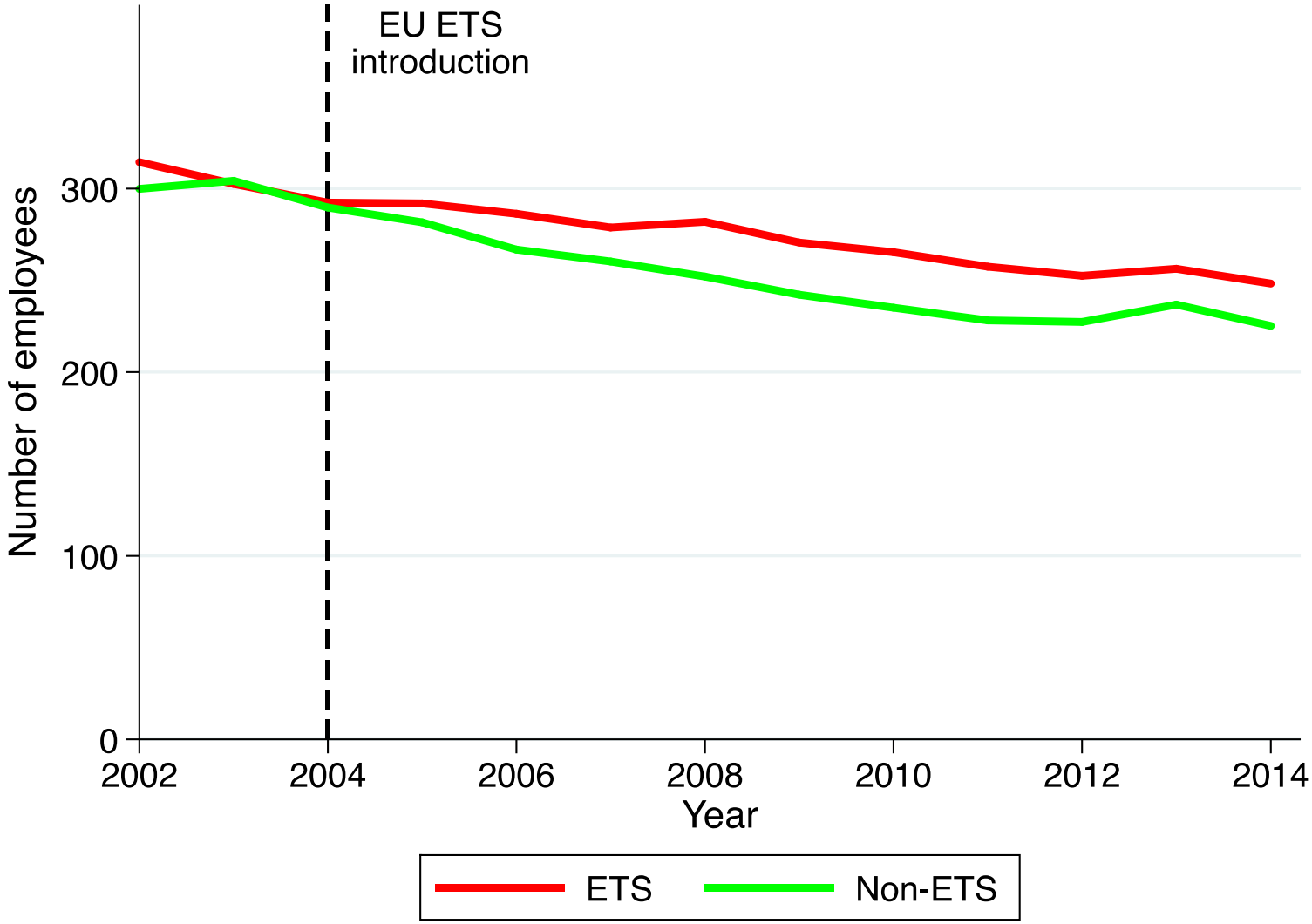
Revenue


EU ETS
introduction
Revenue (million euros)
0
20
40
60
80
100
120
140
2002
2004
2006
2008
2010
2012
2014
Year
ETS
Non-ETS

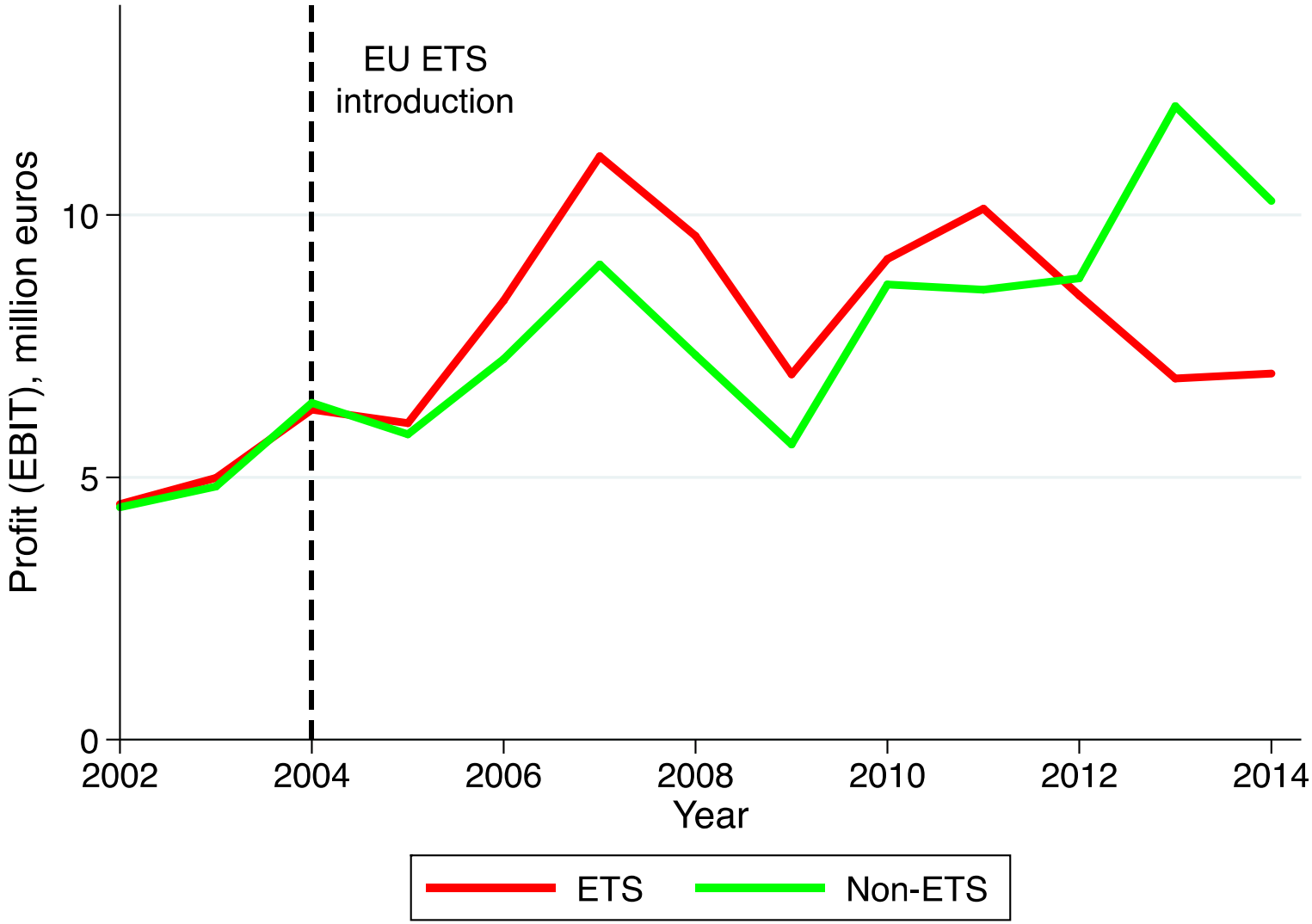
Fixed assets



Employees


EU ETS
introduction
Number of employees
300
200
100
0
2002
2004
2006
2008
2010
2012
2014
Year
ETS
Non-ETS

Profit


EU ETS
introduction
Profit (EBIT), million euros
0
5
10
2002
2004
2006
2008
2010
2012
2014
Year
ETS
Non-ETS

Summary of results

Outcome variable	Effect
Employment	+2% (not significant)
Profits	+280k€ (not significant)
Revenue	+8-16%***
Fixed assets	+6-8%***

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- Calel & Dechezleprêtre 2017: EU ETS caused +30% filings of low-carbon patents

Robustness

- Control for country- and sector-specific trends
- Keeping only firms observed throughout the whole sample period
- Replace values with missing within pairs
- Matching at NACE 2-digit or 4-digit level

Explanations

- Free allocations?
  - Effects stronger for firms in sectors deemed at risk of relocation
  - But effect in many sectors (not only electricity): esp. Non-Metallic Minerals and Basic Metals
  - Assume 100% cost pass-through with free allowances: can only explain 20% of the effect on revenue
- Productivity improvements?
  - Stronger effect on revenue and employment for firms that reduced emissions the most

Comparison with other micro studies

- Commins et al 2011: EU ETS +1.5% employment, -3% TFP growth
- Abrell et al 2011: no stat. sign. impact of EU ETS on value added, profit margin or employment.
- Wagner et al 2014 (**France**): no stat. sign. impact on employment
- Petrick & Wagner 2014 (**Germany**): no stat. sign. impact on employment, turnover or exports
- Klemetsen et al 2016 (**Norway**): increases in value added and labor productivity
- Jaraite and Di Maria 2016 (**Lithuania**): no stat. sign. impact on profitability
- Calligaris et al 2018 (**Italy**): positive impact on TFP

Conclusion

- The EU ETS seems to have:
  - Modestly reduced emissions (in line with modest price)
  - Without damaging firms' competitiveness, and even improving their performance
  - Incentivized investment and low carbon innovation (Calel & Dechezleprêtre 2016)
- The big questions
  - What are the mechanisms?
  - What will happen when the carbon price increases?

For more information:

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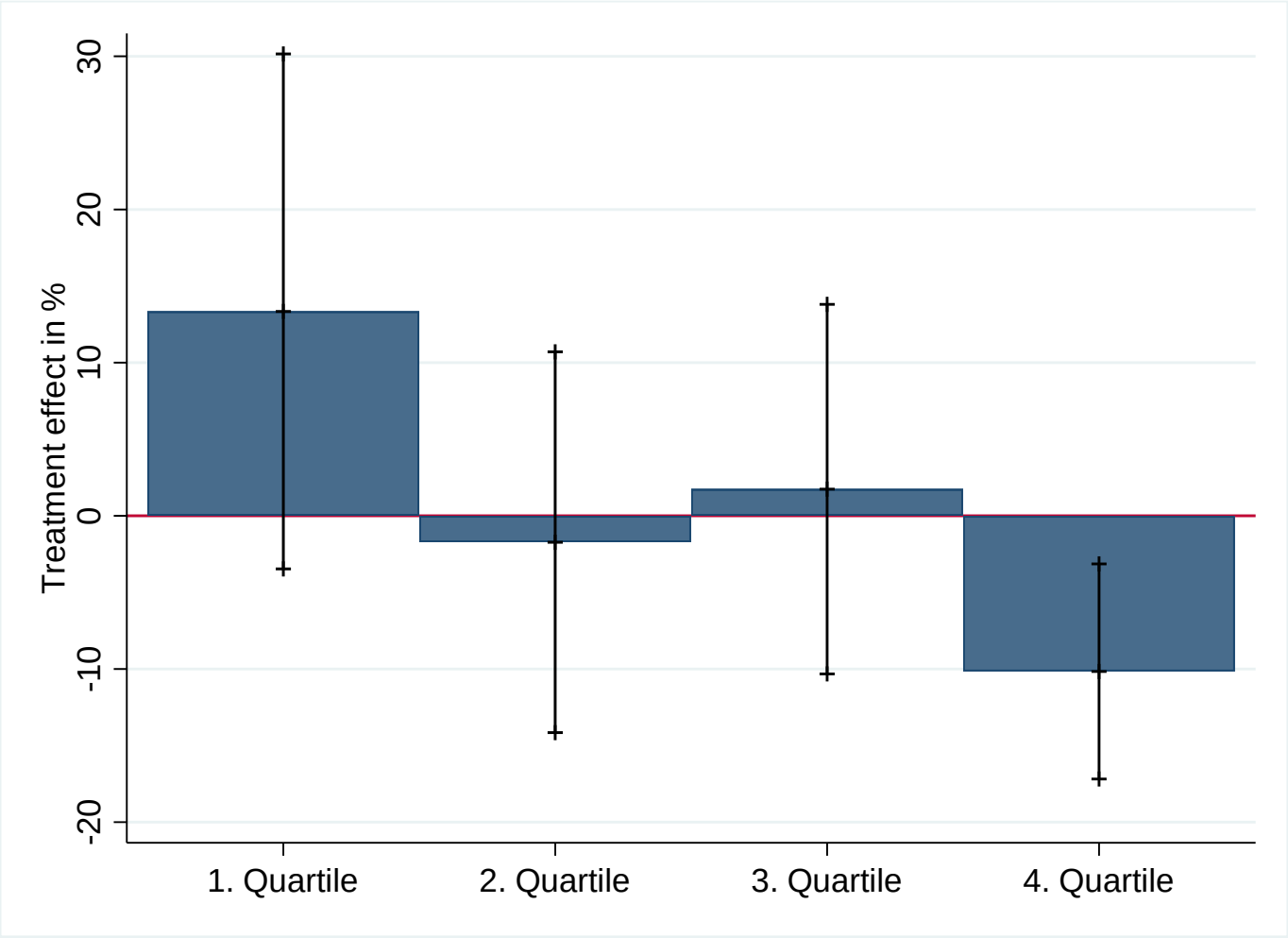
BETTER POLICIES FOR BETTER LIVES

Back up

Implied elasticity

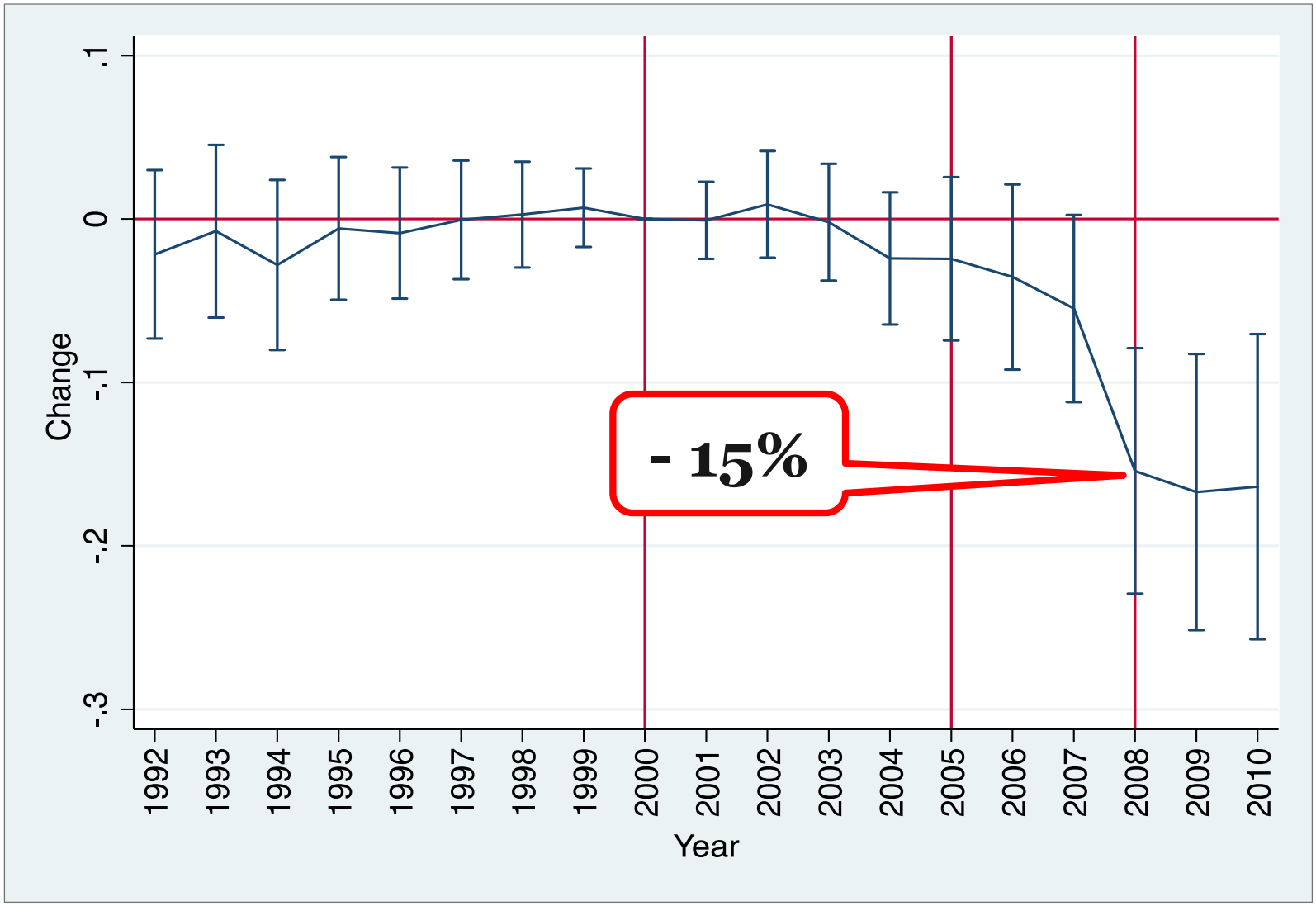
- Average price of carbon over the period:
  10€/tCO2
- 10€/tCO2 increases electricity prices by
  2.5-7.5€/MWh (Lise et al 2010)
- Average electricity costs in Europe:
  15-20€/MWh
- So EU ETS increased electricity prices by
  20-50%
- Implied carbon price elasticity of our results:
  0.2/0.5

Results by size (pre-ETS emissions)

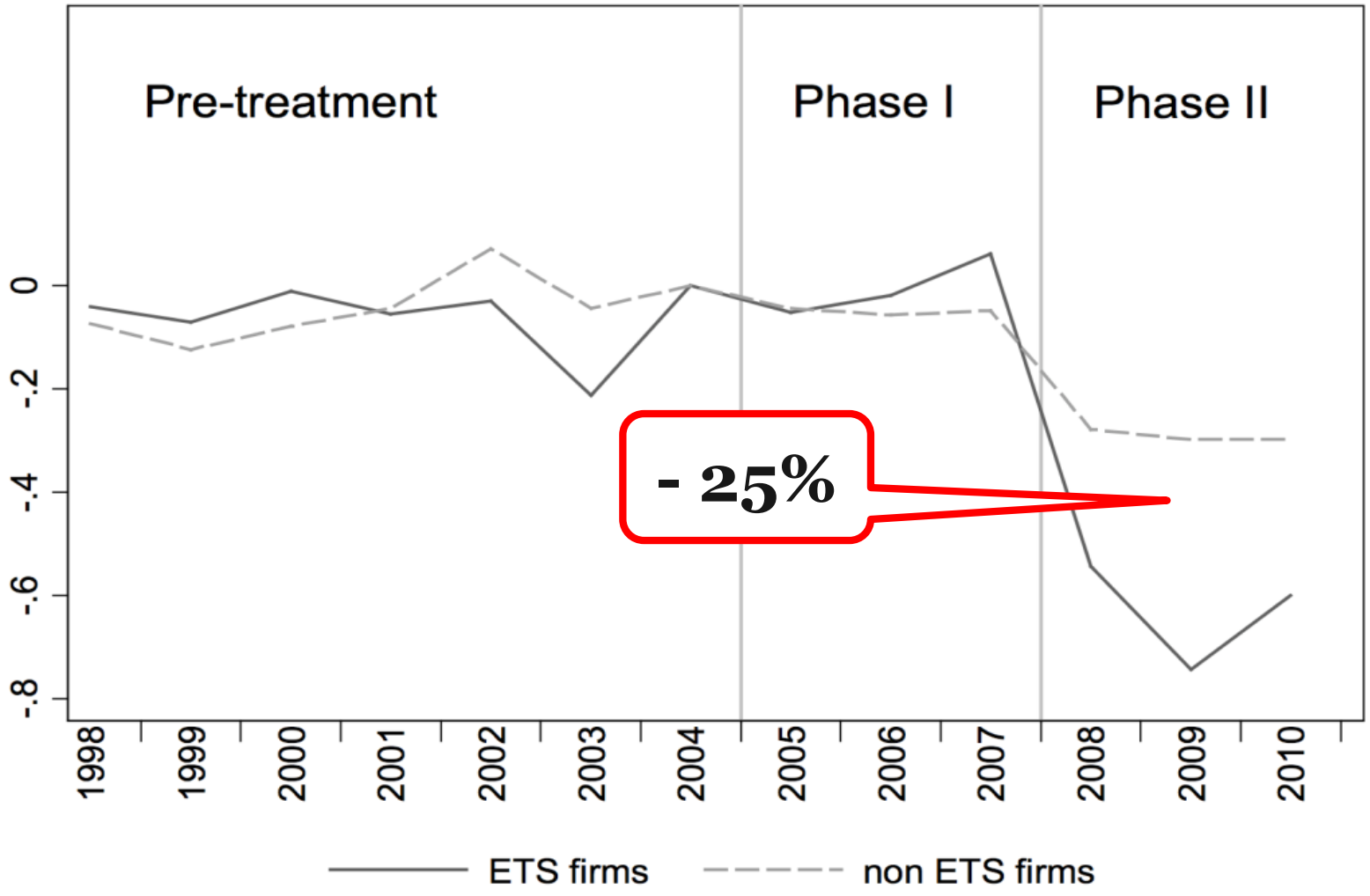


Price of EU ETS allowances 2005-2015

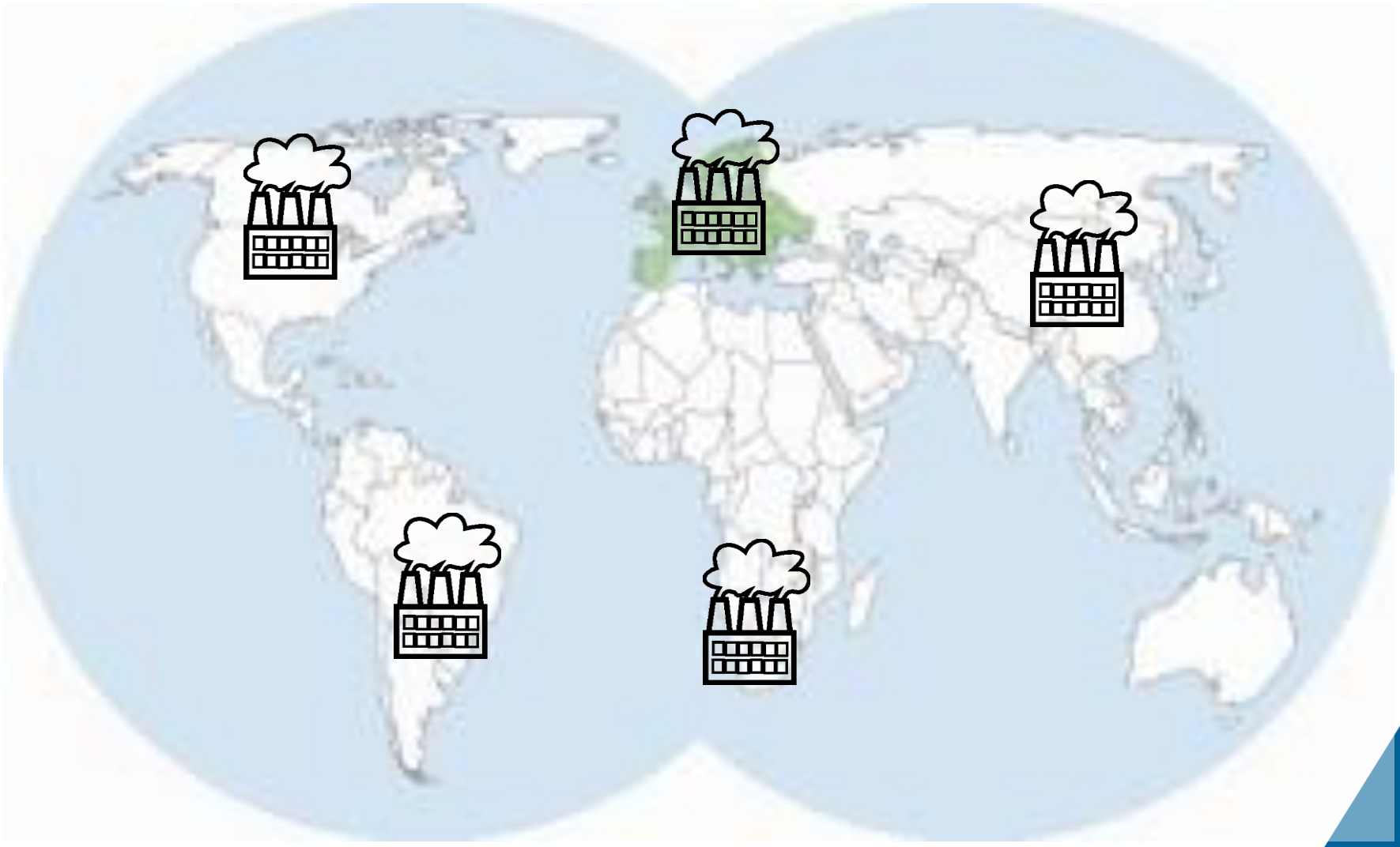
Impact in France (Wagner et al 2014)



Impact in Germany (Petrick & Wagner 2014)



Is it simply leaking?



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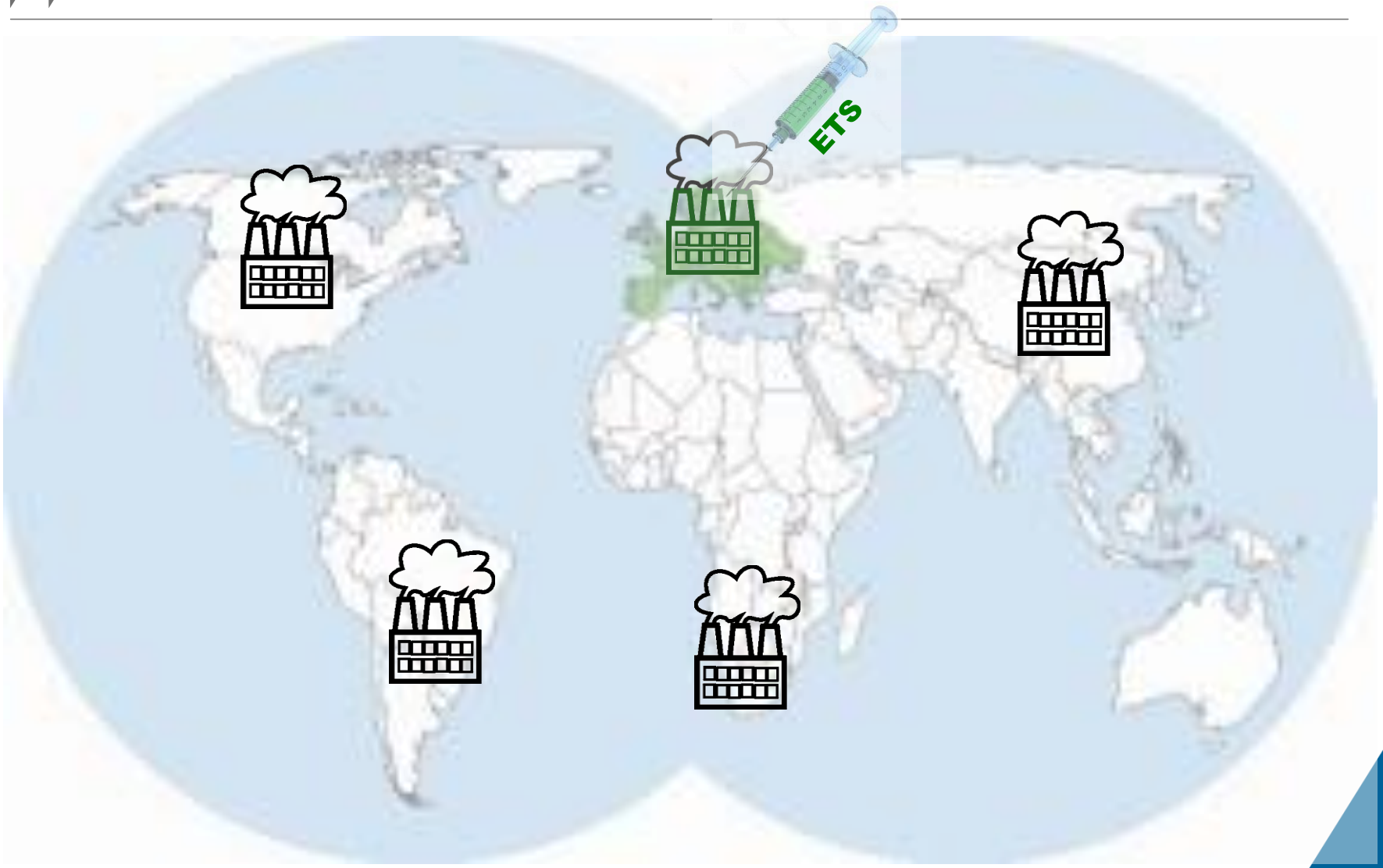

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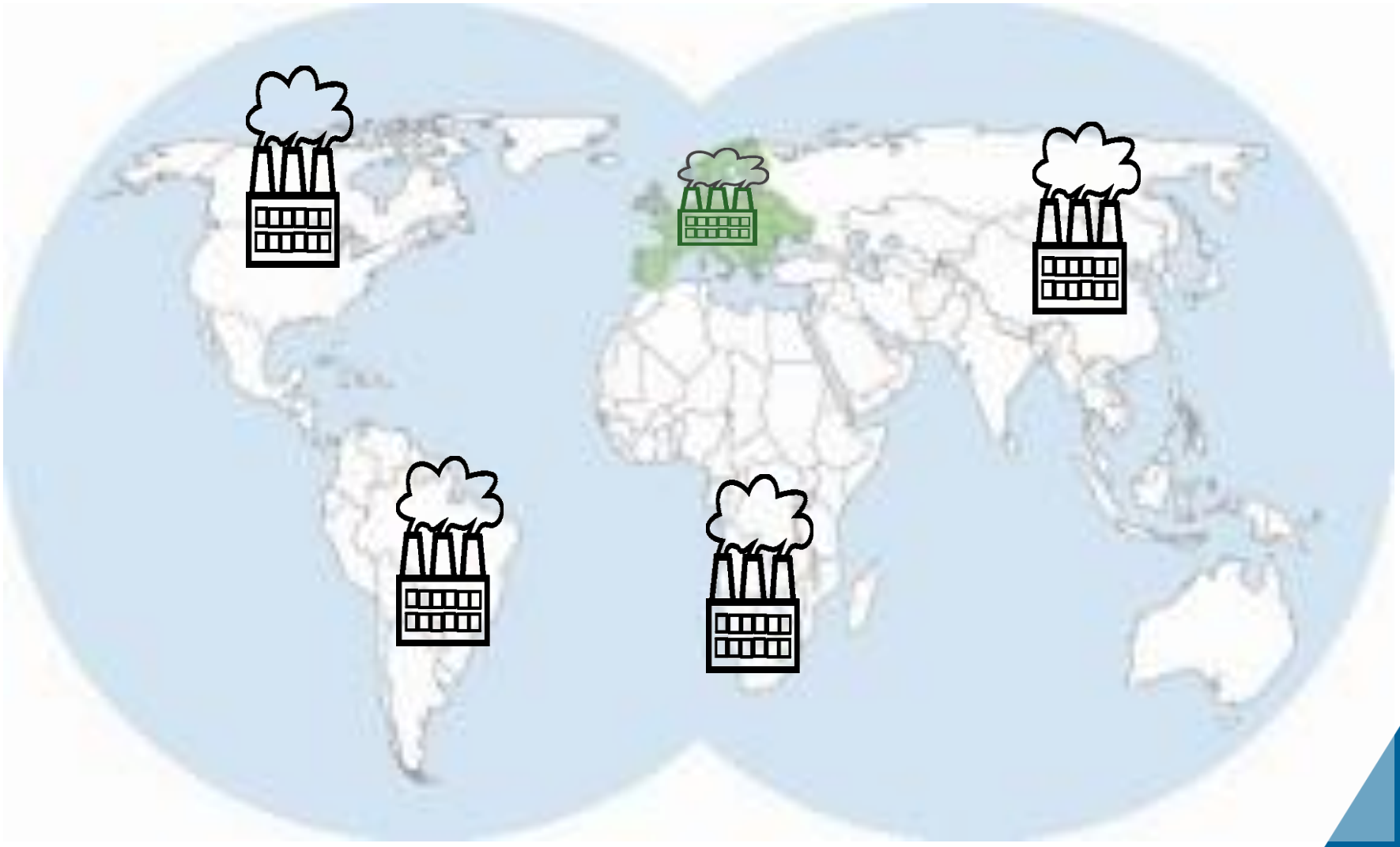
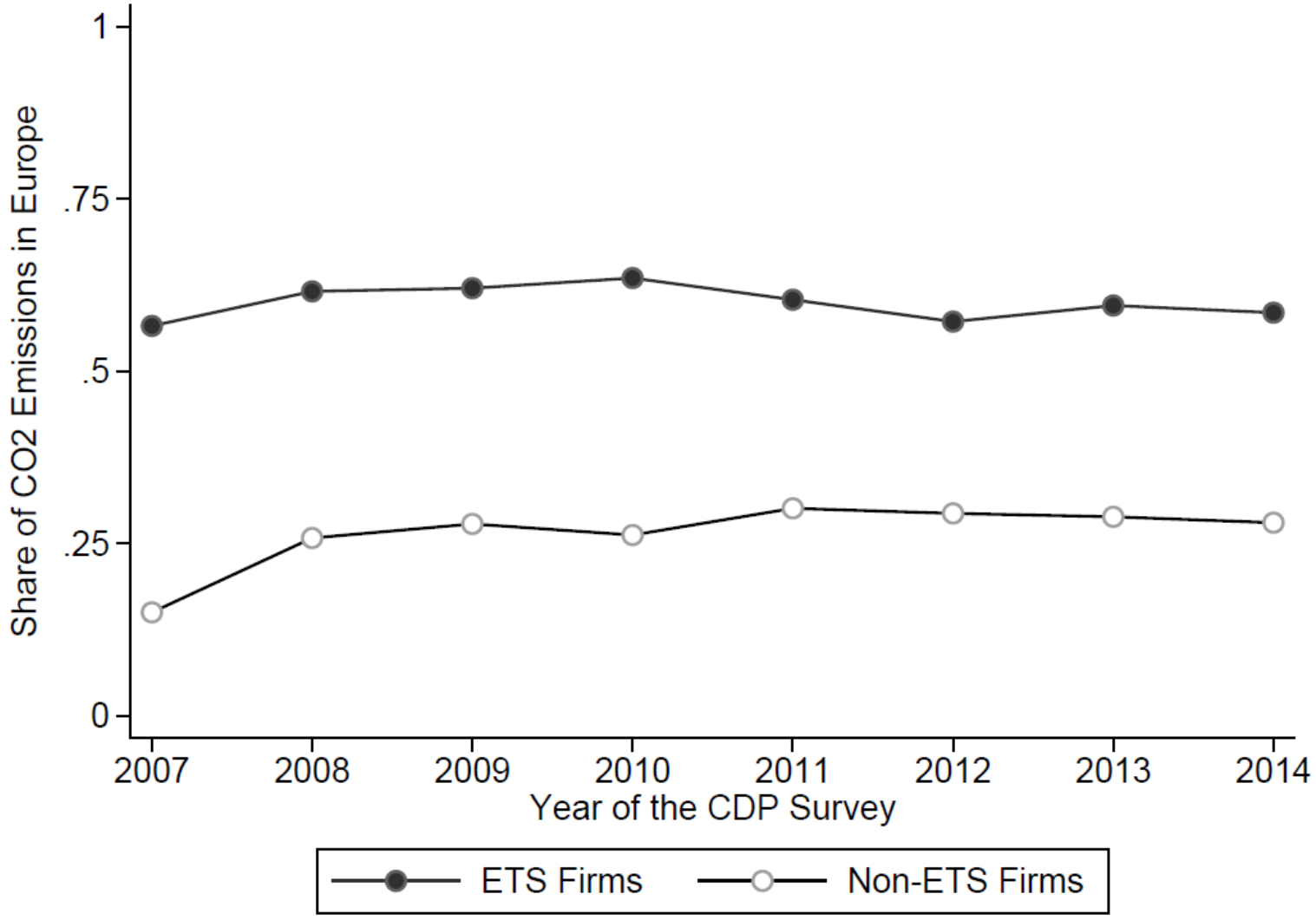


Evidence from CDP data

- Carbon Disclosure Project: firm-level carbon emissions by country
  - NGO acting on behalf of over 600 institutional investors
  - Since 2003 asked listed companies to disclose information on emissions
  - 1,041 companies, 2007-2014 (unbalanced)
- Focus on multinational companies operating both within and outside the EU
  - Should be easier for them to relocate activities

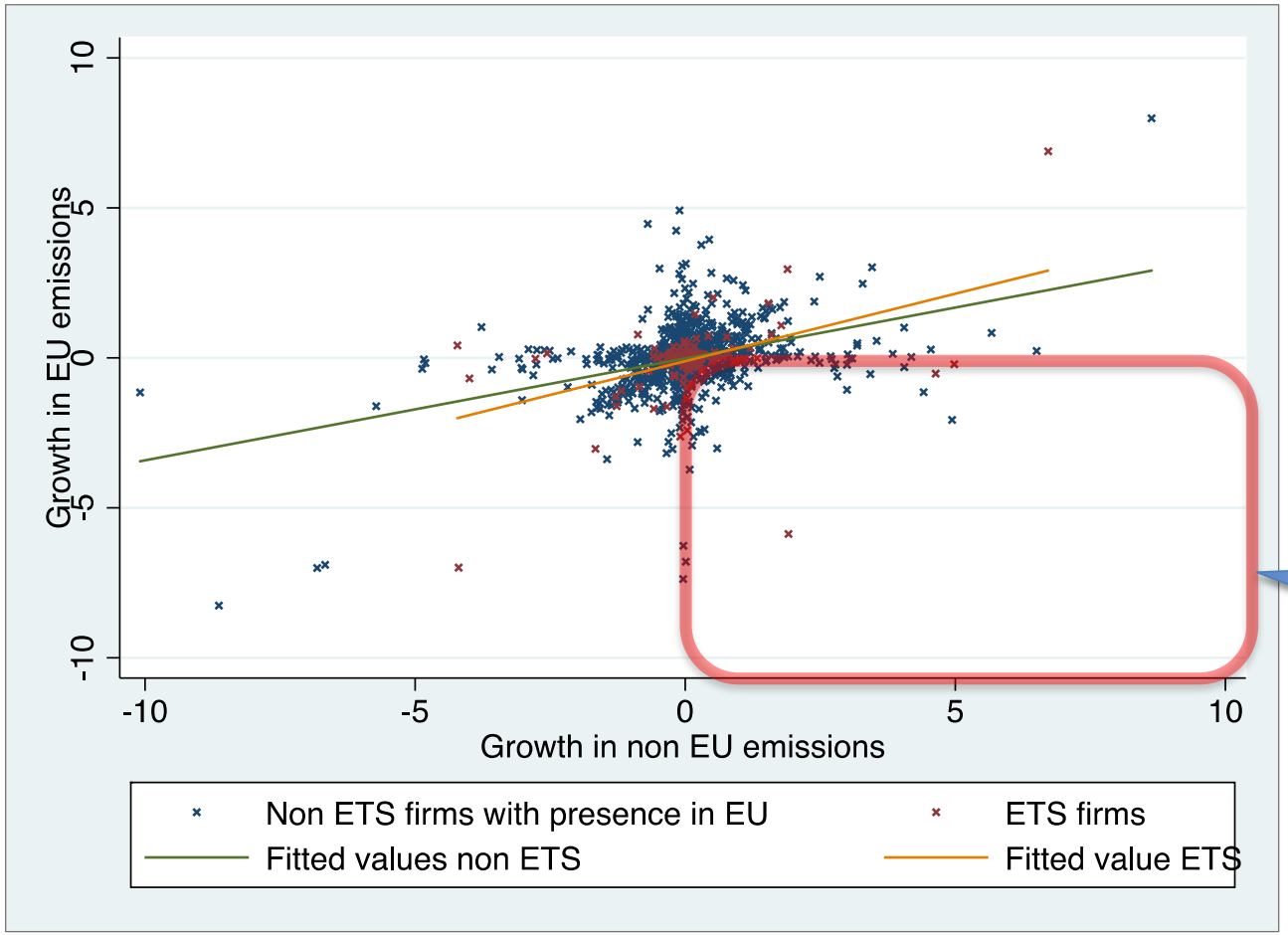
Share of EU emissions



Regression results

	(1)	(2)	(3)	(4)
	Change in the share of EU emissions			
Panel A: All firms				
ETS Company	0.003	0.007	0.010	0.010
	(0.005)	(0.006)	(0.006)	(0.006)
Observations	3,772	2,838	2,366	2,366
R-squared	0.003	0.004	0.005	0.005
Number of firms	1134	785	674	674
Number of EU ETS firms	235	213	191	191
Panel B: Manufacturing firms				
ETS Company	0.006	0.010	0.014	0.014
	(0.006)	(0.008)	(0.009)	(0.009)
Observations	1,966	1,559	1,243	1,243
R-squared	0.003	0.004	0.007	0.007
Number of firms	565	421	348	348
Number of EU ETS firms	153	145	127	127
Panel C: Manufacturing firms at risk of carbon leakage				
ETS Company	0.004	0.008	0.013	0.013
	(0.006)	(0.007)	(0.009)	(0.009)
Observations	1,542	1,212	967	967
R-squared	0.006	0.008	0.013	0.013
Number of firms	446	336	277	277
Number of EU ETS firms	115	112	98	98

Growth of CO2 emissions in the EU vs the rest of the World



Any leaks here?