



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

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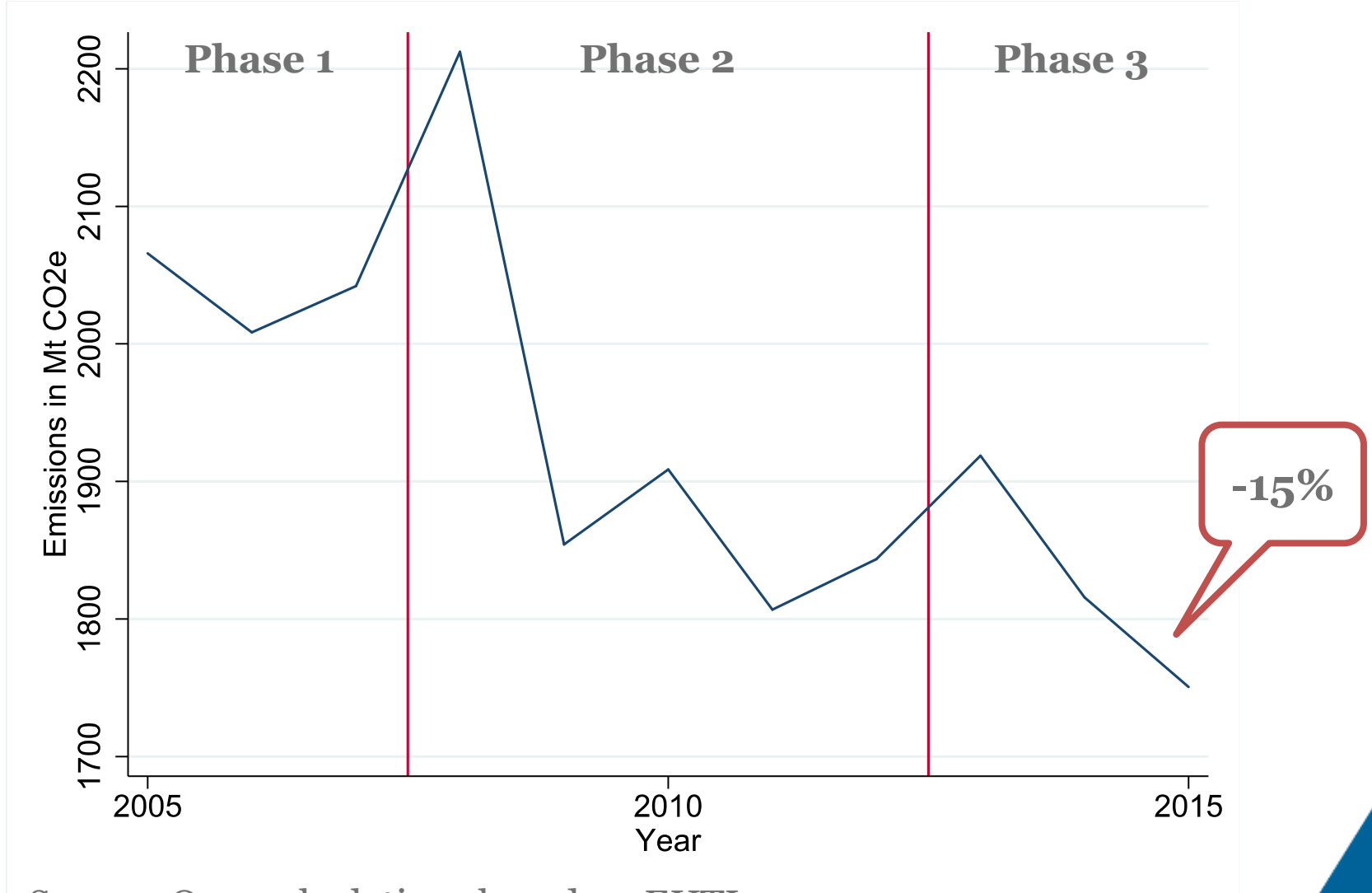


EU ETS: background

- 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



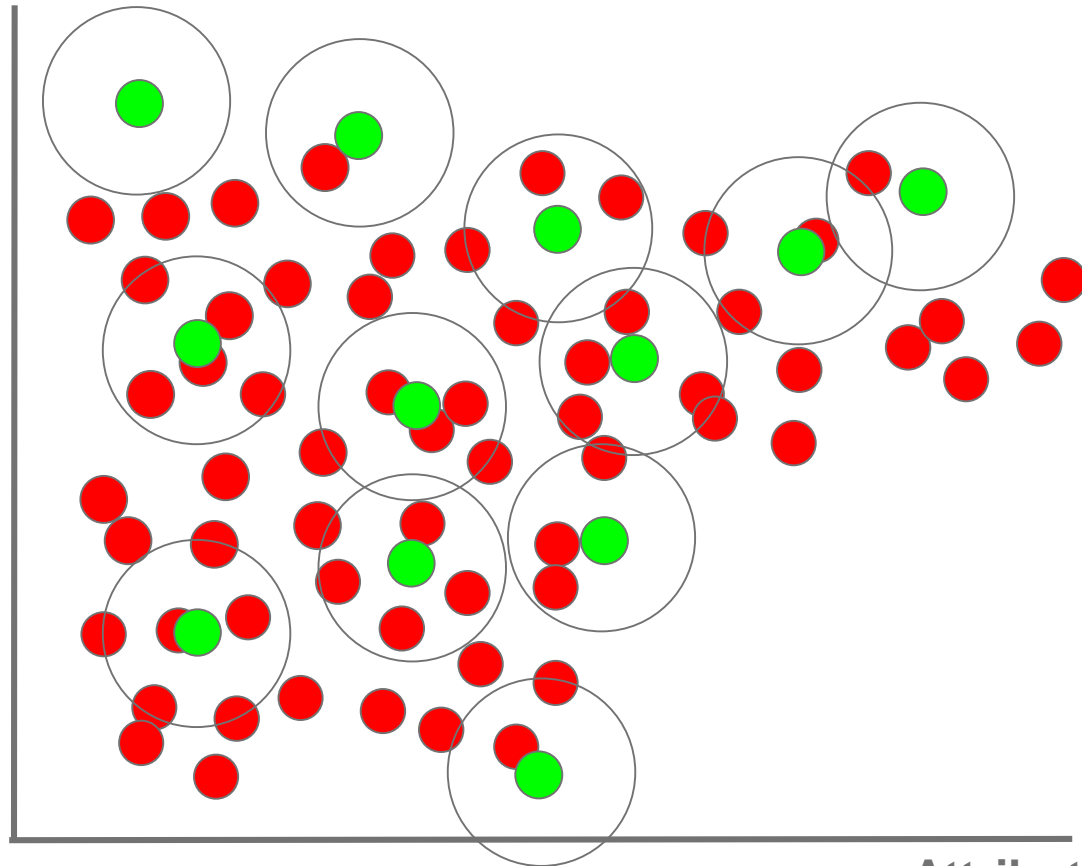
A matching method

- 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

Attribute 2
(ex: assets)



● EU ETS

● Non EU ETS

Attribute 1
(ex: revenue)



What we are comparing

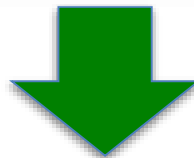
Hammer GmbH

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



Papierfabrik Hainsberg GmbH

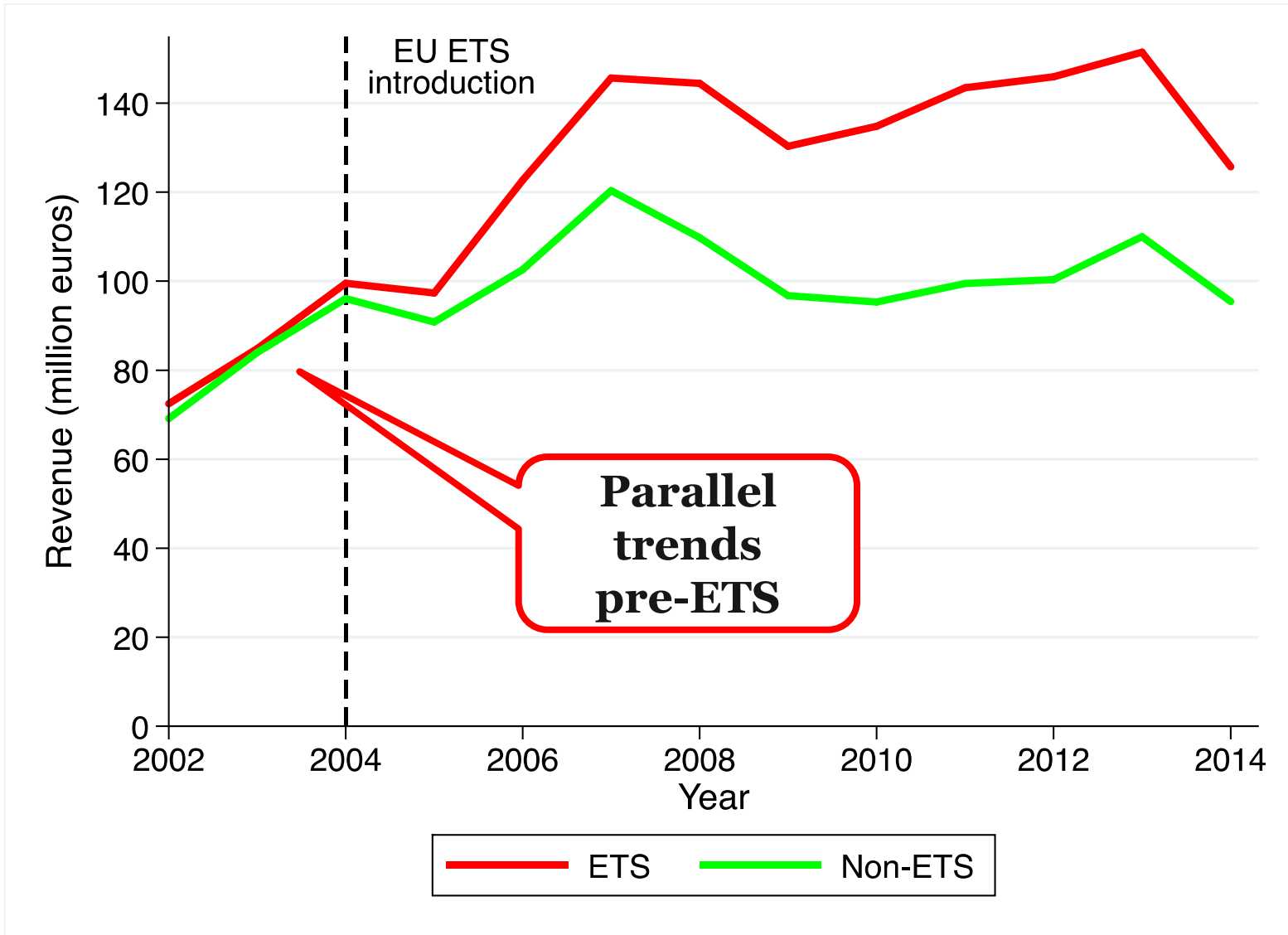
- NACE 1712 (Manufacture of paper and paperboard)
- 152 employees
- Turnover 25.9M
- Fixed assets 9.7M



EU ETS impact?

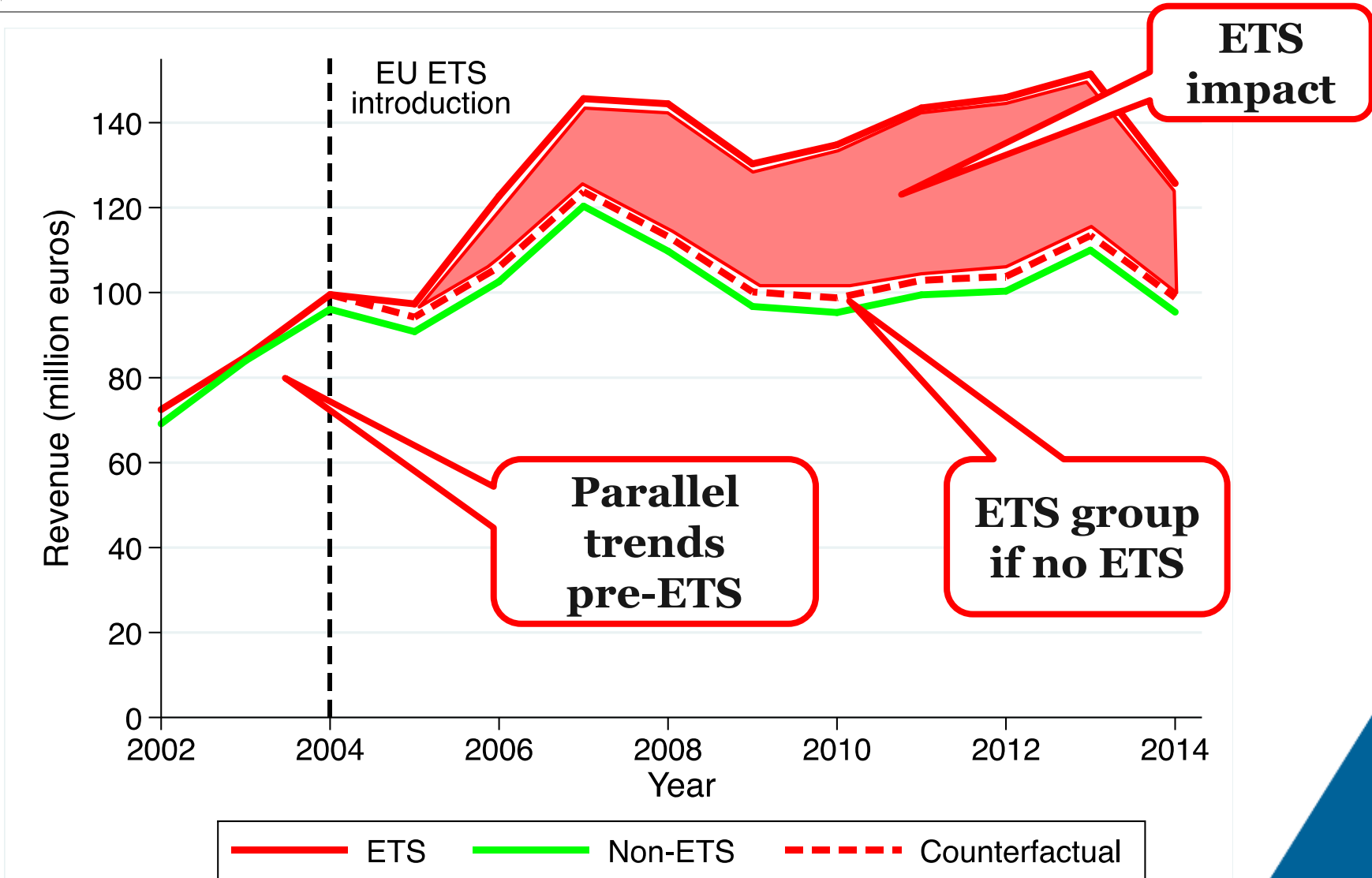


ETS effect: ex. firms' revenue





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

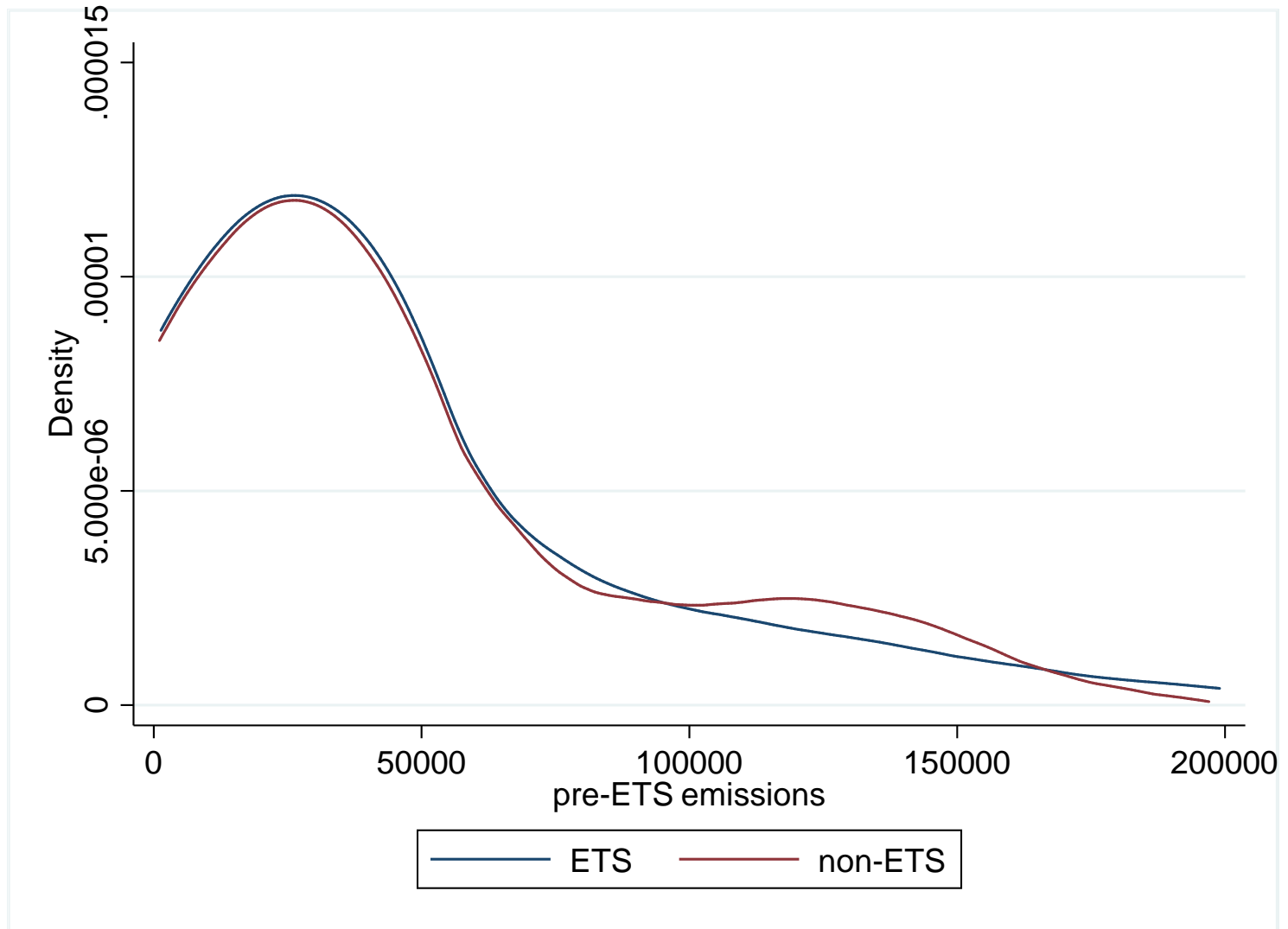


Matching

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



After matching: Emissions distribution





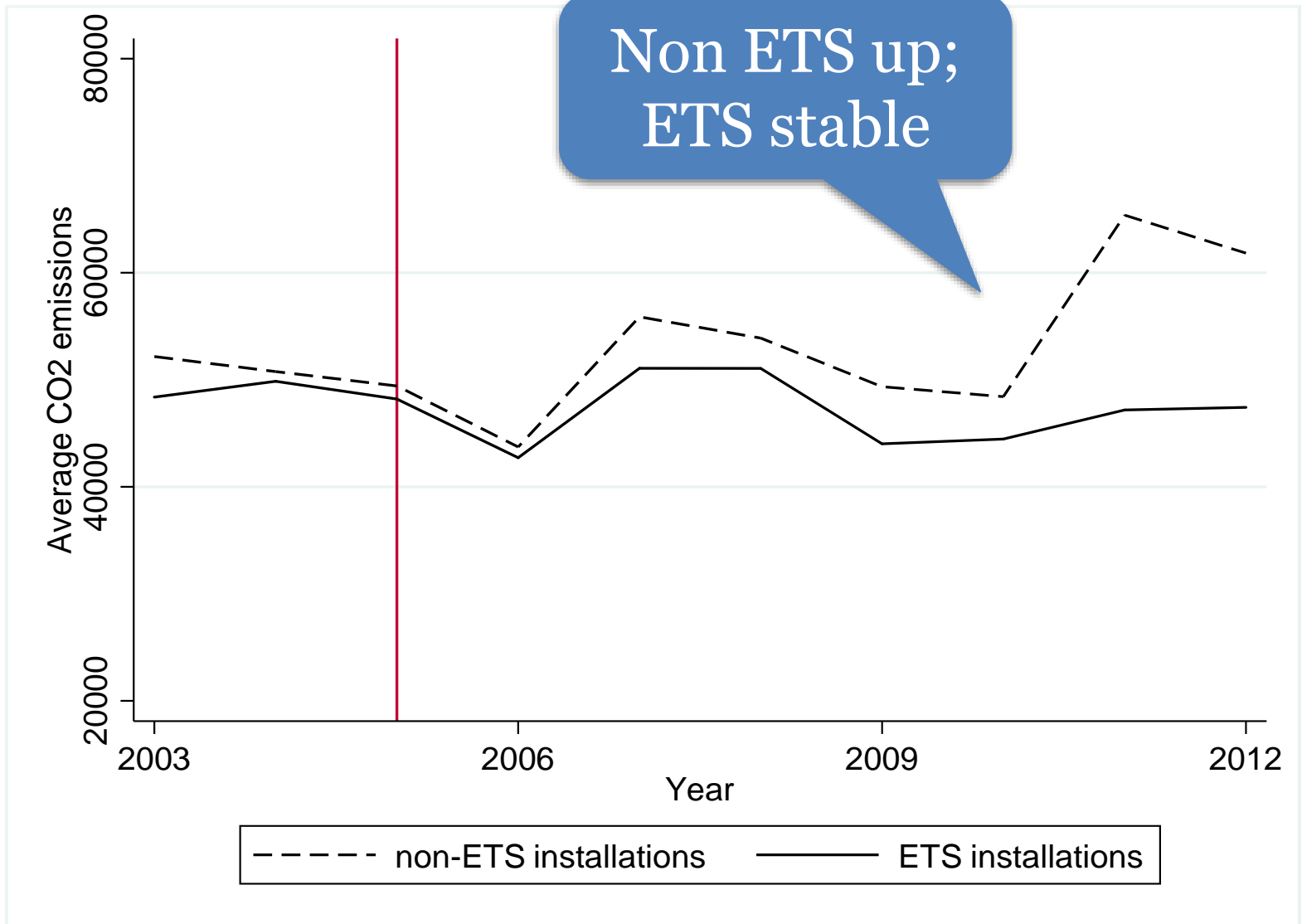
Limited sample

- 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

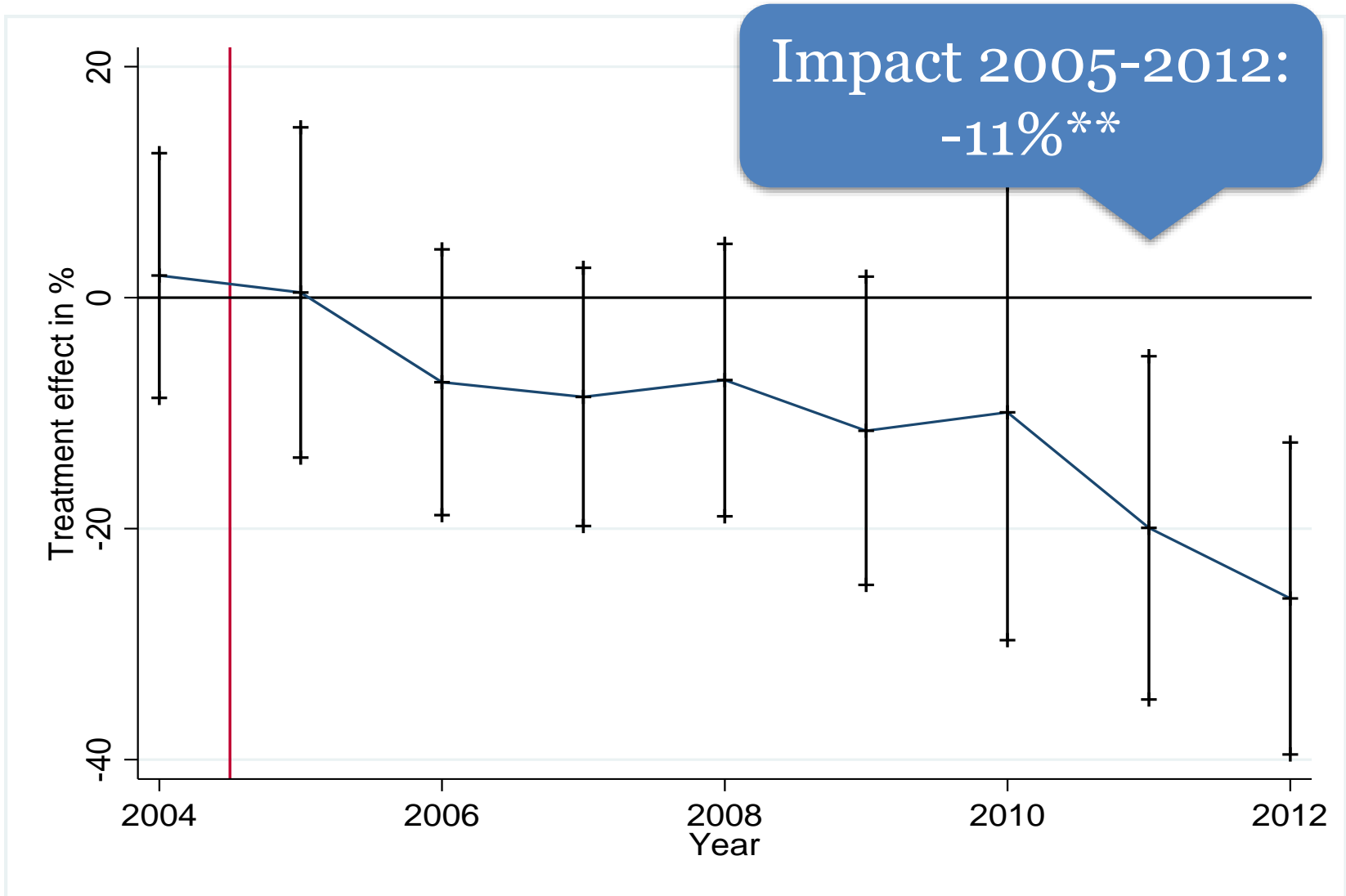


Emissions after matching





ETS impact on emissions by year



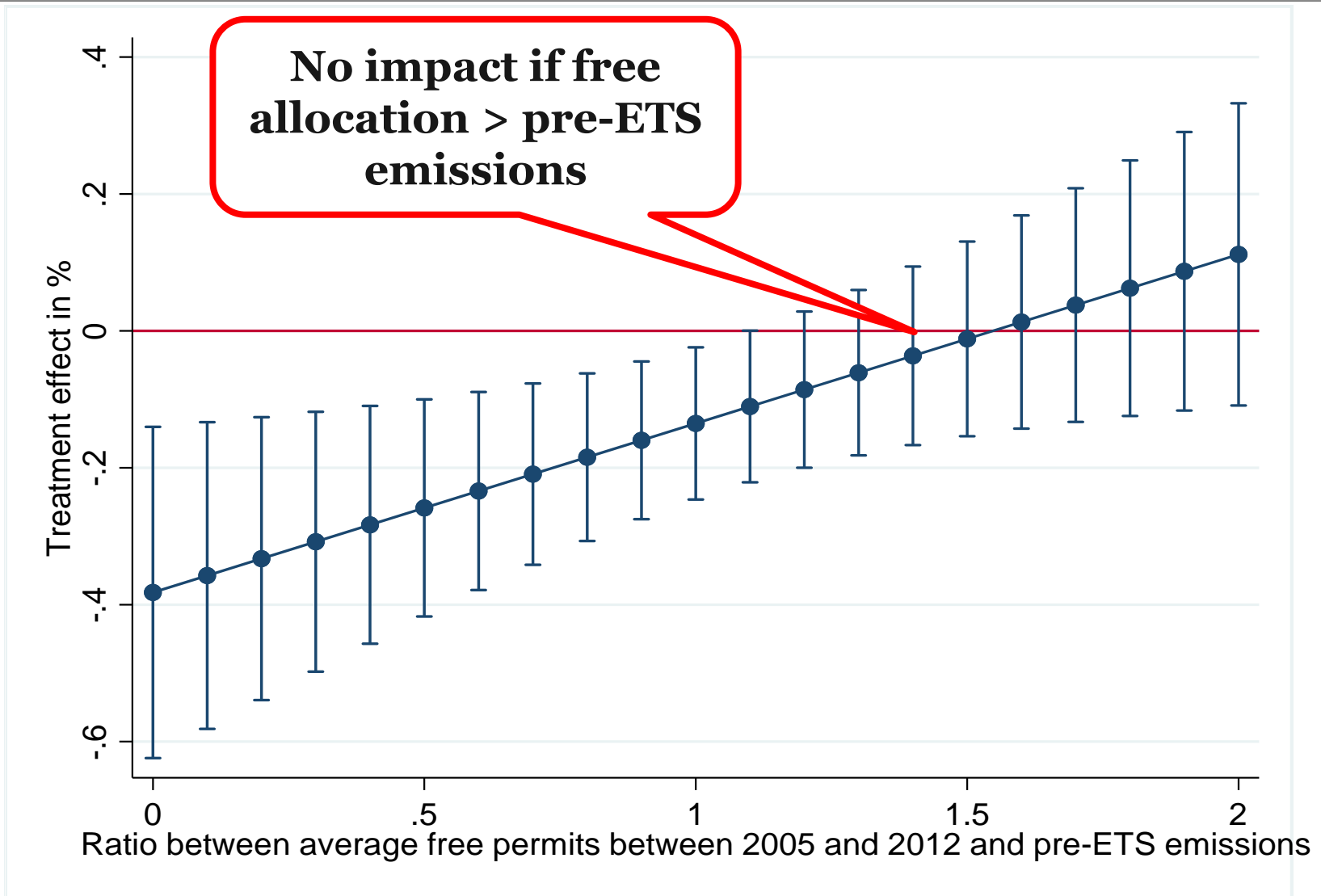


Robustness

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

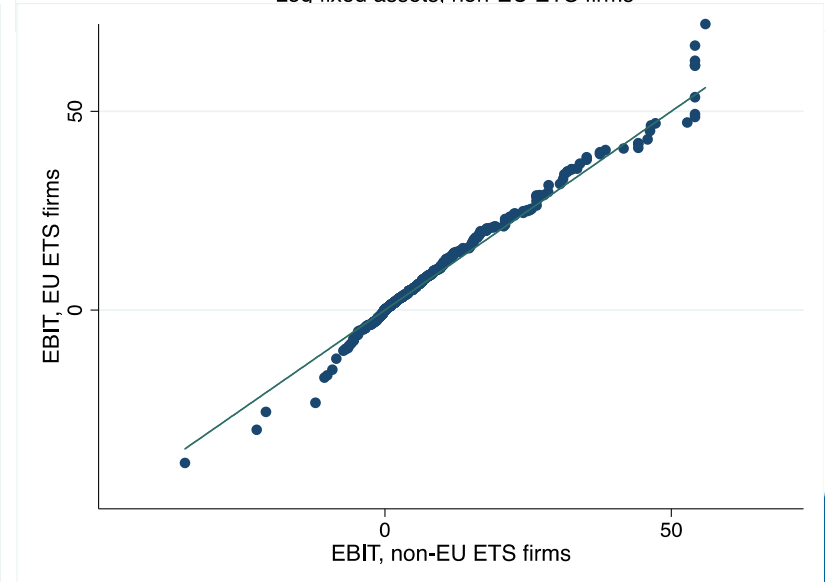
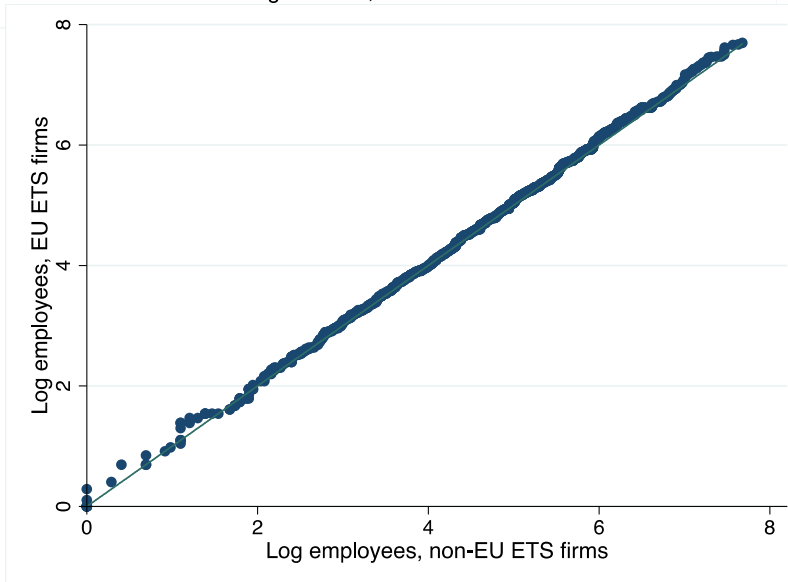
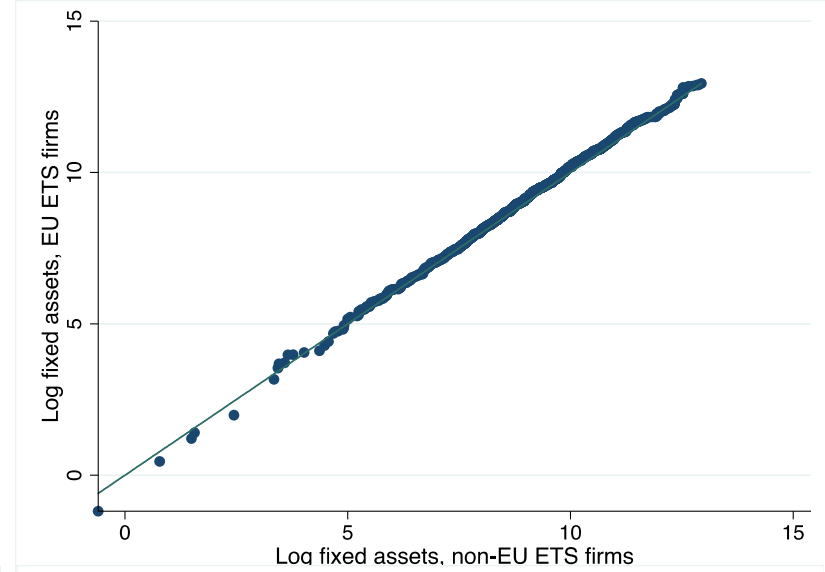
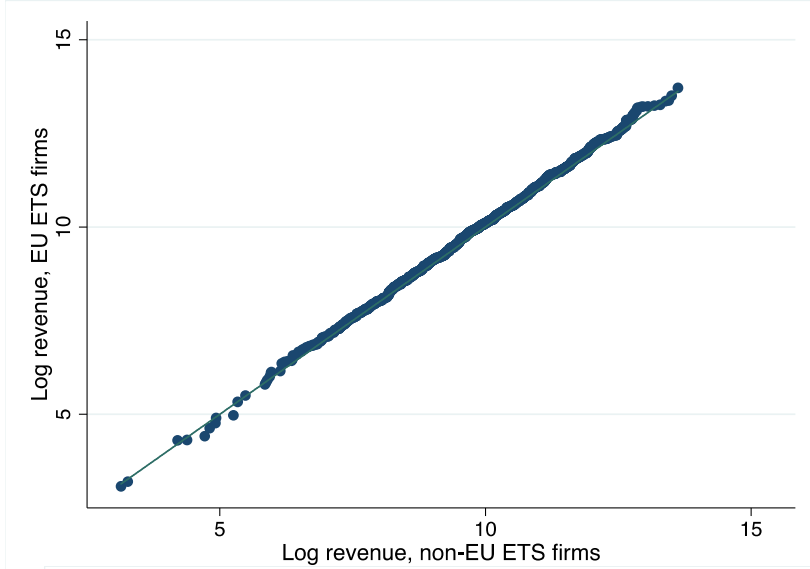


Matching

- 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)

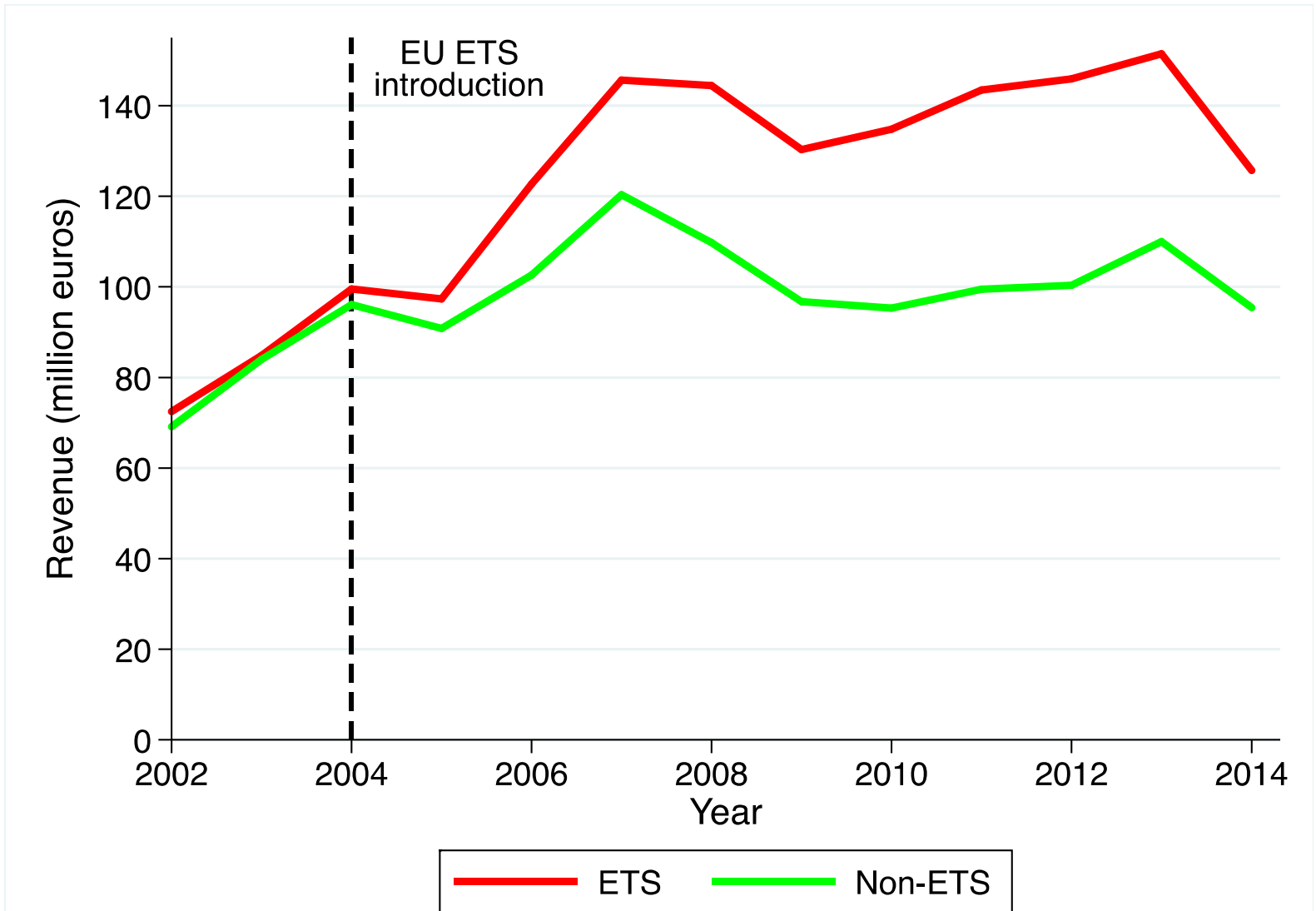


A good control group



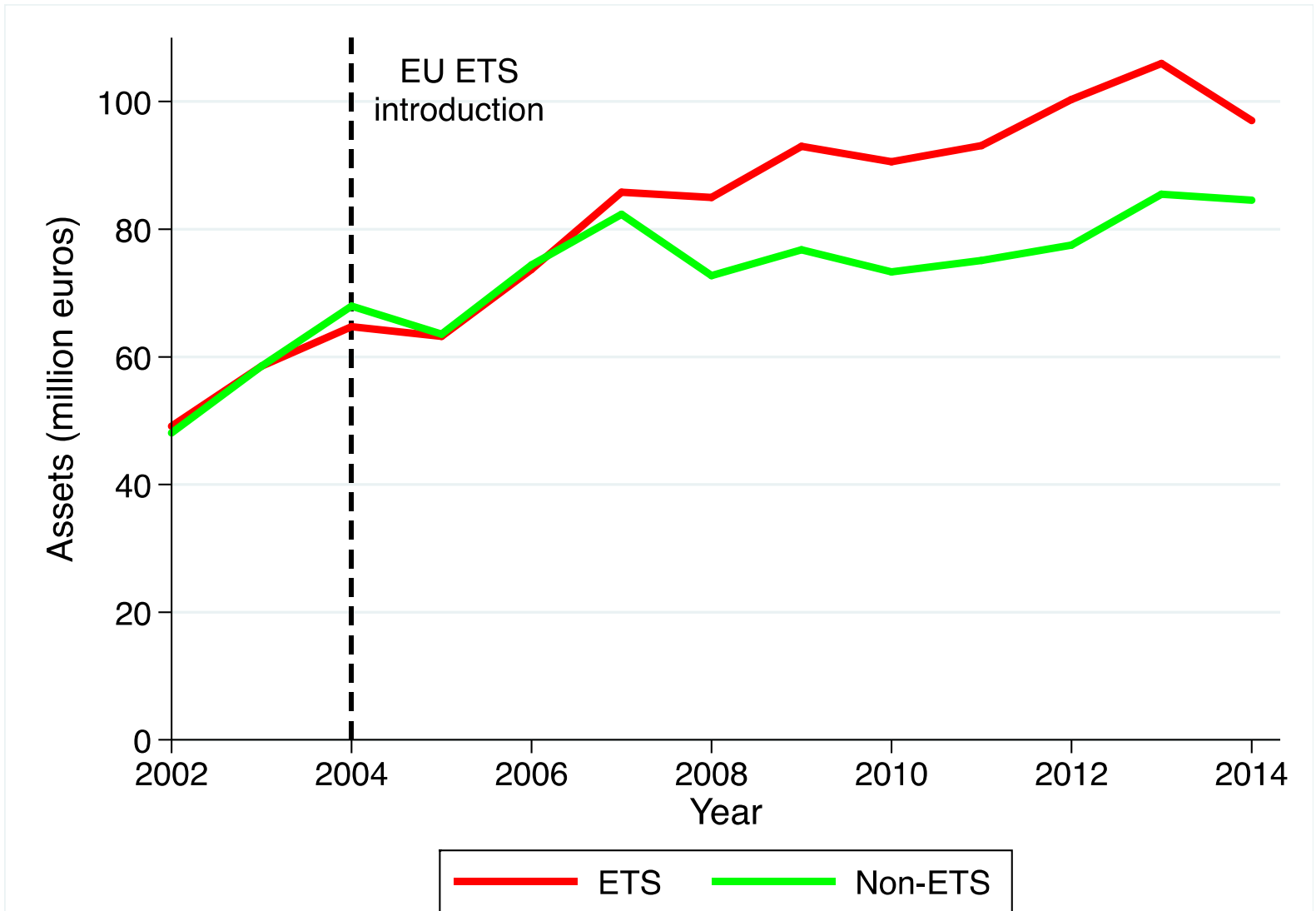


Revenue



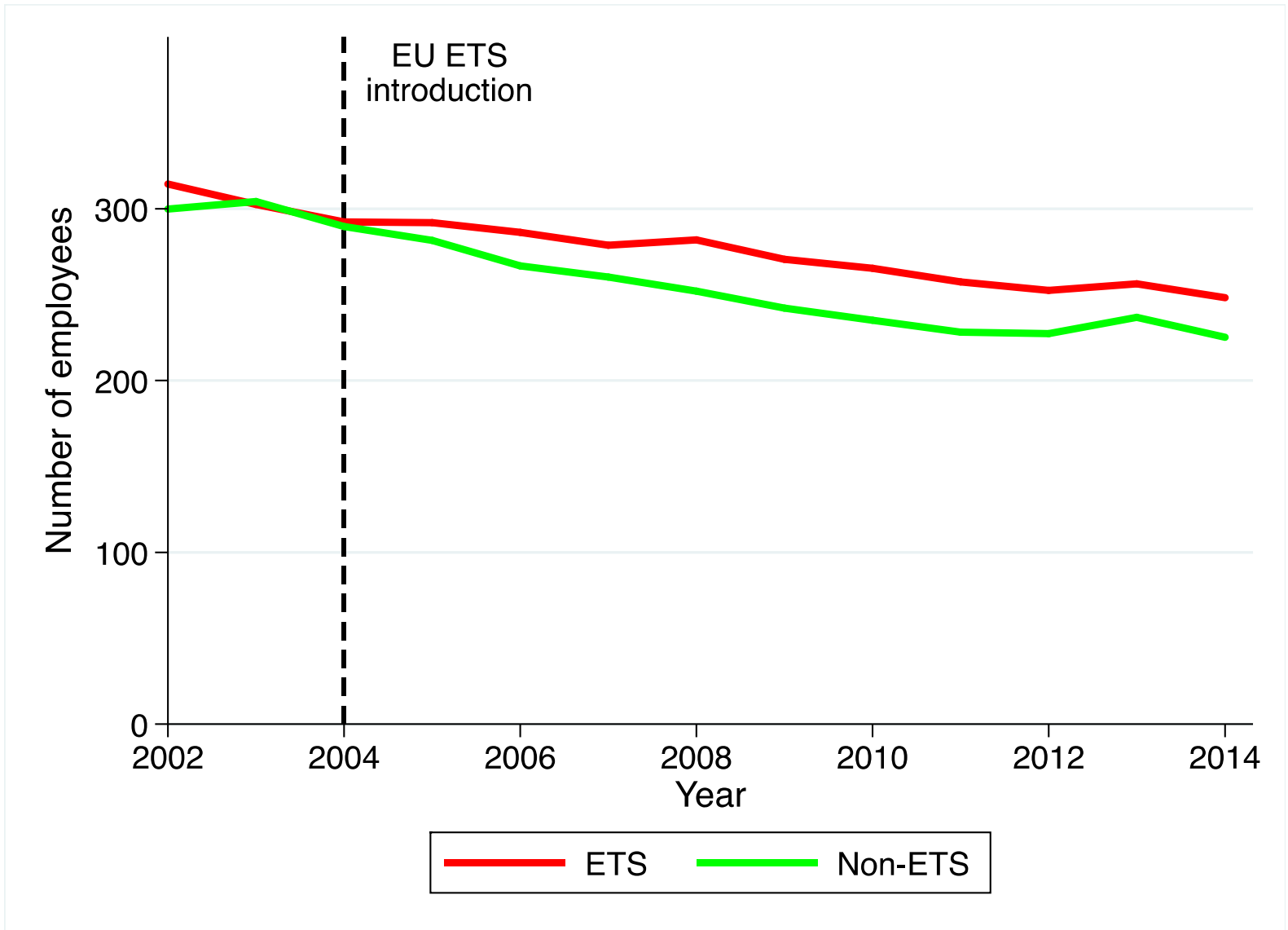


Fixed assets



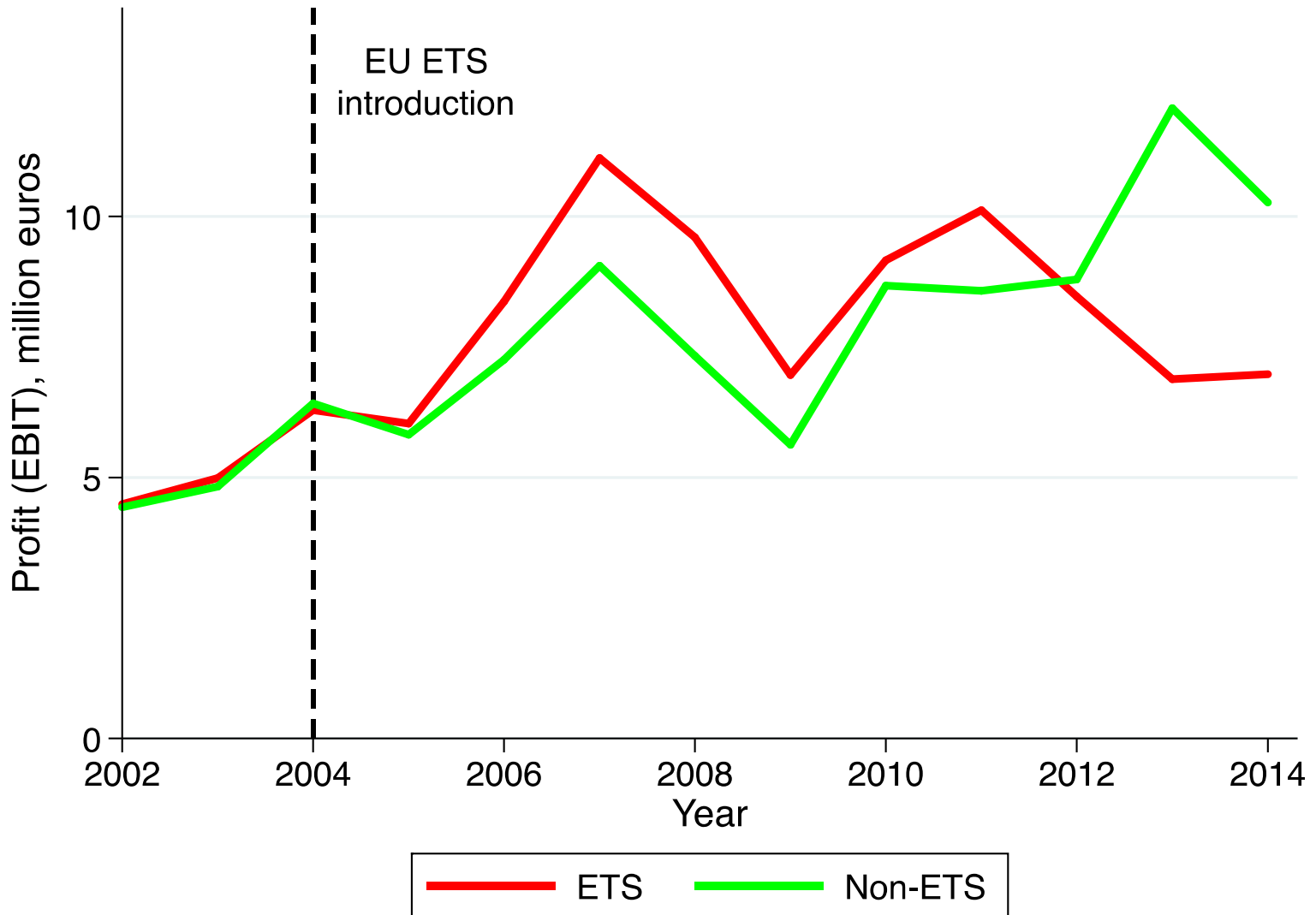


Employees





Profit





Summary of results

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

- Cael & 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?



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