

Abatement and allocation in the pilot phase of the EU ETS

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Research Questions

- Did over-allocation or abatement cause the collapse of EUA prices in the pilot phase of the EU ETS?
- Did the pilot phase of the EU ETS lead to net aggregate emissions reductions?

Evidence from CITL

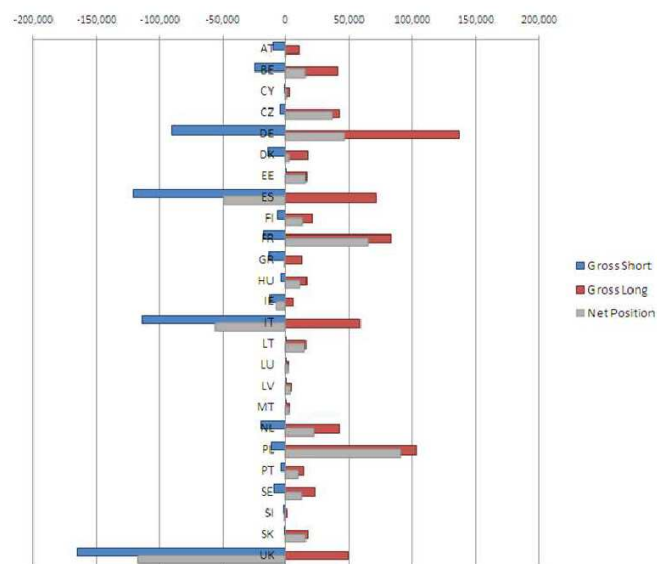


Figure: Gross short/long positions for 2005-2007 (Kt CO₂)

Contrasting views- Kettner et al. (2008)

"...it is rather unlikely that the EU ETS has already created incentives for abatement investments in the first trading years. Given the rather low carbon prices, it is also extremely unlikely that industries...have reduced their production levels because of the stringency of allowances. In a few installations the option for a fuel shift may have been used. Most probably the only reduction option that was widely used was the improved operation of existing equipment. The reduction potential of this option is, however, rather limited."

Contrasting views- Ellerman and Buchner (2008)

In contrast:

"...the refutable presumption must be that the EU ETS succeeded in abating CO₂ emissions in its first two years based on three observations.

- 1. A significantly positive EUA price. A significant price was paid for CO₂ in 2005-06, which would have the effect of reducing emissions as firms adjust to this new economic reality.*
- 2. Rising real output. Real output in the EU has been rising at the same time that the rate of improvement in CO₂ intensity has been declining, which has led to rising CO₂ emissions before 2005.*
- 3. Historical emissions data that indicate a reduction of emissions even after allowing for plausible bias."*

Relevant Literature

Delarue et al. (2008)- ex post model of EU power generation sector for 2005-2006 based on relative fuel prices, EUA price, electricity generation capacity and load.

- estimates of 34.4-63.6 Mt CO₂ in 2005 and 19.2-35 Mt CO₂ abatement in 2006

Ellerman and Buchner (2008)- ex post analysis of 2005-2006 estimating misallocation and abatement separately

- allocation ratio used to determine 125 M EUAs over-allocation in 2005 and 2006
- construct counterfactual using country level data and find 130-200 (2005) and 140-220 (2006) Mt CO₂ of abatement

Methodology

- Match emissions data from Eurostat to create a proxy for EU ETS historical emissions
- Use historical data to fit an econometric model for emissions
- Estimate emissions levels for pilot phase using econometric equation and ex post data for 2005-2007.
- Use EU ETS allocation and verified emissions data to attribute the correct proportion of estimated emissions to the EU ETS in each member state

Data- Independent variables

Economic activity levels- Industrial indices of production (C, D, E, CDE, 'Industry')

Climate factors- Heating Degree Days, Cooling Degree Days, Precipitation

Energy Prices- Electrical energy prices for industrial customers

Data- Dependent Variable

Only historical record of EU ETS emissions is 'historical baseline' in NAPs

- match emissions data based on EU ETS Directive to the data in Eurostat by NACE classification
- use verified emissions data for 2005-2006 to check robustness of data matching
- ratio of EU ETS emissions to Eurostat emissions is 1.002 in 2005 and 1.008 in 2006

Econometric specification

Unbalanced panel data set of 25 countries by 18 years

- dynamic panel estimation with bias corrected least squares dummy variable estimators (Bruno, 2005) using Arellano and Bond (1991) estimators to initialize bias correction

$$CO2_{it} = \beta_1 CO2_{it-1} + \beta_2 econ_D_{it} + \beta_3 econ_E_{it} + \beta_4 elect_{it} + \beta_5 hdd_{it} + \beta_6 cdd_{it} + \beta_7 rain_{it} u_i + e_{it},$$

Econometric Results

Table: Estimation Results

Equation	(1)		(2)	
	Coeff.	St. Err	Coeff.	St. Err
$CO2_{t-1}$	0.6542***	(0.0710)	0.6525***	(0.0723)
NACE_D	0.0076	(0.0439)	0.0135	(0.0523)
NACE_E	0.2336***	(0.0688)	0.2649***	(0.0859)
elect	-0.0371	(0.0511)	-0.0057	(0.0578)
hdd	0.0875	(0.0839)	0.0843	(0.0846)
cdd	0.0094	(0.0108)	0.0098	(0.0106)
rain	-0.0242	(0.0224)	-0.044	(0.0244)
euets			0.1601	(0.5660)
NACE_D_euets			-0.0116	(0.1040)
NACE_E_euets			-0.0293	(0.1135)
elect_euets			0.0008	(0.0665)

Number of observations = 251, Number of groups = 25;

Notes: *** indicates significance at the 1% level;

Joint test for significance of interaction and euets terms: $\chi^2(4) = 5.56$,
 $\text{Prob} > \chi^2 = 0.2349$.

Robustness Checks

Performance of model as predictor- Correlation of 0.9992 fitted and historical values

Test for parameter stability- Joint test for significance of interaction and *euets* terms: $\chi^2(4) = 5.56$ Prob $> \chi^2 = 0.2349$

Robustness checks-alternative economic variables, estimators- Blundell and Bond (1998), Anderson Hsiao (1982)

Pilot phase results

Table: EU ETS BAU emissions for Austria, 2005 (Kt CO₂)

Year	Allocated A	Verified B	Eurostat CO ₂ C	Projection D	Ratio E=B/C	EU ETS BAU F =E*D
2005	32,413	33,373	35,598	35,158	0.937	32,960

Table: Summary for EU25 (Mt CO₂)

	Year	Allocated	Verified	BAU	Abatement	Inflation	Over-all.	Under-all.
EU25	2005	2,096.4	2,014.0	2,044.4	46.7	16.3	109.2	57.2
EU25	2006	2,071.7	2,035.6	2,036.9	37.1	35.8	123.6	88.7
EU25	2007	2,078.7	2,051.5	2,007.8	23.5	67.2	143.2	72.2
EU25	2005-7	6,246.9	6,101.2	6,089.1	107.2	119.3	376.0	218.2

Compared with previous studies

Delarue et. al. (2008)- 34.4-63.6 Mt CO₂ in 2005 and 19.2-35 Mt CO₂ abatement in 2006 in power sector

Table: Comparison with Ellerman and Buchner (2008) (Mt CO₂)

Year	Ellerman and Buchner (2008)		Anderson et. al. (2009)			
	Over-Alloc.	Abatement	Gross Over-Alloc.	Net Over-Alloc.	Gross Abatement	Net Abatement
2005	≤125	130-200	109	52	47	30
2006	≤125	140-220	124	35	37	1
2007	–	–	143	71	23	-44

The importance of reliable data

Historical Emissions

- 18 of 25 member states have higher ratios of Eurostat emissions to EU ETS emissions in the baseline period than in the pilot phase

Ex ante BAU projections

- either 15 of the 25 member states achieved double digit percentage reductions in emissions or that the ex-ante projections of questionable quality.

Policy Implications

EU 2008-2012

- more stringent allocation
- economic collapse changes landscape

EU 2013-2020

- Energy and Climate Package- increased auctioning, no more NAPs
- longer period, clear about future caps levels

U.S. (ROW)

- sound data necessary
- top down cap formation
- allocation/auctioning and equity

Thanks

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