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Trading Costs and the Efficiency of Emissions Trading – Evidence from the EU ETS

Regina Betz joint work with Johanna Cludius and Martin Jones

IAEE Asian conference, September 2014, Beijing

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Motivation

- Assess the validity of the statement: "Emissions trading Schemes (Cap and trade) are efficient policies in reducing greenhouse gases as entities will be trading allowances until marginal abatement costs are equalised"
- Research question:
  - How high are transaction costs in the EU ETS?
  - Which characteristics are influencing trading activity?

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Related Literature

- **Emissions trading**
  - Coase (1960) property right, Crocker (1966), Dales (1968) develop the idea of emissions trading in water context
  - Montgomery (1972) shows emissions trading schemes achieve same efficiency equilibrium independent from allocation method
  - All studies abstract from transaction costs
- **Emissions trading and transaction costs**
  - Theoretical analysis by Stavins (1995) shows that trading volumes will be lower and equilibrium prices higher in the presence of transaction costs and that initial allocation affects the final equilibrium if marginal transaction costs (trading costs) are non-constant.
  - Empirical analysis on transaction costs by e.g. Foster and Hahn (1995)
  - Empirical analysis of transaction costs of EU ETS by Betz (2003), Betz et al. (2010) and Jaraite et al. (2009) and Jaraite & Kazukauskas (2012), Heindl (2012), but usualy broader approach not only trading costs.

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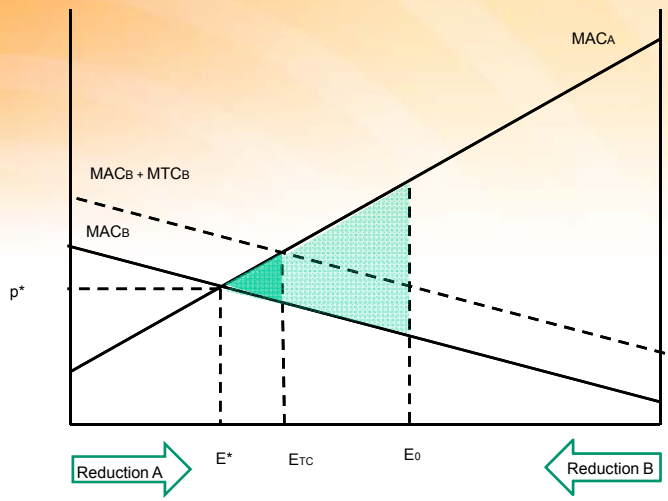
Emissions Trading & Trading Costs



cf. Stavins (1995)

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Data: Community Independent Transaction Log (CITL)

- Records all transfers of European Union Allowances (EUAs)
- Published with a 5 year delay (now: Jan 05 – Dec 09): Since permits can be surrenderd until April of the following year, Phase 1 extends to April 2008
- Only physical transfers (no price information)
- Additional information on account holders
- Information on installation basis, matching to companies difficult, can be done on the basis of account holder names, email addresses, web research, etc.

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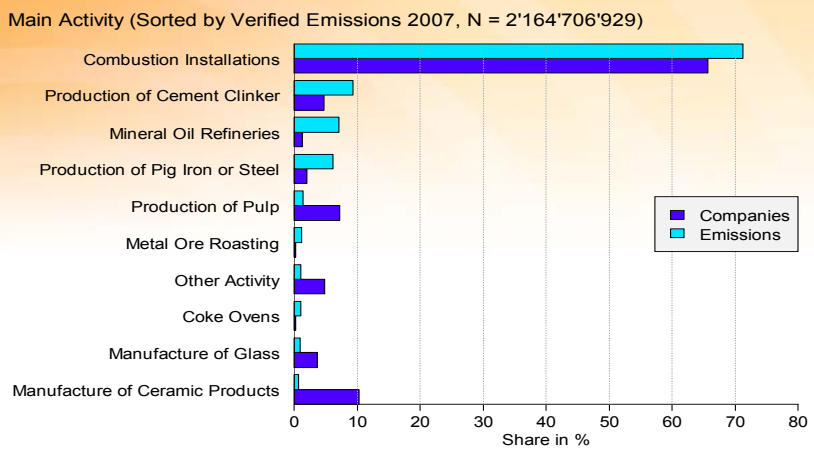
EU ETS Sectors



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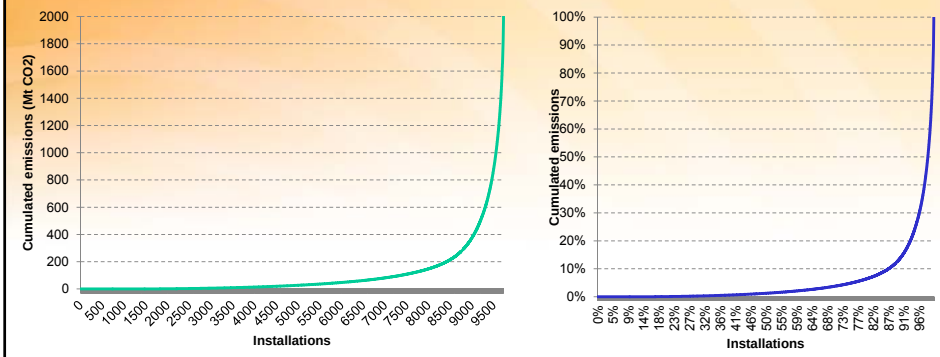
Lorenz curve of CO_2 Emissions



Unequal distribution: 85 % of the installations covered emitted less than 10 % of the total emissions in 2005-2007

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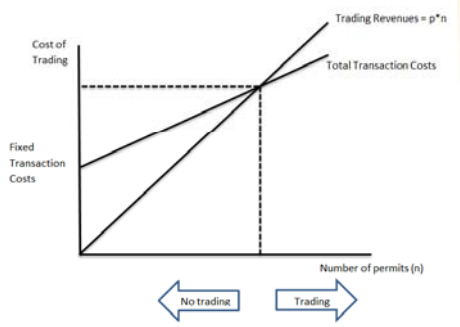
Worthlessly Expired Permits

- Maximisation problem for an overallocated firm

$$\max_n p * n - \int_0^n MTC(x)dx$$

$$s.t. \quad n \leq allocation - ver.emissions$$

$$p = MTC$$



- But: Uncertainty might also be a factor

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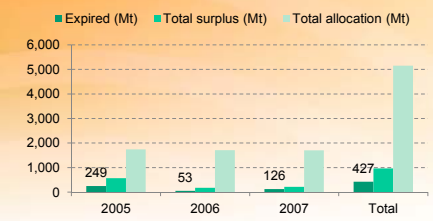
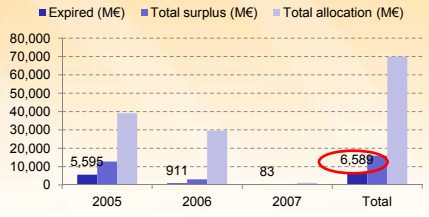
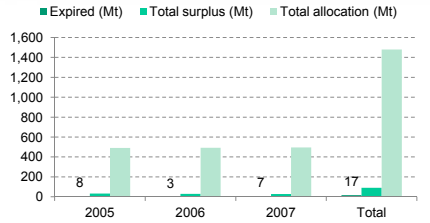
Overall Expired Permits

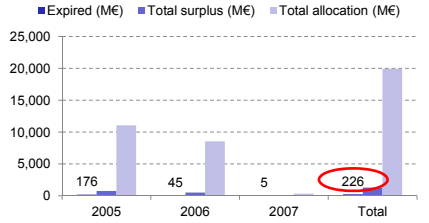
Installations





German companies





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Trading Costs per Installation/Firm

	Aggregate Trading Costs (M€)	Installations that did not trade	Per installation (€)	Aggregate Trading Costs (M€)	German firms that did not trade	Per German firm (€)
Upper bound (individual years, yearly prices)	6,589	7,912	832,828	226	702	322,001
Middle bound (all years, 2005-07 av. price)	2,092	3,111	672,492	66	264	248,542
Lower bound (all years, 2007 av. price)	102	3,111	32,877	3	264	12,151

- Very high as compared to bottom-up studies
- There might be additional factors that inhibit trade, e.g. uncertainty

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Probit Estimation Results (aver. marg. effects)

	Installations			German companies		
	2005	2006	2007	2005	2006	2007
Medium	0.08*** (0.01)	0.11*** (0.01)	0.08*** (0.01)	0.15***(0.03)	0.01 (0.04)	0.10*** (0.04)
Large	0.19*** (0.02)	0.21*** (0.02)	0.16*** (0.01)	0.28*** (0.04)	0.12*(0.07)	0.25*** (0.04)
Verified emissions	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.02 (0.03)	0.08 (0.10)	0.00 (0.02)
No. of installations				0.03*** (0.01)	0.05*** (0.02)	0.00 (0.01)
Abs. position	0.00** (0.00)	0.00*** (0.00)	0.00** (0.00)	0.00 (0.00)	0.00*** (0.00)	0.00*** (0.00)
Short	0.08*** (0.01)	0.11*** (0.01)	0.02* (0.01)	-0.04 (0.03)	0.17*** (0.04)	0.13*** (0.03)
Absxshort	0.00*** (0.00)	-0.00** (0.00)	-0.00* (0.00)	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Country dummies	X	X	X			
Observations	8564	8564	8555	797	797	791
Log likelihood	-5032.3678	-5536.0226	-4045.6189	-388.28227	-436.44662	-381.34095
Pseudo R2	0.1059	0.0641	0.0616	0.2251	0.2081	0.1878

$$Pr_i = \Phi(\beta_0 + \beta_1 size_i + \beta_2 ver_i + \beta_3 surplus_i + \beta_4 sector_i + \beta_5 country_i)$$

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	Installations			German companies		
	2005	2006	2007	2005	2006	2007
Refining	0.02 (0.04)	0.00 (0.05)	0.09*** (0.03)	-0.30** (0.12)	0.02 (0.18)	0.02 (0.11)
Coke	-0.15 (0.15)	-0.33* (0.17)	-0.08 (0.12)			
Metal ore	-0.18 (0.16)	-0.39** (0.18)	(omitted)			
Steel	-0.15*** (0.03)	-0.08** (0.03)	-0.03 (0.03)	-0.42***(0.12)	-0.06 (0.11)	-0.23* (0.11)
Cement	-0.15*** (0.02)	-0.11*** (0.03)	0.01 (0.02)	-0.27*** (0.07)	-0.08 (0.08)	0.01 (0.07)
Glass	-0.15*** (0.03)	0.03 (0.03)	0.10*** (0.02)	-0.23*** (0.07)	0.10 (0.08)	0.10 (0.07)
Ceramics	-0.15*** (0.02)	-0.07*** (0.02)	0.02 (0.02)	-0.18*** (0.05)	-0.19*** (0.05)	-0.05 (0.05)
Paper	-0.01 (0.02)	-0.01 (0.02)	0.04*** (0.02)	-0.02 (0.05)	0.01 (0.05)	0.01 (0.05)
Opt-in	-0.12*** (0.03)	-0.11*** (0.04)	-0.17*** (0.04)			
Airports&Trade				-0.02 (0.14)	-0.16 (0.16)	0.08 (0.14)
Auto&Transport				-0.24*** (0.09)	0.08 (0.09)	-0.04 (0.08)
Chemicals				-0.09 (0.06)	0.03 (0.07)	-0.05 (0.06)
Food & Bev				-0.04 (0.05)	0.06 (0.06)	-0.02 (0.06)
Machinery				-0.10 (0.10)	0.14 (0.10)	0.04 (0.09)
Mining				-0.09 (0.19)	-0.13 (0.27)	0.01 (0.19)
Non-ferrous				0.03 (0.15)	0.39** (0.20)	(omitted)
Textiles				-0.25** (0.11)	-0.12 (0.10)	-0.08 (0.11)
Uni, Research & Health				-0.27*** (0.10)	-0.03 (0.08)	-0.14 (0.09)
Waste & Water				-0.08 (0.12)	-0.02 (0.13)	0.15* (0.12)
Other				-0.11 (0.13)	-0.36** (0.18)	0.22 (0.12)
Country dummies	X	X	X			
Observations	8564	8564	8555	797	797	791
Log likelihood	-5032.3678	-5536.0226	-4045.6189	-388.28227	-436.44662	-381.34095
Pseudo R2	0.1059	0.0641	0.0616	0.2251	0.2081	0.1878

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Discussion and Outlook

- Transaction activity increases and number of expired permits decreases over time
- The size of transaction costs seems rather high and therefore other factors may be influencing the transfer activity, cf. uncertainty
- Size effect is significant and fairly robust over time (small installations are less likely to trade, which indicates that there are fixed costs)
- Sector affiliation important at the start, but lessens over time
- Phasing in of sectors over time could increase welfare
- Assistance to small installations at the start: brokerage services, information (financial sector took some time to provide services to EU ETS companies)
- Future work:
  - Company level analysis for al of EU this means excluding internal transfers
  - Include the 2008 first quarter

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