BEYOND COMPLIANCE: STRATEGIC USE OF EMISSIONS TRADING

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Background

European Union Emission Trading Scheme

- First large greenhouse gas emissions trading scheme in the world
- Launched in 2005
- Regulates emissions of electricity generation, energy-intensive industries and aircraft operators
- Divided into trading periods (2005-2007; 2008-2012; 2013-2020; 2021-2030)
- EU ETS has grown over time: more countries and more types of greenhouse gases
- Possible Extension of EU ETS to other sectors under discussion
- Long period of low prices → reforms (e.g. 2013) and increased reduction targets leads to increasing prices > 50€
- Companies formulate individual trading strategies based on expectations, abatement options and allowance pieces



Background

- In theory: Emissions trading achieves a given target at minimum cost
- If companies bid for allowances at their marginal abatement costs, allowance price correctly signals scarcity
- > This efficiency result depends largely on the willingness and ability to trade allowances
- Two factors might discourage companies from trading allowances
 - Transaction costs \rightarrow increase total compliance costs
 - Incorrect evaluation of the opportunity costs of holding allowances
- Both factors make it clear that understanding why and how companies trade allowances is critical for
 - the performance of allowance markets
 - improving the future design



Objectives

- Analyze how characteristics of companies and institutional features affect companies' trading behavior
- Explore differences over time



Previous literature

- Zaklan (2013) analyses determinants of participation in emissions trading in the first period
 - \rightarrow Results suggest that participation is driven by size, sector, ownership structure, value of free allocation
- Jaraitė-Kažukauskė and Kažukauskas (2015) analyze trading behavior in the first period
 - \rightarrow Results suggest that small companies were less likely to participate in trading
 - \rightarrow Results support concerns that transaction costs could be excessive for small companies
- Cludius (2018) analyze trading behavior in the first period
 - \rightarrow Results suggest that small companies were less likely to participate in trading
 - → Results suggest significant transaction costs as small companies did not realize potential market gains
- Naegele (2018) analyze transaction costs of trading in the first and second period
 - \rightarrow Results suggest substantial (fixed) transaction costs, rather than additional participation in offset trading
- Hintermann and Ludwig (2019) trading behavior until 2013

→ Results show home bias, suggesting that transaction costs are higher trading across national borders and therefore firms use existing networks

- Zaklan (2020) concentrates on the second period
 - → Results show that primary allocation of allowances only weakly impacts abatement behavior of electricity companies
- Baudry et al. (2021) use a theoretical approach and analyze data of the second period
 - → Results suggest significant fixed and variable transaction costs ($10k \in p.a.$ and $1 \in per permit$)

Contribution

- Longer temporal scope: 2005-2014, i.e. include parts of the third trading period
- Broader set of outcome variables
 - total trading volume
 - number of transactions
 - use of market intermediaries
 - use of forwards and futures
- Contribution to how trading behavior depends on companies' net positions
- Novel dataset, which allows analysis at the company level



- EUTL data can be downloaded free of charge from the European Commission's website
- Data on transactions are published on a three-year delay
 - Transactions data contains all transactions completed in the EU ETS
 - Account data contains information to the accounts involved in transactions
 - Installation data provide information to free allocations and compliance
 - ORBIS data contains information to company characteristics
- Matching of EUTL data to the ORBIS data using company registration numbers
 In cases where a match was not feasible, we used account names and addresses of account holders



Periods

- Entire period: 2005-2014
- By trading period, i.e. 2005-2007; 2008-2012; 2013-2014

Sample: Transactions at monthly level January 2005 to April 2015

Aggregation and selection

- Aggregation on an annual per-company basis
- We exclude administrative transactions \rightarrow they do not reflect trading activity
- A (trading) year in our dataset is defined as running from May through April
 → Companies must surrender allowances by end of April
- We only include regulated stationary installations and respective companies
- We removed all transactions between accounts of the same installation



Variables

Indicators (dependent variables)

Total transactions	Transaction volume of EUA in trading year t	source: EUTL
Transaction frequency	Number of transactions in trading year t	source: EUTL
Use of Intermediaries	Number of intermediaries used in trading year t	source: EUTL, ORBIS
 Use of Forwards Futures 	Estimated transactions involving EUA via forwards and futures	source: EUTL
Company characteristics (explanatory variables)	
Net position	Allocation of EUA minus verified emissions in year t	source: EUTL
 Carbon leakage 	Dummy = 1, if company belongs to carbon leakage sector	source: ORBIS
Energy	Dummy = 1, if company belongs to energy sector according to NACE	source: ORBIS
Productivity	Revenues divided by number of employees in year t	source: ORBIS
Employees	Number of employees	source: ORBIS
Installations	Number of installation regulated under the EU ETS	source: EUTL
 Dummies for Periods and 	source: EUTL	



Panel econometric Models

Total transactions, use of forwards and futures

> Panel double hurdle models (distinguish decision to *participate* from *intensity* of activity)

Transaction frequency, use of intermediaries

Panel count data models (Poisson)

Employ Mundlak-approach to capture time-constant unobserved heterogeneity



Results (selection)

	Total tra	Total transactions		Use of intermediaries	Use of forwards and futures	
	Participation	Intensity			Participation	Intensity
Net position	0.101***	0.373***	0.112***	0.108***	0.076***	0.520***
Carbon leakage	0.103***	0.221***	0.135***	0.203***	0.101***	0.475***
Energy	0.218***	0.361***	0.340***	0.193**	0.270***	1.717***
Productivity	0.194***	0.135***	0.075	0.078*	0.030	0.313***
Employees	0.110***	0.109***	0.132***	0.062	0.026	0.286***
Installations	0.067***	0.051***	0.177***	0.023***	0.012***	0.040***
Period 2	0.468***	0.839***	0.568***	1.069***	-0.034	3.146***
Period 3	0.462***	0.535***	0.332***	0.839***	0.015	1.123***
Region 2 (BE, FR, NL)	-0.216***	-0.191***	-0.017	-0.589***	-0.259***	-1.512***
Region 3 (GR, IT, PT, ES, CY, MT)	0.019	-0.186***	0.047	-0.186*	-0.275***	-1.955***
Region 4 (EE, LT, LV, PL)	-0.343***	-0.179**	-0.206***	-0.354***	-0.513***	-2.589***
Region 5 (CZ, HU, SI, SK)	-0.040	-0.182***	-0.063	0.409***	-0.432***	-2.355***
Region 6 (DK, FI, IS, NO, SE)	0.299***	-0.401***	0.239**	-0.844***	-0.076*	-0.842***
Region 7 (UK, IE)	-0.044	-0.245***	-0.133*	-0.845***	-0.360***	-1.997***
Region 8 (BG, HR, RO)	-0.098**	0.176***	-0.016	-0.100	-0.859***	-4.140***



Results Discussion

Estimation results for explanatory variables are consistent across all four indicators

- Net position and energy increase emissions-trading activities
 - → Results in line with findings for first trading period reported by Cludius (2018), Jaraitė-Kažukauskė and Kažukauskas (2015) and Zaklan (2013)
- Carbon-leakage is positively related to all indicators
- Productivity is positively related to indicators
 Zaklan (2013) finds no evidence that a company's profitability is associated with its trading activity
- Size (*Employees*) is positively related to emissions-trading activities
 - → Results in line with Jaraitė-Kažukauskė and Kažukauskas (2015), Baudry et al. (2021) and Cludius and Betz (2020) even though we employ a different proxy from those used in previous studies
- *Number of installations* is positively related to all four indicators
 - → Results suggest higher transaction costs for smaller companies; in line with Jaraite-Kažukauske and Kažukauskas (2015)
- Region dummies indicate that emissions-trading activities are related with geographical location.
 For most regions we found no clear patterns across all four indicators
- In second and third periods companies were more active than in first trading period



Results Robustness checks

Separate regressions for the three trading periods within the scope of the study

In general, results are consistent with those presented for the entire 2005–2014 period
 → Indicates that factors related to various emissions-trading activities remained stable over time

Estimation of a model which allows for an asymmetric response of net sellers and net buyers

- Without market frictions, the opportunity costs of holding allowances should be the same for net buyers and net sellers
 → For a given net position, trading activities should not depend on whether companies are net sellers or net buyers
- The findings for the explanatory variables are consistent with those for the entire 2005–2014 period of analysis
- For a given net position, net buyers are more likely to participate in emissions trading and trade higher volumes
 → This asymmetry possibly reflects a violation of Coase's (1960) independence property
 → Asymmetry has declined over time



Policy implications

- Higher share of auctioning since 2013 could have increased ability and willingness to participate in emissions trading
 → Could have increased efficiency
- Transaction costs for small emitters and asymmetry between net buyers and net sellers remain issues to be resolved
- Transaction costs for small emitters could be reduced by addressing barriers
 → Use of an electronic bulletin board as a trading institution that would be more accessible than an exchange
- Consignment auctions instead of free allocation
 - ightarrow Free allocation is offered at auction
 - \rightarrow Original holder receives the financial value of allowances (determined in the auction)
 - ightarrow Allowances go to the highest bidder
- Replacing free allocation of allowances to carbon leakage sectors by a carbon border-adjustment mechanism would be a more radical approach



Literature

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Data issues

- For several accounts we could not match EUTL with ORBIS database
- ORBIS database did not provide company characteristics for many companies
- Analysis of forwards and futures is based on information for typical delivery dates
- Data availability limitations does not allow to include information on banked allowances
- Accounting for transactions of allowances which are internal to companies may affect some of our results



Robustness checks

Different estimation models

Findings of the CRE negative binomial model are virtually identical to those for the CRE Poisson models

Distinction between net buyers and net sellers by splitting the sample accordingly

• At a very general level, the results are consistent with those for the full sample

Use profit instead of revenue per employee

Results are very consistent with those reported, but lose 30% of observations

Use of yearly instead of period dummies

• Results are very similar

