A Changing Climate in the EU Emissions Trading System

Analyzing trading and permit flows

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Thesis directed by Prof. Marc Baudry

PhD Thesis Defence – 15 December 2025

Introduction

Decarbonization in Europe: why carbon pricing matters

EU NDC under the Paris agreement: -55% by 2030, climate neutrality by 2050

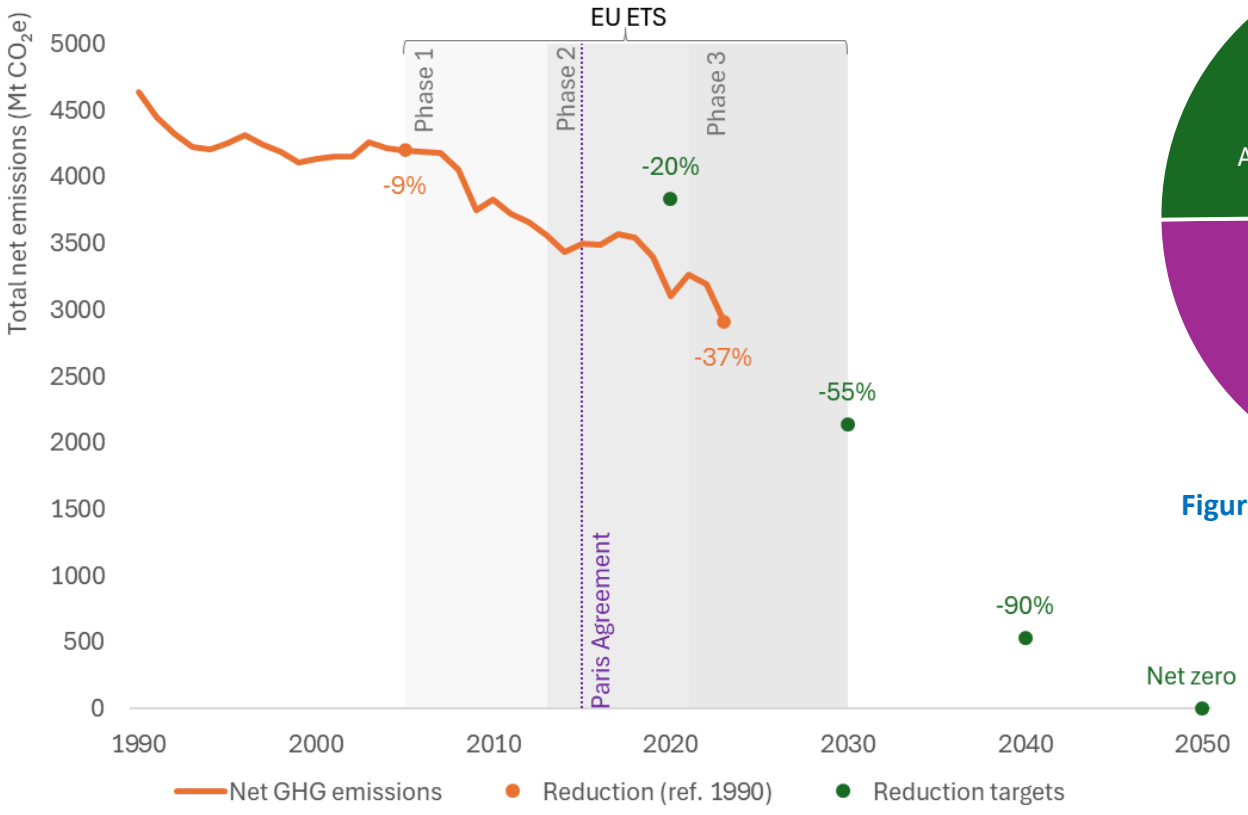


Figure: EU climate targets and emission reductions (*Source: Author based on ESABCC, 2025; EEA*)

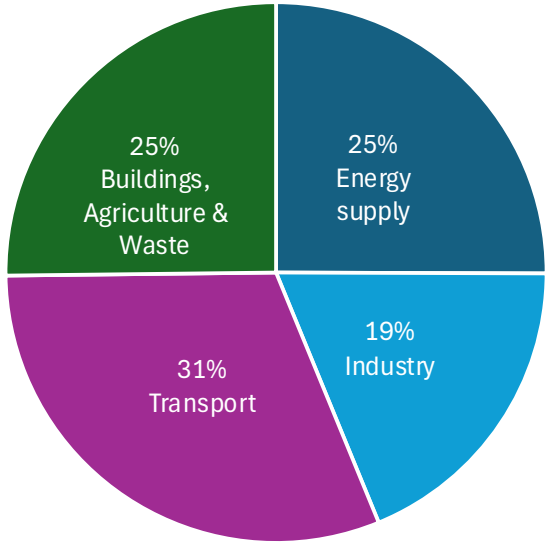


Figure: Sectoral shares of emissions in 2023 (*Source: Author based on EEA*)

ETS1: *energy supply, industry, intra-EU aviation & shipping*
ETS2: *road transport & buildings fuel suppliers*
Outside ETS: *agriculture waste, international aviation, shipping (partially)*

The EU ETS as a market: a microstructure perspective

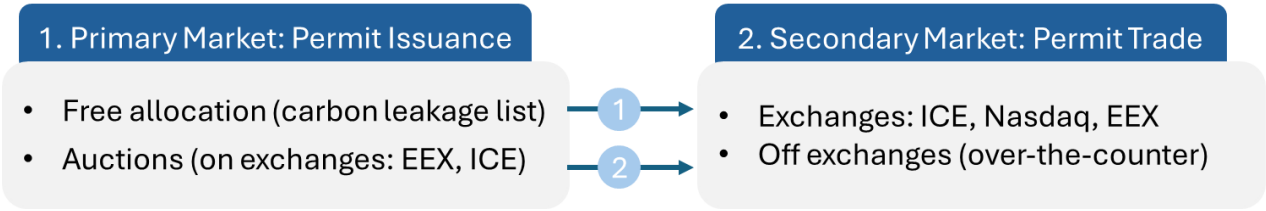


Figure: European carbon market structure (*Source: Author)*

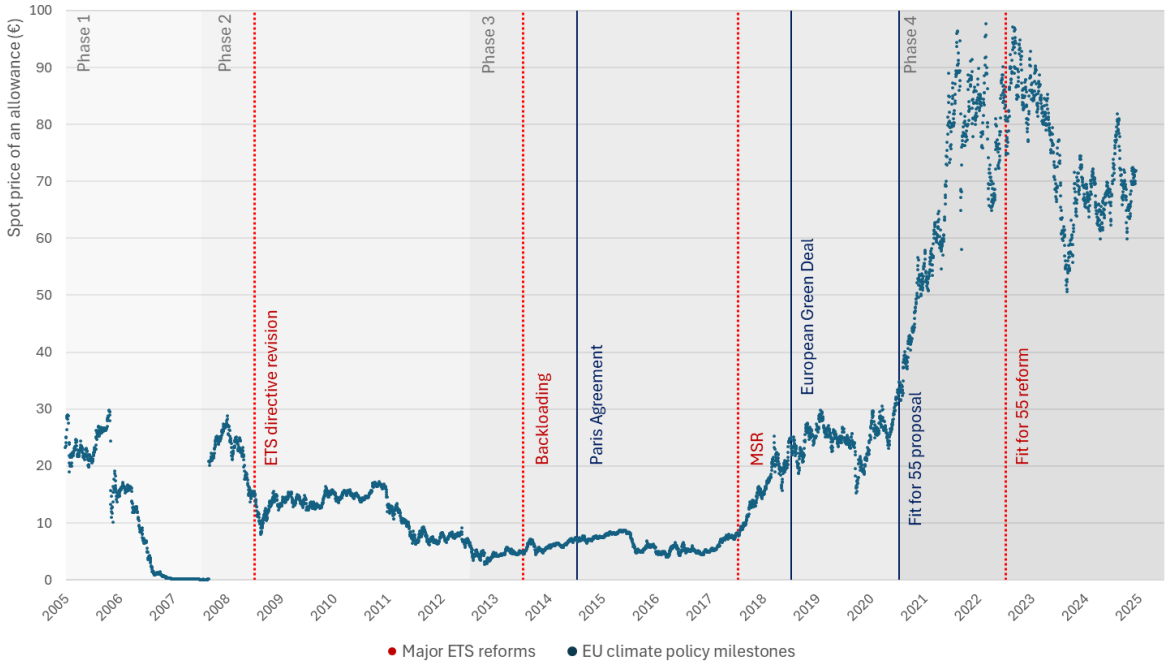


Figure: EU ETS regulatory and price timeline (*Source: Author based on ICAP & EC)*

Research gaps and relevance

Market design – allocation and institutional effects
(Zaklan 2023; Hintermann 2017; Cantillon & Slechten 2024; Borghesi et al. 2023)

→ *Limited evidence on how auctions link to secondary market trading.*

Participants – trading patterns and role of financial firms
(Jaraitė-Kažukauskė & Kažukauskas 2014; Abrell et al. 2021; Cludius & Betz 2020, Betz & Schmidt 2016; Quemin & Pahle 2023; Lausen et al. 2022)

→ *Are financial actors' really all the same? What drives behavior?*

Price dynamics – fundamentals and policy drivers
(Hintermann et al. 2016; Friedrich et al. 2020)

→ *Futures prices systematically exceed spot – why?*
(Bredin & Parsons 2016; Trück & Weron 2016; Azzone et al. 2025; Biais et al. 2025)

This thesis: an overview

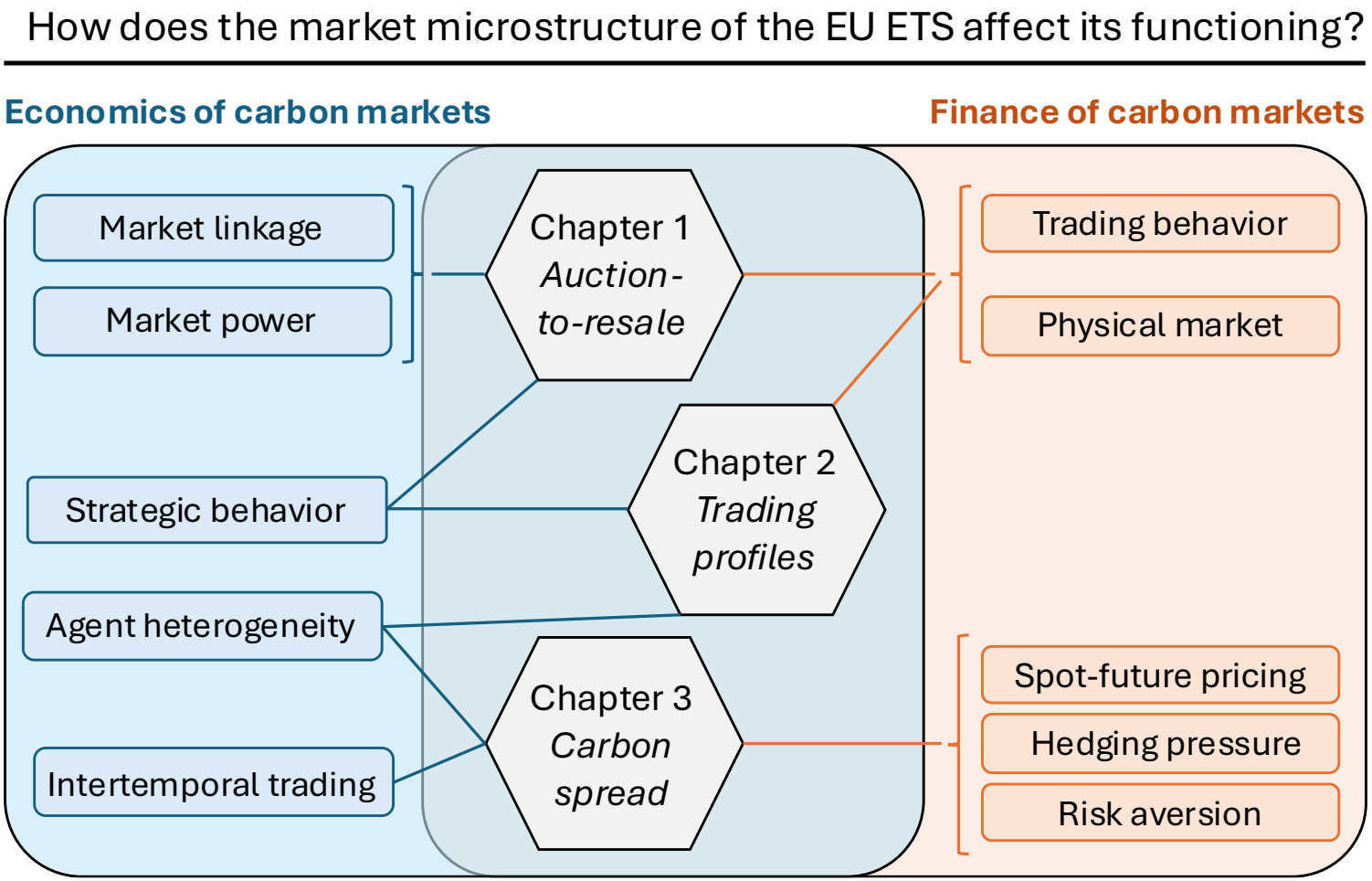


Figure: Thesis graphical abstract (*Source: Author)*

Chapter 1

From auctions to resale: Permit flows in the EU ETS

Dissemination: 2025: 12th FAERE Annual Conference, 13th IAERE Annual Conference
2024: Florence School of Regulation Working Paper Day

Motivation

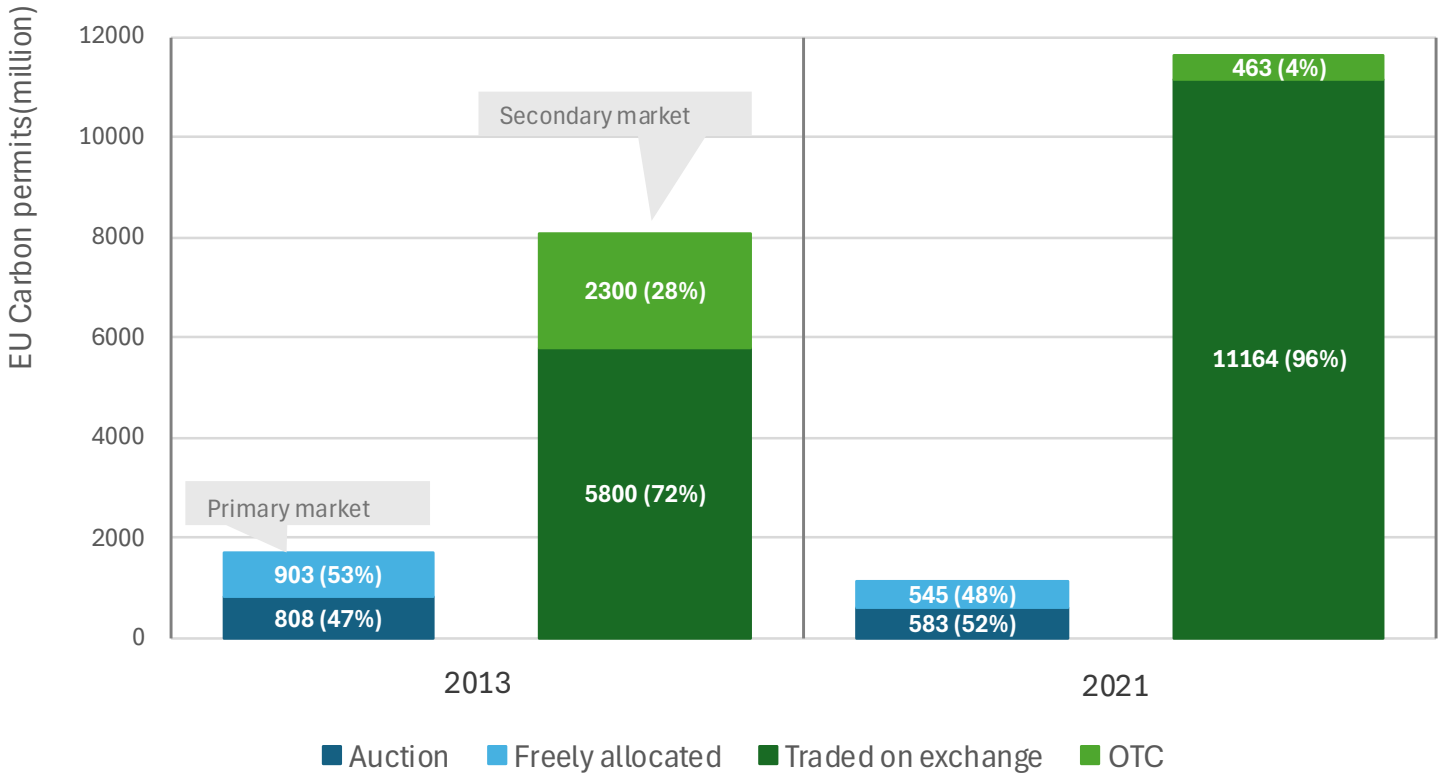


Figure: Evolution of permit trading by segment (*Source: Author)*

How have auction winners behaved in EU carbon markets (2013-2020)?

Methodology & Results

Micro-analysis of auction outcomes & resale behavior:

- Auction concentration
- Secondary dissemination indicators

Data: *consolidated* Union Registry (2013-2020)

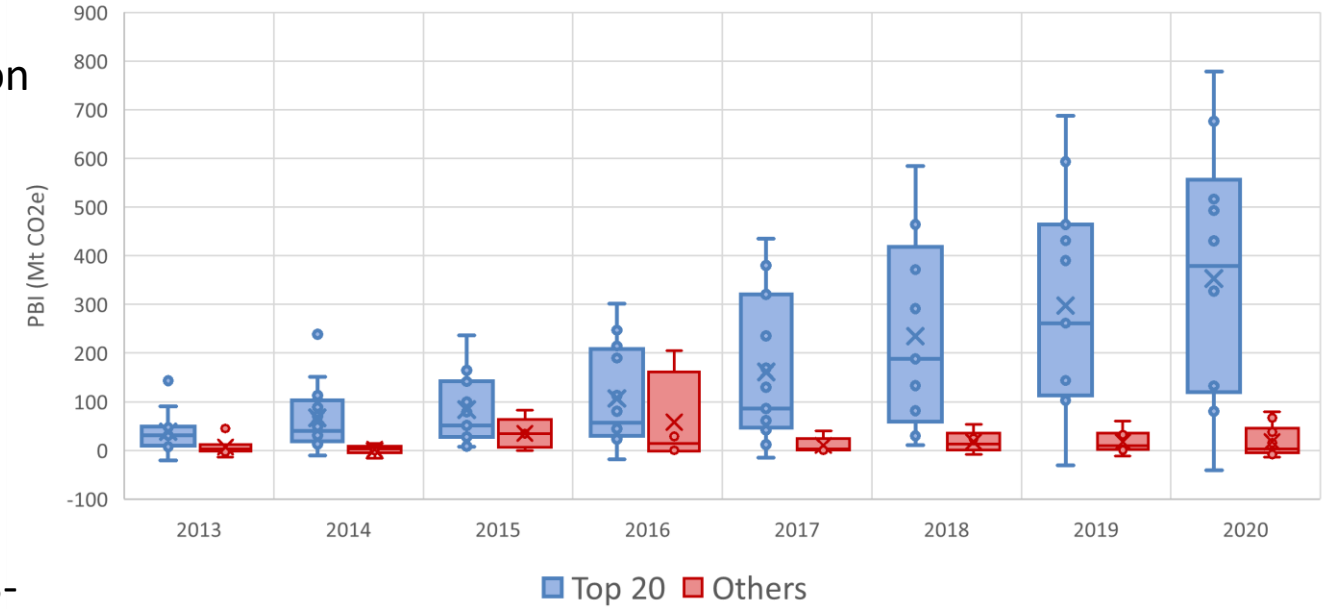


Figure: Permit accumulation by winning firm type (*Source: Author)*

→ Auctions are concentrated with persistent winners

→ Top 20 are net sellers

→ Evidence of delayed resale and buy-and-hold behavior

Chapter 2

Heterogeneous firms in the EU ETS: Mind the bias

Dissemination:
2023: University of Paris-Nanterre Doctoral Seminar, 6th International Conference on Econometrics and Statistics
2022: Florence School of Regulation Summer School, FSR Climate annual conference, Climate Economics Chair Doctoral Seminar, FAERE Doctoral workshop

Motivation

Increased financialization

Financial traders: 200 in 2018 ↗ 500 in 2022 (Quemin and Pahle, 2023)

Potential detrimental role played by purely financial actors

- EU discussions on banning them (EP, 2022)

Increased oversight:

- Derivatives market activity report (ESMA, 2022)

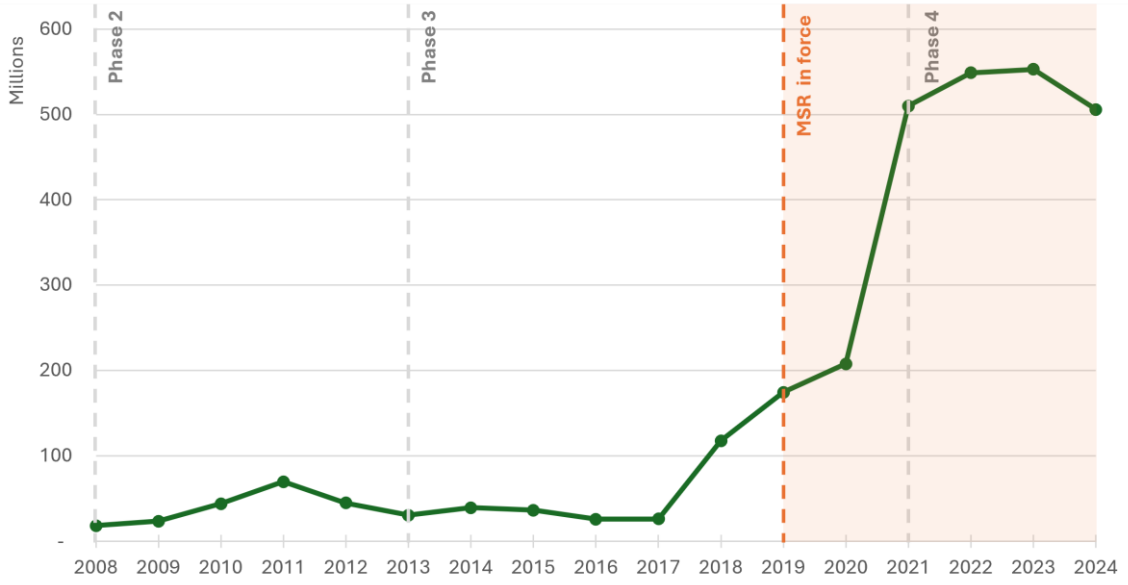


Figure: EUA Futures trading value (*Source: Author based on ICE)*

What are the different categories of actors in the EU ETS?

What characteristics explain how firms behave?

Methodology & Results

3 trading profiles emerge: 1 outlier

(net sellers, few counterparties)

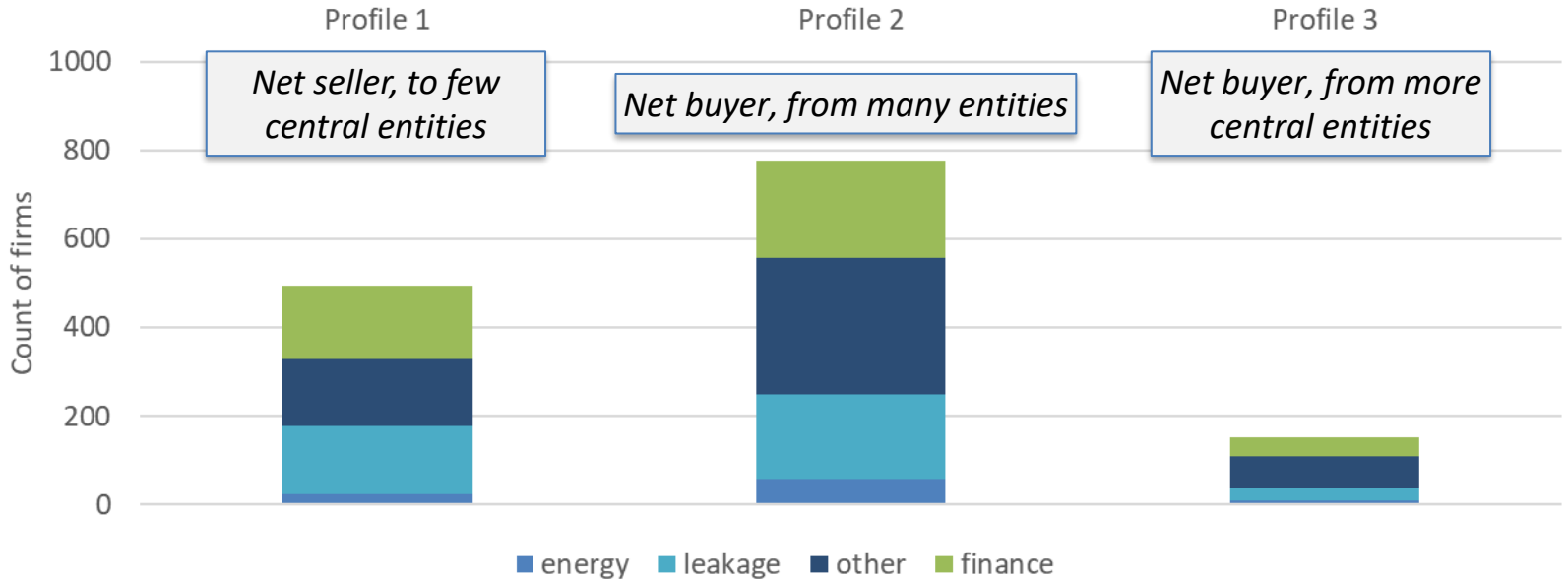


Figure: Firm sectors across profiles (*Source: Author)*

→ No clear sectoral pattern: behavior ≠ sector classification

Chapter 3

Carbon price spread and hedging pressure: Theory and evidence from the EU ETS

Co-authors: Marc Baudry, Simon Quemin

Dissemination: 2024: EAERE annual conference, CEC PhD Workshop

Motivation

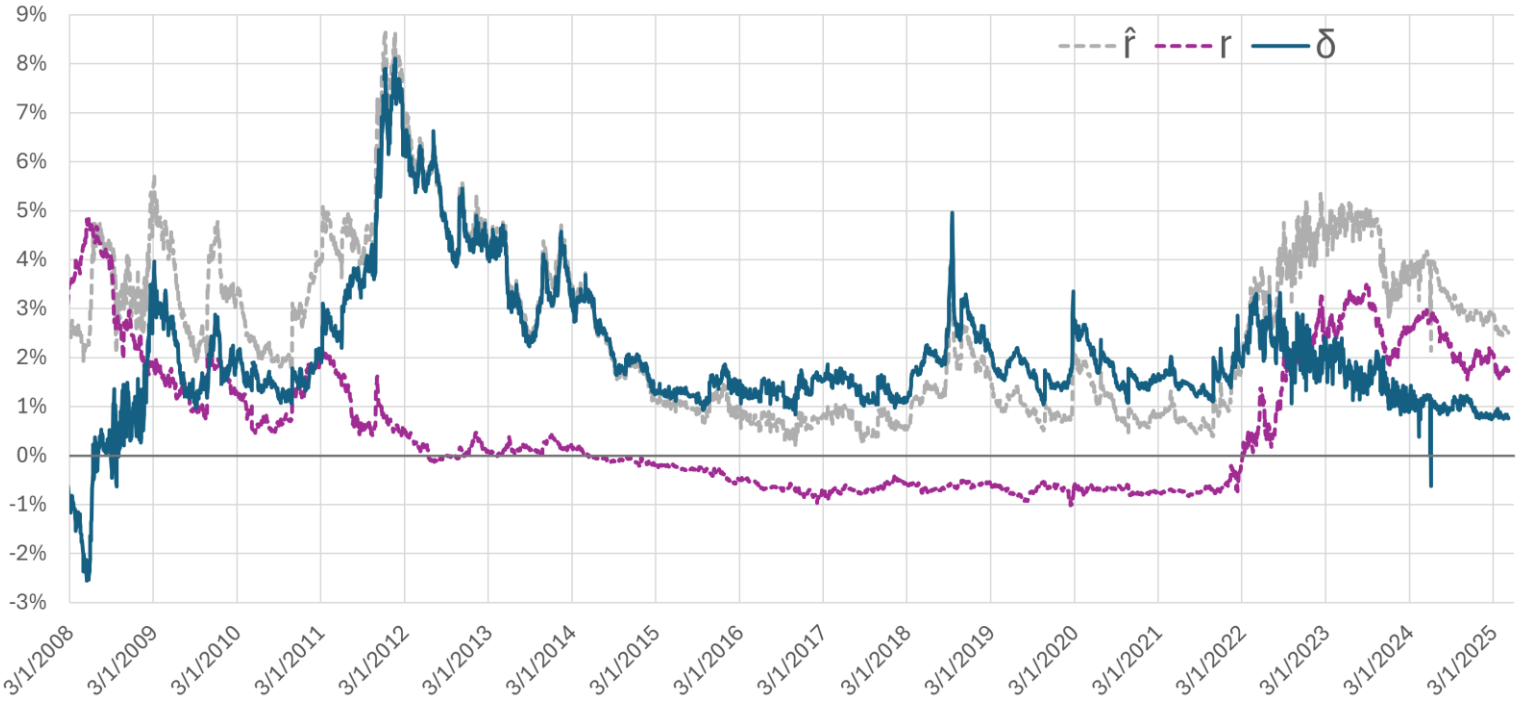


Figure: Implied yield $\hat{\mathbf{r}}$, risk-free rate **r**, and spread **δ** (*Source: Authors)*

Motivation

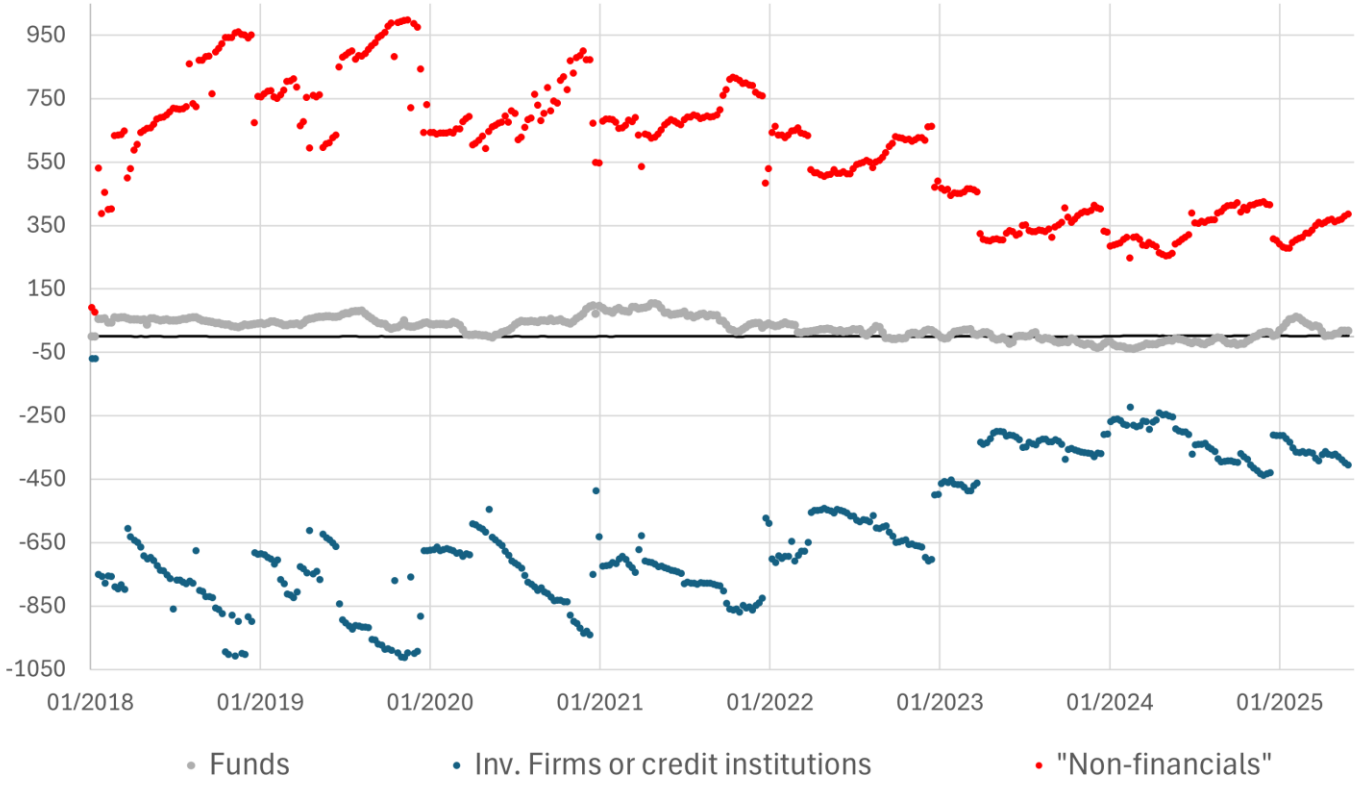
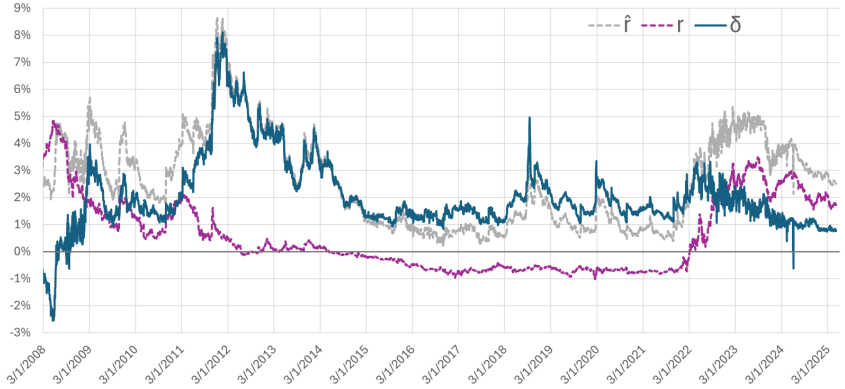


Figure: Total net derivatives positions, Mt CO_2 (*Source: Authors based on COT)*

Motivation



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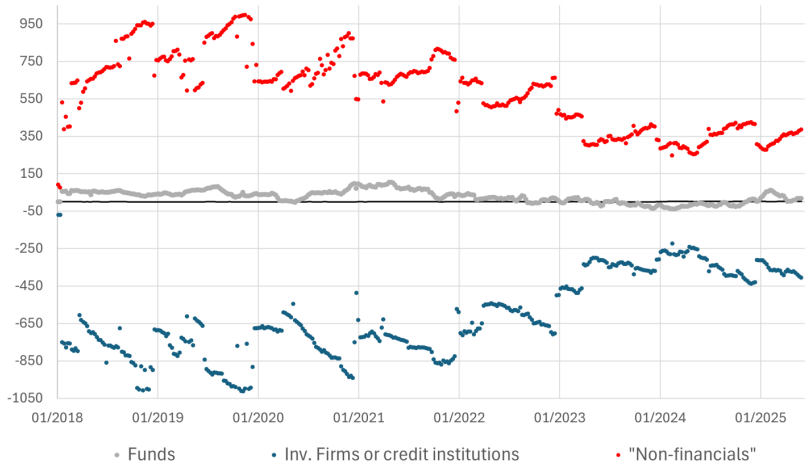

Figure: Total net derivatives positions, Mt CO_2
(*Source: Authors based on COT)*

Can the hedging behavior of compliance actors explain the persistent positive futures-spot spread observed in the EU ETS?

Methodology & Results

Stochastic allowance market model:
Heterogeneous, risk-averse regulated firms and a speculator

Empirical ECM
Data: weekly COT report (2018-2025)

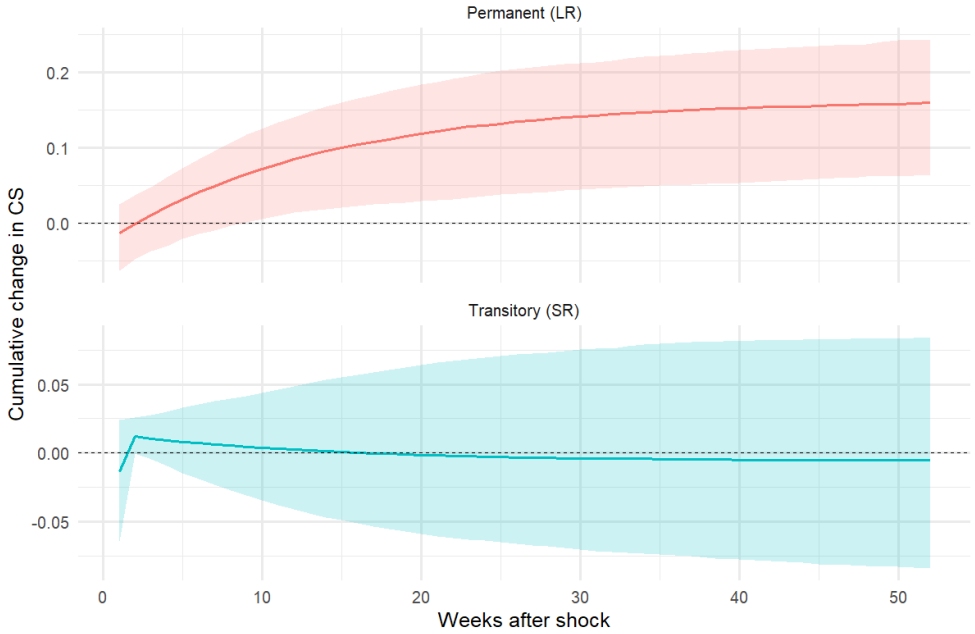

Figure: ECM Impulse Response Functions from hedging pressure shocks (*Source: Authors)*

→ Significant long-run relationship between net hedging demand and the carbon spread

Conclusion

Main findings

How does the market microstructure of the EU ETS affect its functioning?

Chapter 1 – Auction-to-resale

Auction winners show signs of strategic withholding: potential market power

Chapter 2 – Trading profiles

Trading behavior cuts across institutional categories

Chapter 3 – Carbon spread

Hedging pressure from compliance firms drives futures premium

Contributions and policy lessons

Contributions:

Mapping physical permit flows to market activity

Shows potential strategic behavior in auction-to-resale path

Theoretical and empirical framework to explain carbon futures premium

Policy lessons:

Improve Union Registry data transparency

Monitor auction concentration & strategic behavior

Target trading patterns
Instead of participants types

THANK YOU !