Cap and Trade with Imperfect Hedging

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Discussion:
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Paper: "Cap and Trade with Imperfect Hedging"

- Cap-and-trade $\Rightarrow$ **transition risk** for emitters
  - future caps and permit prices are uncertain
- Two ways for emitters to hedge:
  - buy spot permits and store them (needs upfront cash)
  - buy futures (no upfront cash)
- Financial constraints $\Rightarrow$ **imperfect hedging**
- Two questions:
  - **positive**: explain hedging behavior & positive basis
  - **normative**: what is the optimal cap path?

Four stylized facts in the EU ETS

(1) Permit prices are **volatile** (peaked at $\sim$€100/tCO_2);
compliance-cost volatility is large relative to pre-tax profits

(2) **Emitters** hold permits + long futures;
financials are short futures and hold spot

(3) Less capitalized emitters store **fewer permits**, buy them **later**, and use **futures more**

(4) Discounted futures price $>$ spot price:
a **positive basis** of $\sim$80 bps annually

The Model

- Two future **cap states**:
  - low cap / tight policy $\Rightarrow$ scarce permits, low emissions/output, high permit price
  - high cap / loose policy $\Rightarrow$ abundant permits, high emissions/output, low permit price
- Emitters want insurance against the tight-cap state
- Limited commitment:
  agents can divert assets $\Rightarrow$ **imperfect risk-sharing**
- Equilibrium:
  - emitters go long futures; financials go short
  - financials hedge short futures by holding spot permits
  - spot trades at a discount $\Rightarrow$ positive basis

The Policy Result

- Cap-and-trade can still implement the constrained optimum
- But the optimal cap is **smoother** than first-best:
  - when SCC is high $\Rightarrow$ cap looser than first-best
  - when SCC is low $\Rightarrow$ cap tighter than first-best
- Second-best permit prices $<$ first-best permit prices
- The government should **not frontload** permit issuance

Intuition: when firms cannot fully insure against cap uncertainty, the regulator can raise welfare by partly insuring them by making policy less state-contingent.

Comment 1: Clearest Contribution is Mechanism & Policy

(1) Volatility: Känzig (2023), Fuchs et al. (2025)
   - new quantification vs. pre-tax profits is useful

(2) Hedging & financials: Lucia et al. (2015), Cludius and Betz (2020)

(3) **Firm-level patterns**: most novel

(4) Positive basis: Bredin and Parsons (2016), Trück and Weron (2016), Palao and Pardo (2021), Azzone et al. (2025)

This paper:

- a unified limited-commitment interpretation tying the facts together
- the cap-smoothing policy implication

Comment 2: How large is the smoothing motive?

- Paper accounts for high marginal damages when SCC is high
- Second-best smoothing trades off:
  - higher climate damages from a looser high-SCC cap
  - insurance benefits for constrained emitters
- Key question: **how large** is the optimal distortion?
  - welfare weights
  - tightness of limited commitment
  - absence of other insurance tools

Comment 3: Mapping "limited commitment" to EU ETS

- In the model: agents can divert / abscond with a fraction of their assets
- But EU ETS allowances are **registry-based** regulated assets:
  - held in the Union Registry
  - transfers are observable and regulated
  - usable as collateral, with capital charges
- What is the institutional counterpart of "absconding"?
  - default / bankruptcy delay?
  - collateral non-eligibility?
  - bank capital charges on permit holdings?

Comment 4: Is the EU ETS already smoothing?

- Core cap: mostly a precommitted declining path
  - LRF $= 4.3\%$ in 2024–2027; 4.4% from 2028
  - target: ETS emissions 62% below 2005 by 2030
- But effective supply is state-sensitive:
  - banking smooths compliance over time
  - MSR withdraws allowances when surplus is high
  - MSR releases allowances when scarcity is high
- These rules respond to **market states**, not directly to **SCC states**
- EU ETS also broadly follows the **no-frontloading** logic:
  - allowances are issued gradually, not decades in advance
  - avoids forcing firms to pre-finance future compliance

Comment 5: What about decarbonization investment?

- Main model: firms hedge transition risk financially
  - spot permits and futures
  - no irreversible decarbonization investment margin
- Central goal of ETS is decarbonization investment
- With investment, firms can also hedge transition risk in real terms
  - fuel switching, electrification, energy efficiency, CCS
- Then carbon price uncertainty has two costs:
  - Biais et al. (2026): imperfect risk sharing / welfare cost
  - Fuchs et al. (2025): delayed decarbonization investment

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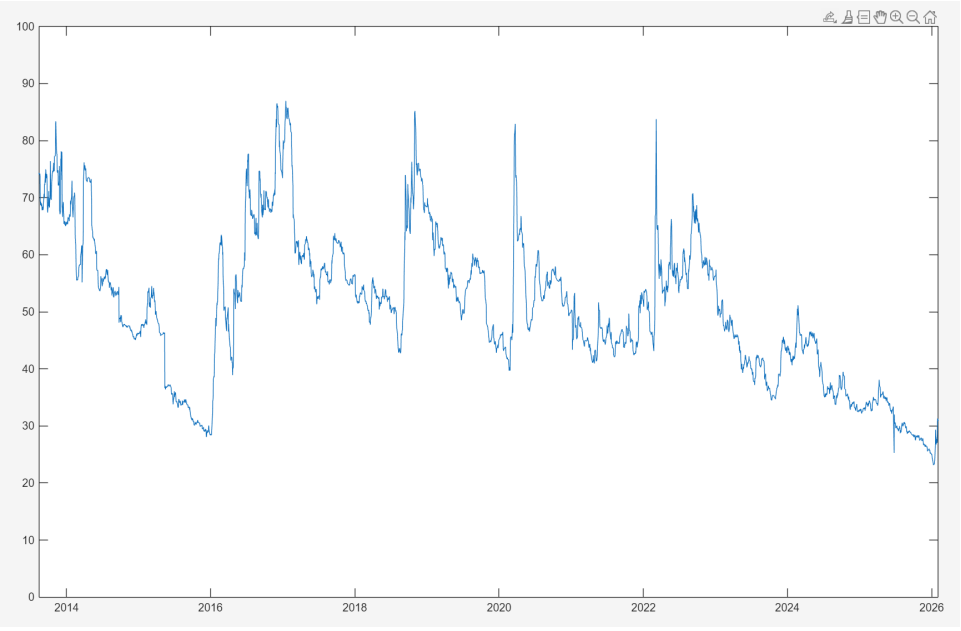
Question: does cap smoothing survive, strengthen, or change once investment is endogenous?

Comment 6: EU ETS options can help test the mechanism



Source: Fuchs et al. (2025); `carbonvix.org`

- Paper's primitive: **uncertainty** about future caps & prices
- EUA options reveal it: **Carbon VIX**
- Spikes around policy and demand events

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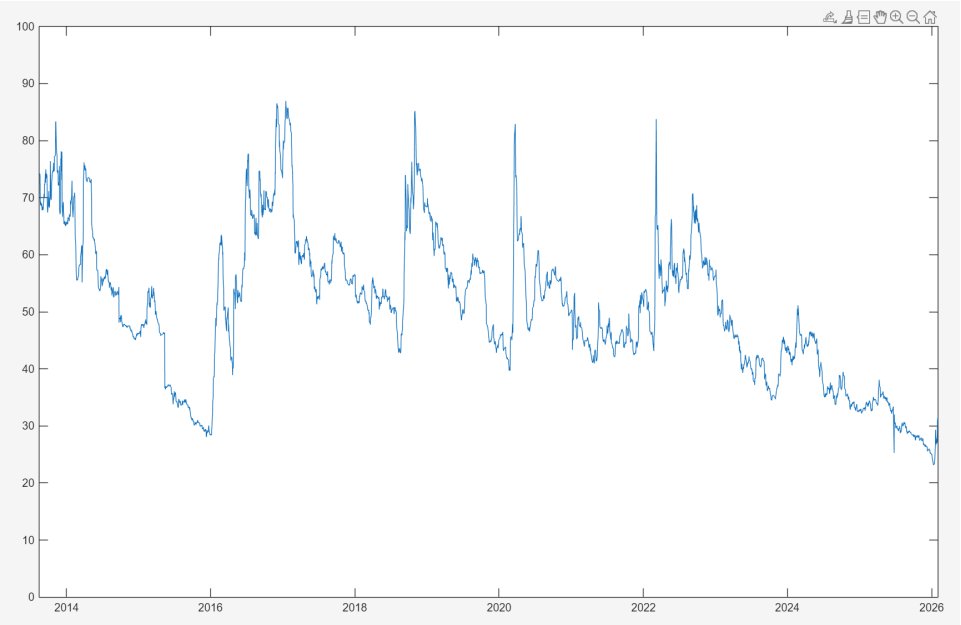

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- Paper's primitive: **uncertainty** about future caps & prices
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Question: do emitters hedge more/earlier when cap policy is more uncertain?

Conclusion: "Cap and Trade with Imperfect Hedging"

(1) Policy result is the core: cap smoothing as second-best insurance

(2) How large is the smoothing motive?

(3) Limited commitment needs a sharper institutional EU ETS counterpart

(4) EU ETS already smooths through banking and the MSR

(5) Investment adds a real-hedging margin missing from the main model

(6) Carbon VIX can help test the mechanism

Credible mechanism. Policy relevant. $\Rightarrow$ Exciting paper!

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Appendix

Backup: Identification of the mechanism

- firm-level regressions are correlations, not causal
  (paper states this clearly)

- The positive basis is consistent with several stories:
  - corporate **credit spreads** (Azzone et al., 2025)
  - **financialization** and segmentation (Palao and Pardo, 2021)
  - **term-structure** / market conditions (Bredin and Parsons, 2016)

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Suggestion: a sharper test that distinguishes limited-commitment from credit-spread or segmentation explanations

- e.g. does the basis comove with emitter equity ratios beyond what credit spreads imply?

Backup: Futures margining in practice

- In the model, futures are attractive because they avoid upfront spot financing
- In practice, futures require **initial** and **variation margin**
- Long futures (emitters) *receive* variation margin when prices rise
- But **short futures** (financials) *pay* variation margin when prices rise — exactly when their balance sheet is most strained
- So margining **shifts** the financing constraint from emitters to intermediaries, rather than removing it

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Suggestion: this strengthens the paper's intermediation story

Backup: Cap smoothing $\neq$ price certainty

- Biais et al.: financial frictions $\Rightarrow$ planner smooths **quantities**
- Fuchs et al.: investment responds to uncertainty about **prices**
- The cap is a policy quantity; the carbon price is an equilibrium outcome
  - a smooth cap can still imply volatile prices
  - a stable price may require state-contingent quantities
- Price floors, ceilings, corridors, reserves, or CfDs target the price distribution more directly

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  Question: with irreversible investment, should policy smooth caps or stabilize prices?