The reformed EU ETS: Intertemporal Emission Trading with Restricted Banking

ENERDAY, 12 April 2019
EU ETS reform: regulation for phase IV (2021-2030)

Price development EU ETS

Three principal amendments:

1. **Linear reduction factor of cap**
   - set to 2.2% for phase IV (phase III: 1.74%)

2. **Introduction of the Market Stability Reserve (MSR):**
   - corridor for allowances in circulation

3. **Cancellation mechanism:**
   - volume in MSR is limited to previous year’s auction volume
   - Total cap becomes endogenous

Source: ICE (2019)
I. Discrete dynamic optimization model
II. Results
III. Further research and discussion
Our research fills an important gap in the literature

Our contribution:

- New EU ETS regulation accurately depicted in a discrete time model
- Modelling of the endogenous cap
- Quantification of the impact of MSR, Cancellation Mechanism and LRF
- Decomposition of the price effects of the EU ETS amendments
- Evaluation of the impact of amendments on dynamic efficiency

Continuous time:
Quantification of the impact of the MSR; e.g. Perino & Willner (2016), Salant (2016)

Discrete time, but qualitat. analysis or iterative models:
MSR Cancellation & Overlapping National Policies; e.g. Beck & Kruse-Andersen (2016), Carlen et. al (2018)

Without latest reform:
Evaluation of dynamic efficiency of different MSR designs; e.g. Neuhoff et al. (2012), Schopp et al. (2015)

Theoretical foundation for intertemporal trading
Hotelling (1931)
Rubin (1995)
Chevallier (2012)
A market equilibrium is derived where firms minimize their costs given the new market rules.

Cost minimizing, price-taking firm with perfect foresight decides on emissions $e(t)$, abatement $u-e(t)$ and banking $b(t)$. Parameter interest $(r)$, counterfactual emissions $(u)$ and cost parameter $(c)$ are exogenous:

$$\min \sum_{t=0}^{T} \frac{1}{(1+r)^t} \left[ \frac{c}{2} (u-e(t))^2 + p(t)x(t) \right]$$

subject to:

$$b(t) - b(t-1) = x(t) - e(t)$$
$$b(t) \geq 0$$

Market equilibrium given individual optimality conditions, supply and regulatory rules:

$$c(u - e(t)) = p(t).$$

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Market prices increase with the interest rate if private bank > 0

Equilibrium price path:

\[
\frac{p(t + 1) - p(t)}{p(t)} = r - (1 + r)^{t+1} \frac{\mu b(t)}{p(t)}
\]

=0, if \( b(t) > 0 \)

- Price develops according to **Hotelling rule (1931)** for extraction of finite natural resources
- Firm is **indifferent between investment** at the capital market and **extraction** of the resource

> 0, if \( b(t) = 0 \)

- Price increases **at less than the interest**
- No bank \( \rightarrow \) **all allowances issued are used** \( \rightarrow \) abatement level and price level develop accordingly

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I. Discrete dynamic optimization model

II. Results

III. Further research and discussion
The price increases with the interest rate until 2038.
The increased LRF reduces overall emissions cap by 9 billion EUA.
The MSR shifts emissions from the present to the future
I. Discrete dynamic optimization model

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Discussion

Contribution of the research

Contribution of the model
- Accurate discrete time representation of regulation in place
- Three simple exogenous parameters; robustness check through sensitivity analysis

Insights into the EU ETS
- LRF has a stronger impact than the cancellation of allowances
- Price effects of the reform more medium term

Open questions

Why did the EUA price increase last year?
- Bounded rationality of market participants
- Regulatory uncertainty
- Other explanations?

How does the new EU ETS interact with other national or European policies?
- Combination with a EU-wide price floor
- Combination with national price floor
- Support for renewable energies (or other demand shocks)
Thank you for your attention!

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