

Effects of Carbon Taxation on Corporate Ratings

The Case of the German Wholesale Power Market

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work-in-progress

Motivational Background

Markets price (climate) risk efficiently – but only absent market failure ...

With respect to climate risk analysts face informational problems:

(1) Uncertainty of future market environment / policy measures

- Usual approaches: aggregate modelling, strong assumptions about future
- Typical tools: IAM / CGE + financial models + intermediaries' portfolios

(2) Asymmetrical/incomplete information

- Data on risk exposure typically only sector-based
- Usual approaches: imputation of (sectoral) values

Motivational Background

How will *measured* individual CCR change in detailed, more informed analyses?

A detailed model of specific (transition) risk can ...

⇒ **reduce uncertainty:**

- confidence about implementation of policy (since specifics are known)
- take into account non-linearities, market-specifics (by modelling market mechanism)
- individual firm modelling incl. immediate microeconomic firm-level reactions

⇒ **reduce asymmetric information/elicitation:**

- transparency allows individual risk assessment on basis of microlevel data (technology and financial statements)

Also: ESCB min standards: *individual credit ratings* shall consider climate risk

Motivational Background

Why electricity, why CO₂ price policies? (...power is key for the climate transition)

- Extreme **transparency** of the market: most credible case for microeconomic foundation available
- CO₂ pricing is one of the most **important and salient policy instruments** of the climate transition
- CO₂ pricing is **visible, relatively simple**, under a number of restrictions first best instrument

Real policy experiment: EU legal packages stimulating CO₂ price (April 2018, June 2021)

Research Design and Methods

Ex post dimension useful for identification, **ex ante dimension** allows simulation

Ex post: What have been historical vs counterfactual effects on cash flows (CFs) and ratings of electricity generating companies?

- CO₂ price acts heterogeneously on firms according to CO₂ intensity of portfolio
- Micro-model allows quantification of firm-CFs from electricity at 8 and 80 €/tCO₂
 - We can add this CF difference to the 2017 rating: Counterfactual $Rating(2017 +)$
- **TBD** Test of underpricing CO₂ risk: $H_0: \varepsilon = |Rating(2017 +) - Rating(2021)| = 0?$
- Compare simulated to actual rating migration → if markets price correctly, difference is noise!

Ex ante: What should be the effects of an increase to 200€/tCO₂ on ratings?

- Simulation of 200€/tCO₂ policy with assumed probability 1
- Necessary rating adoption

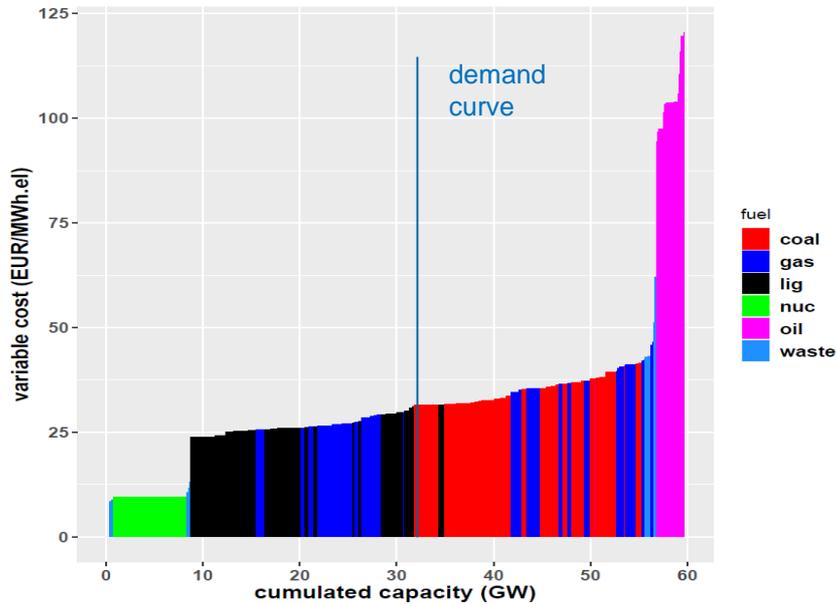
Step (I): Wholesale electricity market model

- Goal: derive CF (margin=revenue-cost) effects of market changes for each individual firm
- microeconomic model of the German power market (wholesale day-ahead market → reference market)
- Total cost minimization model – typical assumption in techno-economic models for policy analysis (possibly realistic → very transparent market, overcapacities to some degree)
- Inputs: input prices (coal, oil, gas, nukes), load, renewable infeed, technical restrictions (plant capacity, plant efficiency, operating restrictions, detailed technology information such as combined heat and power (CHP) production)
- Outputs: market price, operating hours of power plants, plant costs

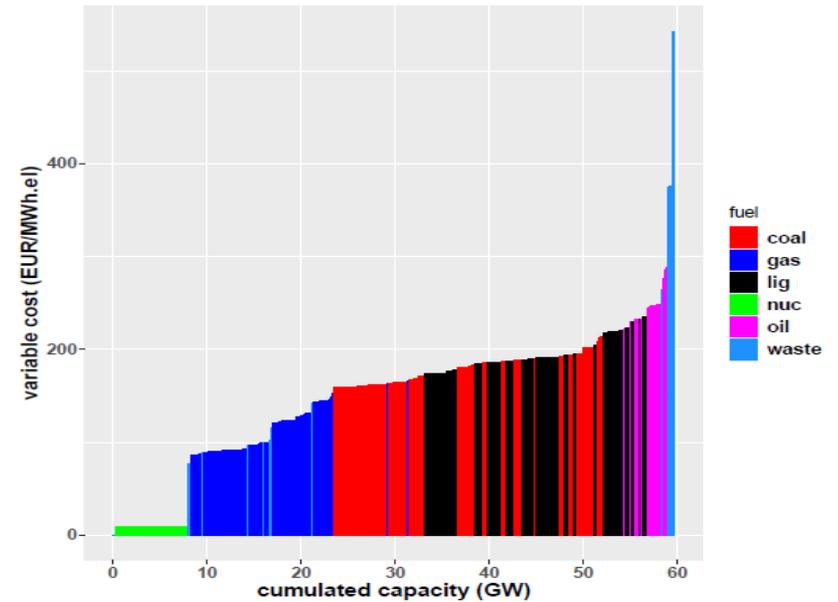
⇒ we can then calculate yearly margins and balance sheet implications

Step (I): supply curve / stack – the merit order

(A) Base scenario: CO₂ price year 2020

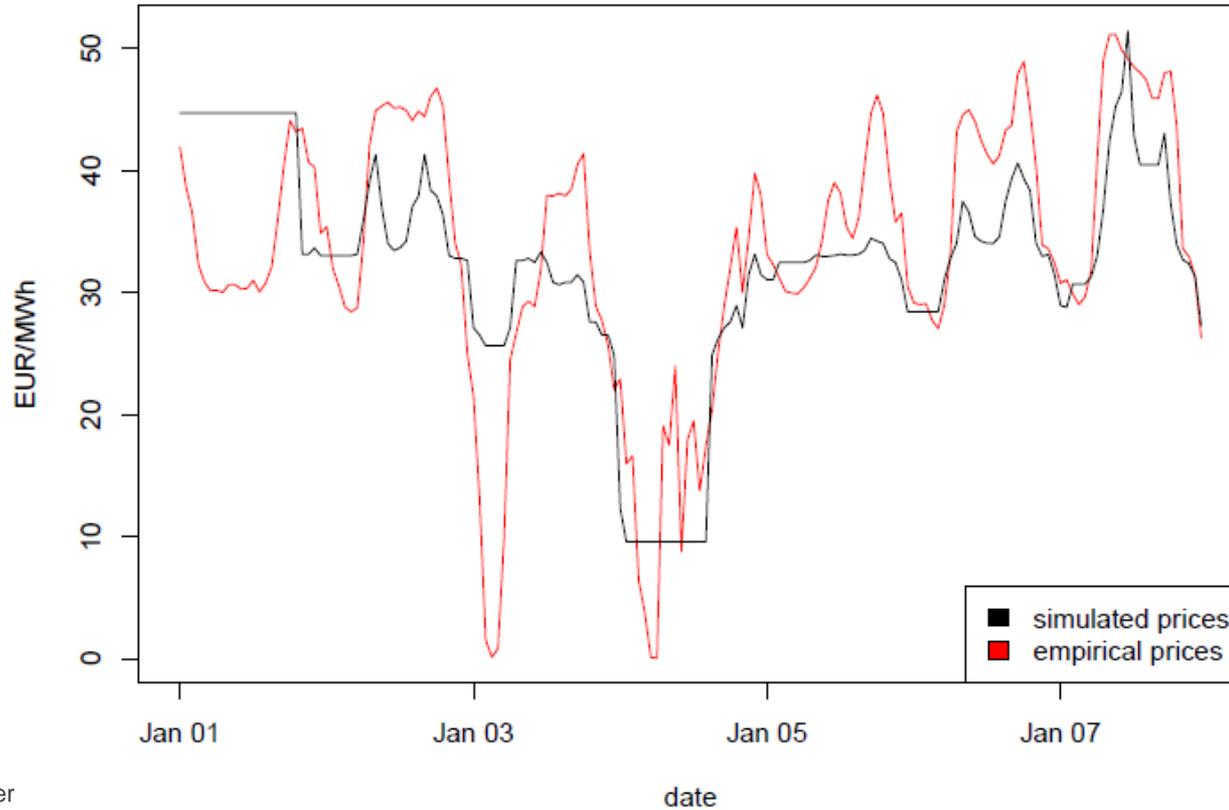


(B) Stress scenario: CO₂ price 200 €/tCO₂



Step (I) : wholesale power price

wholesale power prices 2020

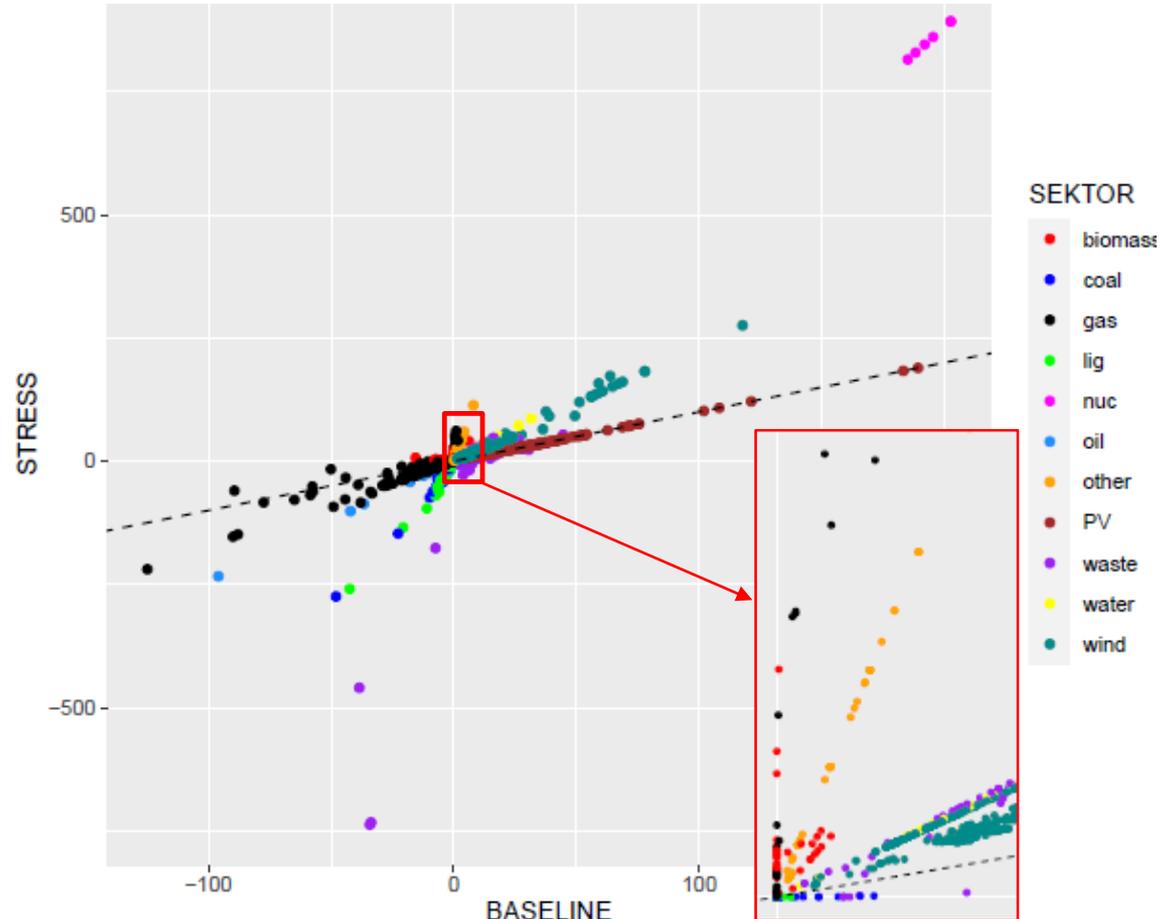


Step (II): Contribution Margins

Contribution margins show how gross profits vary with respect to chosen scenario:

- nuclear power plants reap highest benefits (take full advantage from rising electricity prices)
- renewables already protected by feed-in tariffs → gain only when prices exceed guaranteed compensations (wind vs. solar power)
- gas plants gain/lose according to combined heat and power characteristic

contribution margins 2020 (mio EUR)



Step (II): Balance Sheet Projection and Rating

Two steps are necessary for the balance sheet projection:

- (1) estimation of cost and revenue from power production in the disclosed financial statement of the enterprise under baseline conditions
- (2) estimation of cost and revenue from power production in a stress scenario

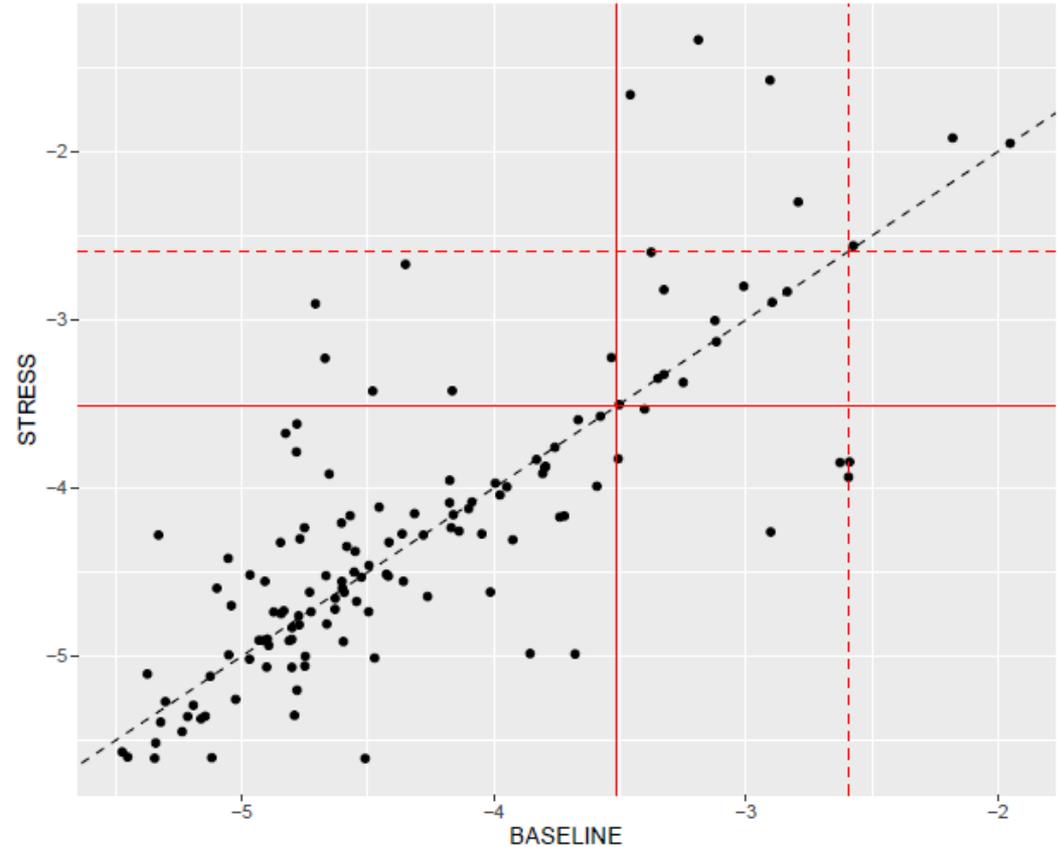
The difference is posted to the financial account, which then in turn serves as input for a statistical rating procedure.

RESULTS: rating migration

Price surge for EUA to 200 EUR would have perceptible consequences for migration of ratings

≤ 1	0	≥ 1
26.3%	48.9%	24.8%

- majority remains within the high quality grades (lower left)
- six lose BBK's creditworthiness rating (upper left)
- five gain BBK's creditworthiness rating (lower right)



Conclusions

- Heterogeneous outcomes of rating movements (taxation produces winner as well as losers)
- Highly non-linear effects:
 - unequal impacts for different technologies and within same technology !
 - firms have individual technology mix in their portfolios
- sectoral approach might be inaccurate in the majority of cases

Further analysis to be done:

- How do financial markets include this information?



Thank you!