INTERTEMPORAL EMISSIONS TRADING AND MARKET DESIGN: AN APPLICATION TO THE EU-ETS

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Overview

The European Union recently reformed its emissions trading system in the face of a significant, prolonged price downturn attributable to the economic recession and the demand-curbing achievements of overlapping renewable and energy efficiency policies, as well as of attendant criticism that the market failed to display responsiveness to changing economic circumstances. Main changes include a discretionary increase in the annual reduction rate of the emissions cap and, effective as from 2019, the implementation of a rule-based supply-side control, the market stability reserve (MSR). So far the literature has assessed the final reform under certainty assuming rational agents with given discount rates to quantify the long-term emission effects of overlapping policies, i.e. the ability of the MSR in puncturing the associated 'waterbed effect' (the downward pressure on ETS price induced by the success of other emissions reducing policies such as renewable and energy efficiency).

Methods

We build a model of competitive intertemporal permit trading under uncertainty where cost-minimizing firms can deviate from perfect rationality in two respects. Indeed, empirical studies indicate that firms covered under the EU-ETS behave consistently with intertemporal cost minimization although their degrees of optimizing behaviors, levels of foresight and time horizons remain hard to elicit. Specifically, we introduce myopia on the part of firms, i.e. on top of discounting the flow of abatement costs, they further discount the flow of required abatement efforts or have an explicitly truncated planning horizon. Additionally, we allow firms to have different degrees of sophistication in understanding the interplay between the MSR-induced supply impacts and their own decisions in the competitive equilibrium over time, ranging from zero sophistication to rational expectations.

The model is calibrated to the EU-ETS and features the core design elements thereof. We first parametrize permit demand using historical emissions data and assuming EU-wide renewable and energy efficiency targets are attained in the future. In line with the observed trend, the resulting baseline emissions are declining over time. We next calibrate the market's interest rate, myopia and marginal abatement costs ex post so that our simulated price and banking paths match with observed paths over 2008-2017. To the best of our knowledge, this is the first attempt to do so. The values we obtain for the interest rate and cost are in line with dedicated empirical studies and the estimated myopia constitutes a first tentative appraisal in the literature. In particular, we show how myopia can be key in explaining observed price dynamics.

Results

We use our calibrated model to assess the role of the MSR in the EU-ETS functioning and investigate its potential to attain its two purported objectives, i.e. raising the price and improving the system resilience to demand shocks. We find that the MSR always reduces the cumulated cap (even without cancellations) and increases the 2050 price by c.a. 30%. Cumulated cancellations are substantial, in the order of 5 to 10 GtCO2 and we characterize how market outcomes depend greatly on the interplay betweenthe firms' types and degrees of myopia and sophistication. For instance, the observed 2018 price surge would be consistent with rational expectations under a truncated planning horizon, irrespective of the cancellation provision. Moreover, the MSR acts as a temporary patch in that it curbs some excess supply induced by the 2008 economic downturn and past achievements of overlapping policies but displays limited responsiveness to similar demand shocks in the future. Finally, we provide a brief comparative analysis of the EU-ETS performance with an alternate control, a soft price corridor, under similar circumstances.

Conclusions

Our first contribution is the introduction of two sources of bounded rationality on the part of regulated firms. First, they can have different types and degrees of myopia as they decreasingly account for estimated annual abatement efforts the farther away theylook into the future. Second, they have different degrees of sophistication in understanding the interplay between the supply control's impacts and their own decisions in the competitive equilibrium over time. Our second contribution is the calibration of the market's interest rate, myopia and marginal abatement costs based on 2008-2017 market data to match observed price and banking paths. As a first attempt in the literature, we find reasonable parameter values and highlight the key role myopia can have in the price dynamics. As a third contribution, we assess the final market reform, essentially the impacts of the market stability reserve. We find that the MSR always reduces the cumulated cap (even without cancellations) and raises the permit price. We show how the MSR supply impacts depend greatly on the firms' types and degrees of myopia and sophistication. Our results indicate the reform has not completely addressed the governance issue as the MSR acts as temporary patch which is able to curb some excess supply induced by the 2008 economic downturn and past achievements of overlapping policies but displays limited responsiveness to similar shocks in the future. We also compare the performances of the MSR with those of a less peculiar supply-side control, a soft price collar.

Additionally, although our model is herein purposely tailored to the EU-ETS, it is amenable to amendments and calibration to other systems, for instance the Regional Greenhouse Gas Initiative (RGGI) or the linked California-Québec ETS where other forms of price collars, intertemporal trading provisions and compliance cycles are in place. More broadly, our framework and the simulation results we obtain for the EU-ETS contribute to improving our understanding of the intertemporal performances of emissions trading systems in general – a topic which is high on the policy and research agendas – as well as the interactions between intertemporal trading and supply-side controls.

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