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Assessing the implementation of the Market Stability Reserve☆

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ABSTRACT

In October 2015 the European Parliament has established a Market Stability Reserve (MSR) in the Phase 4 of the EU-ETS, as part of the 2030 framework for climate policies. In this paper we model the EU-ETS in presence of the Market Stability Reserve (MSR) as it is defined by that decision and investigate the impact that such a measure has in terms of permits price, output production and banking strategies. To do so we build an inter-temporal model in which polluting firms competing in an homogeneous good market are price takers in a permits market and face an uncertain demand. Our main finding is that the MSR succeeds in increasing the permits' price correcting an excess supply (and conversely decreasing it in case of excess demand). However, when the output demand is stochastic, the MSR may alter the arbitrage conditions that determine permits' prices. In some cases which depend on the extend of the demand variation, unintended effects on the price pattern appear. This in turns may adversely affect welfare.

1. Introduction

Tradable emission permits (TEP) can achieve a given pollution reduction target in a cost-effective manner (Montgomery, 1972) and, in a dynamic perspective, if these markets have full temporal flexibility (fungibility), firms can optimally allocate abatement efforts across time (Cronshaw and Brown-Kruse, 1996). The attractiveness of TEP regulation in relation to environmental taxes is that the regulator is not required to have information regarding the production and abatement technologies available in the sector under regulation for the cost-effective equilibrium to arise. Such equilibrium is achieved through the market mechanism itself. However, there is a consensus on the fact that the European Emission Trading System (EU-ETS) is not working properly in this regard. Duncan (2016) analysis is unequivocal: *"Right now the ETS is like a car without an engine, we need to ensure it is fit to do the job it should and drive emissions reductions in Europe"*. In fact, several factors have contributed to the actual situation, in which the price of allowances is low with a very high surplus of permits, such as the economic crisis, the introduction of renewables and the use of Kyoto credits. The fact that the current cost of reducing emissions is low is not a good news since it suggests that the ETS may fail to induce a transformation away from fossil fuels. For all these reasons, the market design of the EU-ETS is being reformed on several issues, such as the speed at which the cap decreases, carbon leakage amendments, rules about innovation funds. So far, a step forward has been taken by creating a Market Stability Reserve (MSR), by the Decision (EU) 2015/1814 of the European Parliament and of the Council.

"The purpose of the MSR is to avoid that the EU carbon market operates with a large structural surplus of allowances, with the associated risk that this prevents the EU ETS from delivering the necessary investment signal to deliver on the EU's emission reduction target in a cost-efficient manner" (EC, 2017).[1] The idea behind such reform is a flexibility mechanism that allows the supply of permits to be responsive to fundamental changes in permits demand (like technology advances or economic shocks). The mechanism works as follows: each year the EC publishes the number of allowances in circulation and, if the number is higher or equal than 833 million, 12% are placed in the reserve[2](and consequently withdrawn from next year's auctions to the electricity sector). Instead, if the allowances in circulation are below 400 million, or if for six month the

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[1] Communication from the Commission. Publication of the total number of allowances in circulation for the purposes of the Market Stability Reserve under the EU Emissions Trading System established by Directive 2003/87/EC (2017/C 150/03): http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52017XC0513(01).

[2] In fact the text says that what is retired is the maximum between 12% of allowances in circulation and 100 Mt. The proposal of increasing this factor to 24% has been discussed but not approved yet.

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price is more than 3 times the average carbon price during the two preceding years, 100 million are released from the reserve. The number of allowances in circulation is defined as the number of allowances issued from 2008 (plus international credits used from 2008) until the year in question minus total emissions since 2008 and minus the number of allowances already in the stability reserve: i.e. firms accumulated banking of allowances. The first calculation of these allowances has been released in May 2017 and amounts to 1,693,904,897 allowances. In line with the agreed MSR rules, no reserve feed is triggered by the indicator published in 2017. The next publication will be made in May 2018. This will result in the determination of the first reserve feed for the period January to August 2019. Moreover, "back-loaded" allowances (900 million allowances withdrawn from the market at least until 2019), will be placed in the MSR's reserve as well as any remaining allowances not allocated by the end of the current trading phase, that is 2020.[3]

Several scholars have studied similar flexibility mechanisms that to some extent are used in the Californian CO_2 market and the Regional Greenhouse Gas Initiative (RGGI).[4] Firstly, Pizer (2002) introduces the idea of a safety valve" which consists in coupling a cap-and-trade system is with a price ceiling. As long as the allowance price is below the safety-valve price, this hybrid system acts like cap-and-trade, with emissions fixed but the price left to adjust. Instead, when the safety-valve price is reached the system behaves like a tax, fixing the price but leaving emissions to adjust. Later, Philibert (2008) and Burtraw et al. (2009) have proposed a symmetric safety valve, also known as a price collar, which would limit price volatility on both the upside and the downside. Fell and Morgenstern (2010) extend this kind of analysis by introducing uncertainty and coupling the collar mechanisms to restrictions on banking and borrowing. They find that adding a price collar to the reserve borrowing proposal can reduce costs: a price collar can achieve costs almost as low as a tax but with less emissions variation. The price collar mechanisms outperform their safety valve counterparts in terms of expected abatement costs at the same level of expected cumulative emissions.

Traditionally, the literature has analyzed price flexibility measures whereas the EC has chosen instead to go for a quantity mechanism.[5] Some recent papers have then analyzed this design. Schopp et al. (2015) show in a computational model that low EUA prices are observed because current supply exceeds current demand of the electric industry that use them to hedge emissions associated with existing 3–4 year power contracts. In this view, the MSR is a good solution since it affects the short-time price without touching to the long-run price signal. Similarly Trotignon et al. (2015) and Perino and Willner (2016) find that the MSR reduces the short-medium term price, fostering earlier emission reductions. This is precisely what Zetterberg et al. (2014) criticize, saying that the risk of price volatility is higher in the presence of the MSR due to the difficulty of predicting hedging needs. There is also a concern that the MSR will not erode the current surplus quickly enough with an excess supply present until 2028 (Mathews et al., 2014). Salant (2016) suggests that low hedging demand from the power sector is not compensated by other sectors expecting to buy low now and sell high later due to the lack of credibility of the survival of the system. In contrast, Fell (2016) simulations find that the MSR can decrease price volatility (but that its performance is very sensitive to parameters). FTI-Lexecon (2017) suggests that alternative design would improve the performance of the market. Several results are put to a trial in an experimental setting by Holt and Shobe (2016), who find that there is little benefit associated to the MSR but that a price collar may instead enhance efficiency.

The paper closest to ours is Kollenberg and Taschini (2016) who model the adjustments in permits availability due to the existence of the MSR using a stochastic partial equilibrium framework. Their model and scope are very different from ours but some of the results are in line: the MSR substitutes private banking and reduces variability in allowance holdings by withdrawing (reinjecting) when the surplus is too high (low).

In this paper we consider a polluting sector subject to the EU-ETS in the presence of the MSR (like for instance the electricity sector). To this end, we study the MSR impact on banking strategies, allowances price and output production to assess to which extent private banking is crowded out by this mechanism. Differently from Kollenberg and Taschini (2016) we perform such exercise for different designs of the flexibility mechanism. We model a "fixed" rule, that is, for an MSR mechanism that is set independently of the banking already accumulated. This rule is similar to the backloading policy already in place in the EU ETS. We then compare it with a "proportional" rule in which the MSR withdraws a given percentage of the accumulated banking. Furthermore, we study uncertainty under the form of a shock on the output demand, to understand whether the MSR actually makes the EU ETS price more responsive to output changes with respect to no intervention. To our knowledge, this is the first paper that studies to which extent the proposed design of the MSR interacts with firms' market strategies under demand uncertainty. To do so, we assume that firms may delay banking as it was an "option", waiting for the MSR to regulate the market. We then calculate firms' optimal strategies under Cournot-like competion, when the regulator modifies the cap, and present a fully fledged analysis of output pricing and banking behavior.

Our main finding is that the MSR succeeds in increasing the permits' price when there is an excess supply (and conversely decreasing it in case of excess demand). However, when uncertainty on the output demand is factored in, the MSR may alter the perfect arbitrage conditions. In some cases which depend on the extend of the demand variation, dynamic inefficiencies in the price pattern appear. In particular, firms prefer to delay banking for wider valued of the demand variation compared to the no intervention case. This in turns may adversely affect not only producers' profits, but also consumers' surplus.

The paper is organized as follows. We first explain our modelling strategy (Section 2), then we develop the model under uncertainty (Section 3). We introduce the notion of delaying banking. We calculate how backloading and MSR modify it, including welfare effects (Section 4). Our main results are also presented by intuitive graphical illustrations. We conclude by pointing out some policy implications.

2. Modelling strategy

2.1. Assumptions and notation

We consider n symmetric firms (indexed by $i = 1 \ldots n$) that compete in quantities during three periods ($t = 0, 1, 2$) where $(b - d\sum_{i=1}^{n} q_{i,t})$ is the inverse demand in t and c is the constant marginal costs. One (some) of the inputs used for production is polluting (e is the polluting intensity of output in t) and therefore firms are subject to environmental regulation based on TEP. A regulator fixes a yearly cap on emissions amounting to the pollution reduction target and sells an equivalent volume of permits in an auction. We denote $\alpha_t A$ is the amount of permits auctioned by the authority each period,[6] with $\alpha_{t+1} < \alpha_t \leq 1$. Firms are price takers in the TEP market whose price is σ_t. Firms maximize inter-temporal profits over three periods (by

[3] Since the MSR operates as a buffer stock to reduce private holdings of permits in the short run, the uncertainties regarding the long run cap as well as the incorporation of renewables are not properly addressed. This is particularly the case when considering the uncertainty on the demand of permits that the inclusion of renewable electric sources and their intermittency may produce.

[4] The RGGI covers emissions from the power sector in 9 States of the Unites States of America (Those states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont) as from January 2009.

[5] A review on the price behavior in the second Phase of the EU ETS can be found in Hintermann et al. (2016). For an analysis on strategic behavior see Hintermann (2015).

[6] Notice that we consider the allocation A, the emission intensity e, demand b, d and cost parameter c as constant all along the regulatory period.