COVID-19 tests the Market Stability Reserve

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Abstract

We compare the decrease in energy demand and CO2 emissions in Europe during the financial crisis 2008-2009 with the COVID-19 expected drop in demand and emissions, and the price response of the EU Emission Trading System (EU ETS). We ask whether the rather limited current price reduction may be due to the Market Stability Reserve (MSR), implemented in the EU ETS between the two crisis. Stylized facts and basic theory are complemented with simulations based on a model of the EU ETS. Together, they suggest a mixed result. The MSR stabilizes the EU ETS price in turbulent times, but less than perfect. We show that the more persistent the COVID-19 shock is, the less the MSR is able to serve its purpose.

JEL codes: H23; Q41; Q54; Q58

Keywords: COVID-19; EU ETS; MSR; Environmental policy

1 Introduction

The COVID-19 pandemic brought economic activity to a sudden halt throughout the world in the first half of 2020. This decline in activity went accompanied by a substantial fall in energy demand. At the end of April 2020, the IEA (2020) expects global energy

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demand to fall by 6 percent this year, and global CO2 emissions to drop 8 percent. In the Europe Union, the IEA (2020) expects even bigger impacts, with 11 percent reduction in energy consumption. As about half of EU's CO2 emissions are regulated by the EU Emission Trading System (EU ETS), demand for emission allowances (EUAs) will likely fall along with lower emissions. Hence, one would expect lower EUA prices as well. When the financial crisis hit in 2008, the EUA price dropped more than 50 percent during a few months. So far, the EUA price has fallen less in 2020 even though the IEA expects the impact on EU emissions to be "almost double the impact of the global financial crisis". In Section 2, we establish that indeed, the energy demand shocks caused by the 2020 COVID-19 pandemic at least equals the 2008 financial crisis.

The present paper discusses whether a recent regulatory change in the EU ETS can explain the seemingly different price response in 2020 vis-à-vis 2008. In 2015, the EU introduced the Market Stability Reserve (MSR), and the rules for the MSR were crucially revised in 2018. The purpose of the MSR is to "address the current surplus of allowances" and "improve the system's resilience to major shocks by adjusting the supply of allowances to be auctioned".[1] The COVID-19 pandemic is indeed a "major shock" (which we elaborate on in Section 2), and the question is whether the MSR lives up to its expectations.

So, how does the MSR work? The precise nature of the MSR is explained in Perino (2018) and Gerlagh and Heijmans (2019), and also in Section 3 below. Essentially, the MSR decreases the (cumulative) supply of EUAs when a sustained shortage of demand for EUAs occurs, stabilizing prices in the process. Hence, as Perino (2018) puts it, the waterbed effect is temporarily (and partially) punctured,[2] and a negative shock in demand can reduce cumulative emissions (over time). Although there are efficiency arguments to be made for such a system of endogenous supply (Gerlagh and Heijmans, 2018; Pizer and Prest, 2020), it is not perfect as we briefly touch upon in Section 5.[3]

Section 4 develops a simulation model to quantitatively connect theory and empirical

[1]https://ec.europa.eu/clima/policies/ets/reform˙en

[2]If the emissions cap is fixed and binding, any supplementary policies will not affect total emissions, but only shuffle emissions around (Böhringer and Rosendahl, 2010). This is often referred to as the waterbed effect.

[3]Besides the studies mentioned above, there are quite few published studies examining the effects of the revised version of the MSR so far. Bruninx et al. (2020) use a long-term investment model to examine the effects of the MSR. In a short paper, Bruninx and Ovaere (2020) simulates potential impacts of the COVID-19 pandemic. Compared to the current paper, they do not contrast with the 2008 crisis, and their analysis is rather brief. There are more studies of the first version of the MSR, see e.g. Kollenberg and Taschini (2019), Fell (2016) and Salant (2016).

observations. Through the model we investigate the effects of a negative shock in demand, comparing the outcome with and without the MSR. The results suggest the following answer to our question whether the MSR has stabilized the ETS market between the financial crisis and the COVID-19 pandemic. The MSR passes the test – it reduces price volatility – but not with flying colors. The price drop after the emerging COVID-19 crisis, observed during the first half of March 2020, is less pronounced than that observed in 2008, despite a bigger drop in demand, but still substantial.

We identify a pertinent issue: the persistence of the negative demand shock. The more persistent, the less the MSR is able to serve its purpose. This is an important observation. The MSR succeeds in absorbing small shocks almost perfectly, while large and persistent shocks – those that are most in need of an absorbing mechanism – are not covered by the MSR mechanisms. In early June 2020, the stock markets showed a robust rebound picturing trust in an economic recovery, and the EUA price also recovered ground and almost returned to its levels of January 2020. In the concluding Section 5, we return to this problem.

Our paper fits into a broader literature on the effect of wider economic phenomena on emissions and prices within EU ETS. In its early years of operation (Phase I), EUA prices were driven by macroeconomic developments (Chevallier, 2011) and fuel prices (Hintermann, 2010). Koch et al. (2014) find that economic activity was a robust explanator of EUA price dyanmics in 2008-13. Moreover, even as the wider economy recovered after its plunge in 2008, EUA prices remained low (Ellerman et al., 2016). Indeed, the financial crisis has been found to be a structural break in the EUA price time series, characterized by a sharp drop with long-lasting effect (Zhu et al., 2015).

2 Comparing demand shocks

When the financial crisis hit the global economy in the middle of 2008, the EUA price responded quickly. It decreased from 25 Euro per ton at the end of August to below 10 Euro in February 2009, before stabilizing around 13 Euro for the next year, see Figure 1. The EUA price likely decreased as market participants anticipated lower economic activity and hence reduced demand for EUAs in the ETS market. When the financial crisis was followed by a recession in many EU countries, the EUA price fell further and stayed below 10 Euro in the years 2012-17.

When the COVID-19 pandemic hit the world in the beginning of 2020, and most countries in the world closed down large parts of their economic activity, the EUA price also fell, but not as much as in 2009 (Figure 1). From January/February to early May 2020 the price decreased around 20 percent (from around 24 to 19 Euro per ton), before increasing almost to pre-Corona levels in early June 2020.

Can the lower price response in 2020 be explained by a lower negative shock in emissions? More precisely, are market participants expecting less of an impact now than they did ten years ago? Or are there other reasons why the price decrease has been more moderate this time? This is not easy to answer while the COVID-19 response still unfolds, but it can be useful to consider some relevant indicators and forecasts.

The most natural indicator to start with is emissions itself. Emissions regulated by the EU ETS declined by 3 percent from 2007 to 2008, and by additional 8 percent to 2009 (EEA, 2019). To what degree these reductions were driven by the financial crisis and to what degree by the emission regulation itself is hard to assess. After 2009, emissions continued to decline along with the EU recession, but much more gradually. Yet prices decreased as well, so that actual decrease in demand is probably a lower bound for the structural decrease in the demand function.[4]

There is little doubt that the COVID-19 pandemic will reduce EU ETS emissions in 2020, but at the time of writing it is hard to know how much. According to IEA (2020), CO2 emissions in the EU fell by 8 percent in the first quarter this year (vis-a-vis Q1 2019). Further, at the end of April, IEA (2020) expects a reduction of EU's energy consumption of 11 percent in 2020 vis-à-vis 2019, and we quote: "almost double the impact of the global financial crisis". Forecast for CO2 emissions in the EU is not provided.

Considering EU ETS emissions specifically, Refinitiv (2020) expects these emissions to drop 14 percent this year, and 17 percent compared to their previous (pre-Corona) forecast for 2020. They also expect significantly lower emissions after 2020 than previously expected, in total 1.3 Gt in the years 2020-2030 (close to 10 percent on average over this decade). IEA (2020) does not provide forecast beyond 2020, but write: "Even in 2021, global economic activity might well be below the 2019 level". Taken together, data and forecasts from the IEA and Refinitiv suggest that the negative shock in emissions due to COVID-19, at least in the short run, will be bigger than in 2008-09. The longer term is more uncertain. For this we consider other indicators.

Indicators that are documented as good proxies for changes in demand for ETS

[4]Whereas the review of the EU ETS in Martin et al. (2016) suggests quite moderate effects on emissions in the second phase, Dechezleprêtre et al. (2018) finds 15 percent emission reduction.

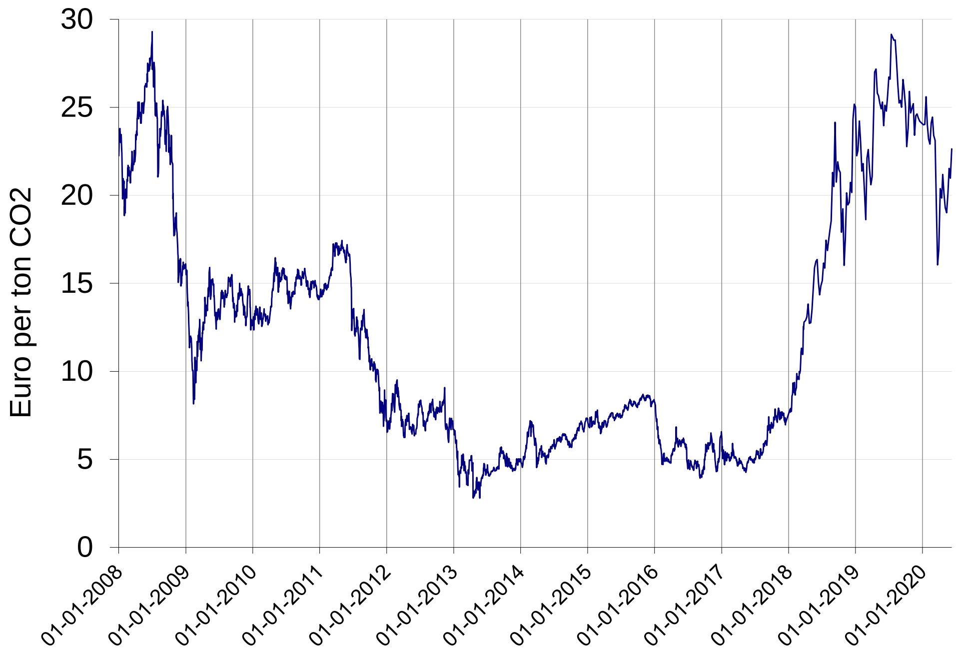

Figure 1: EUA (EU ETS) price 2008-2020

allowances include GDP and fossil fuel prices, see Hintermann (2010), Chevallier (2011), Creti et al. (2012), Koch et al. (2014), Zhu et al. (2015), and Ellerman et al. (2016). For comparison of the two crisis, we focus on crude oil, which is traded in high volumes. Its price is rich in information, as it responds quickly to changes in the (forecast of) economic activity. In 2008, it fell from all time high of 140 USD per barrel (Brent blend) in the summer of 2008 to around 45 in the beginning of 2009. It recovered quite quickly though, and the average price in 2010 was slightly above the average price in 2007 (around 75 USD per barrel). In the first months of 2020, the Brent blend price has been halved.[5] While the oil price reflects current demand relative to current capacity, the expectations of future oil prices are aggregated through stock prices for major oil companies, measuring the expected persistence of the crisis. Shares of Royal Shell and BP fell in both crises by somewhat less than 50 percent.[6] Exxon Mobil share prices did

[5]Prices of coal and natural gas in Europe have shown a quite similar pattern as the crude oil price, both in 2008 and 2020. One difference between the two periods is that both prices were at very high levels when the crisis hit in 2008, while they were already at very low levels at the start of 2020. Still, the prices have fallen significantly, and in the second half of May 2020 the UK gas price fell below 10 p/th for the first time since 1999 (www.barchart.com/futures/quotes/NF*0/interactive-chart).

[6]Royal Shell's share dropped from around 80 USD at the end of 2007 to around 45 at the end of 2008, and from around 60 USD at the end of 2009 to 30-35 USD by May 2020. BP dropped from around 70 USD to around 40 USD during the credit crisis, and from around 40 USD to below 25 during the COVID-19 crisis.

not decrease as much as the others in 2008, but fell from around 70 USD at the end of 2019 to around 45 USD in May 2020. However, end of May and early June 2020, all three oil companies saw their share prices rise again.

Summing up, when evaluated in March 2020, evidence collected suggested a decrease in demand for EUAs during and after the COVID-19 crisis that is at least of the same order and persistence as that in 2008, while end of May long-term expectations became somewhat more optimistic. Yet the EUA price in the EU ETS dropped less in March 2020 than during the 2008 crisis, and almost fully recovered end of May. There might be various reasons, as the EU ETS today is not the same as it was ten years ago. Expectations about the future of the ETS are different. Here we focus on a natural candidate for the different price responses: the Market Stability Reserve (MSR) that has been introduced as part of the EU ETS between the financial crisis and the COVID-19 pandemic. In the next section we explain how the MSR works and how it smoothens the price response in a demand crisis.

3 Market stability reserve (MSR)

In 2015, the EU established a Market Stability Reserve (MSR) as part of the EU ETS; in 2018 new and substantially revised rules were implemented. Each year in which banked EUAs exceed 833 $MtCO_2$, the number of auctioned EUAs next year is reduced.[7] EUAs that are not auctioned are instead moved into the MSR. The number of EUAs that enter the MSR equals 24% of banked EUAs (12% as of 2024, according to EU regulation). When banking drops below $400MtCO_2$, EUAs corresponding to $100MtCO_2$ are taken out of the MSR, and added to the auctioned volumes next year.

The most important revision introduced in 2018 states that when the number of EUAs in the MSR exceeds the number of auctioned EUAs of the previous year, all EUAs in excess of this threshold are permanently canceled. Canceling EUAs in the MSR, which then cannot return to the market, effectively reduce the cumulative cap on emissions in the EU ETS; cumulative supply of EUAs has become endogenous. For more details about the MSR, see e.g. Perino (2018) and Gerlagh and Heijmans (2019).

Let us consider how the MSR works conceptually in a simple two-period framework, see Figure 2. The two leftmost panels show the equilibrium in the first and second

[7] To be precise, auctioned EUAs are reduced from September the following year to August the year after. The EU has introduced the term "Total number of allowances in circulation (TNAC)" (EU Commission, 2019), which for our purpose is equivalent with private banking of EUAs.

period, while the rightmost panel displays the intertemporally integrated equilibrium. Initially, for expositional convenience, we assume equal supply and demand functions in the two periods, given by the vertical and downwards sloping solid lines, respectively.

Assume now a negative demand shock in the first period. If intertemporal trading is not allowed, the ETS price drops to zero in period 1 while being unchanged in period 2.[8] If banking is allowed, we find a new equilibrium with lower positive prices in both periods ($\widehat{p}$). Demand is reduced in period 1 while increased in period 2, with aggregate demand unchanged. This is the waterbed effect: If emissions are reduced at one point in time (or space), emissions go up at another point in time (or space). In the figure, we use the triangle for the adjusted equilibrium. An important effect of the waterbed is that it dampens price volatility. A 10 percent reduction in demand over one or a few years, either 2009 or 2020, becomes a much smaller relative cumulative demand reduction when put in perspective of the full time horizon of the EU ETS. We should thus not expect large price swings based on contemporary demand shocks. We can reverse the logic, and interpret the observed large price swings as strong evidence for a very small price elasticity of allowances demand.

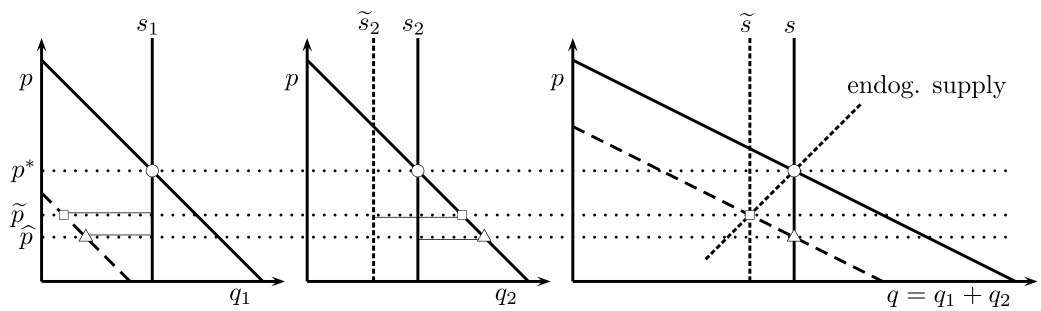

Figure 2: Equilibrium selection

Circles as equilibrium marker prior to demand shock, triangle for post-demand shock without MSR, square for post-demand shock with MSR. Dashed downwards sloping lines indicate demand function after shock. Vertical dashed lines denote endogenously adjusted supply. Lines on top of price lines denote banking, lines below denote the emptying of the allowances bank. Dashed upward-sloping line in right panel denotes implicit supply curve for first-period demand shocks that do *not* spillover to second period.

Then we add the MSR. As explained above, increased initial banking reduces future supply of allowances and thus also aggregated supply, cf. the negative shift in supply

[8]Hintermann et al. (2016) suggests that the emissions cap in phase II of the EU ETS was not binding, and thus the nonzero price toward the end of the phase "reflected expectations of a cap on overall emissions that is binding in the long term, given the opportunity to bank allowances".

($\widetilde{s}$) in period 2 in Figure 2. In the rightmost panel we have also illustrated the supply effect by drawing an upwards sloping endogenous supply curve. Importantly, the slope of endogenous supply depends on the origin of the demand shocks. If a demand shock is symmetric over both periods, so that prices drop but banking does not change, the MSR will not interfere with auctioning and supply is unaffected. That is, the endogenous supply curve is vertical, as if there is no MSR.[9] The bigger is the demand reduction in period 1, the more allowances will be banked, and the bigger is the shift in supply. As a consequence, the price is reduced but less than without the MSR ($\widetilde{p} > \widehat{p}$). Thus, the MSR tends to dampen price volatility beyond the waterbed effect. The relative effectiveness of the MSR is a matter of quantitative analysis, for which we resort to model simulations below.

4 Model simulation

To simulate the ETS market with and without the MSR, we use a stylized, dynamic and deterministic model, see Gerlagh et al. (2020b) also for the calibration. The model incorporates the details of the MSR. In the baseline scenario (before the COVID-19 shock), the price begins at 21.0 Euro per ton CO2 in 2019 and increases with the interest rate of 5 percent. Exogenous supply of EUAs declines linearly to zero in 2057, whereas endogenous demand (i.e., emissions) drops to zero in 2067.[10]

We then construct a model version without the MSR, but with lower exogenous supply of EUAs so that the starting price in 2019 is the same as in the model version with the MSR. Thus, since emissions only depend on the ETS price, the emissions paths are the same in the two model versions before the shock is implemented.

The future effects of COVID-19 on demand for EUAs is uncertain, especially the long-term effects. Hence, we construct three alternative scenarios that have the same short-run effects (2020-22), but different long-term effects, see Table 1, which shows annual reductions in demand at given ETS prices. In the "Short" scenario, there are no impacts on demand after 2022. The difference between "Long and medium" and "Long and big" is bigger demand reductions after 2030.[11] The last column of the table

[9] Demand shifts in period 2 will in fact have the opposite effect on supply, resulting in a downwards sloping endogenous supply, see Gerlagh et al. (2020b) and Rosendahl (2019).

[10] This follows from our model calibration, cf. Gerlagh et al. (2020b) for more details.

[11] The reduction in 2020 is consistent with Refinitiv (2020)'s revised forecast of ETS emissions in 2020, while the cumulative reduction in 2020-30 in the two last scenarios is consistent with Refinitiv's revised forecast for the whole decade. It is not clear to what degree Refinitiv takes into account any

shows cumulative reduction in demand, given the baseline price path. We notice that cumulative demand is almost five times higher in “Long and big” than in “Short”. As the model is deterministic, there is perfect foresight within each scenario. Thus, in e.g. the ”Short” scenario market participants expect correctly that there is no impact on demand after 2022. We discuss the implications of this assumption in the next section.

Table 1: Annual and cumulative reductions in demand for allowances

	2020	**2021**	**2022**	**2023-30**	**2031-66** (annual)	**2020-66** (cumulative)
Short	260	195	130	0	0	**585**
Long and medium	260	195	130	73	20	**1872**
Long and big	260	195	130	73	50	**2859**

Note: Demand changes at given baseline equilibrium price, in [Mt CO_2]

Before examining the effects of the MSR, it is constructive to first consider how the demand reductions play out in the model without the MSR. Since supply of EUAs is then fixed, the waterbed effect is fully operative and hence cumulative emissions are the same as without the COVID-19 shock. To bring demand in line with constant supply, the ETS price has to come down; the price reduction, shown in Figure 3, is approximately proportional to the reduction in cumulative demand shown in Table 1. In the “Short” scenario, the price drops by 1.2 Euro, while in the “Long and big” scenario it drops by 6.0 Euro.[12]

Next we consider the effects of the MSR. In the “Short” scenario, reduced demand for EUAs in 2020-22 leads to more banking of EUAs. By 2024, after three years of 24 percent intake, 56 percent of these additional banked EUAs have entered the MSR. In the later years, almost all of the remaining additionally banked EUAs eventually enter into the MSR (see Figure 5 in the Appendix) and later become canceled. Thus, cumulative supply of EUAs is, through the MSR, reduced almost one-to-one with the drop in demand; cumulative extra canceling amounts to 560 Mt (Figure 4, first bar), only slightly below the direct drop shown in Table 1, implying that there is only a 4

dampening effects from lower EUA prices in their forecast. If they do, it follows that the negative shock in demand in their analysis is higher.

[12] Although cumulative emissions are the same across scenarios, the emission paths are not, see Figures **??**-**??** in Gerlagh et al. (2020a). In all scenarios, emissions are higher after 2030 than in the baseline scenario, stimulated by lower ETS prices.

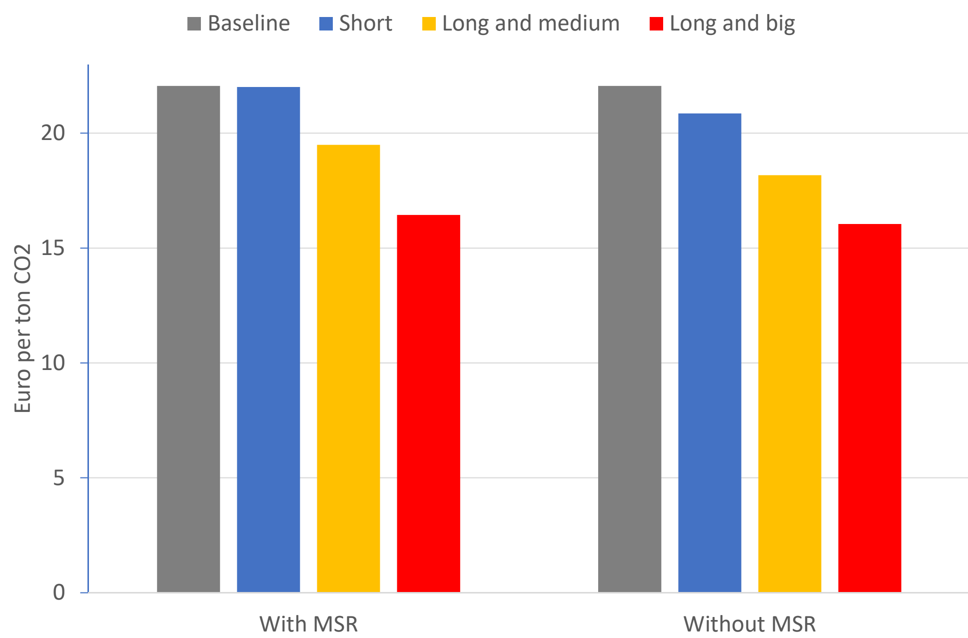

Figure 3: Price in 2020 in different scenarios with and without MSR

percent waterbed effect (Figure 4, right axis). And so the ETS price hardly changes (Figure 3, second vs first bar). As a result, emissions after 2022 are almost identical to baseline emissions, and always slightly below emissions in the case without MSR.

In the "Long and medium" scenario, the demand reduction is more persistent. Future demand reductions, however, have a lower propensity to flow into the MSR. The extra MSR canceling is less then 80 Mt (Fig 4, second vs. first bar), while cumulative demand is decreased by almost 1300 Mt more than in the "Short" scenario (Table 1, second vs first row). The waterbed effect now amounts to 66 percent (Fig 4, second y-axis). Taken together, the price in 2020 falls by 2.6 Euro, as compared to a drop of 3.9 Euro without the MSR (Figure 3).

Why is the MSR less effective in this scenario, relatively speaking? In the baseline scenario, the MSR stops taking in EUAs in 2048, which means that after this year reductions in demand will not lead to any corresponding reductions in supply. Instead, it leads to lower ETS prices, not only in later periods but in all years (via Hotelling's rule). Demand reductions in years slightly before 2048 lead to some but quite limited supply reduction, as the annual rate of inflow into the MSR is merely 12 percent. Hence, the ETS price is further reduced. As the initial demand reduction is dampened by lower prices, initial banking and thus inflow into the MSR is also dampened compared to the "Short" scenario, and stops one year earlier (see Figure 5 in the Appendix).

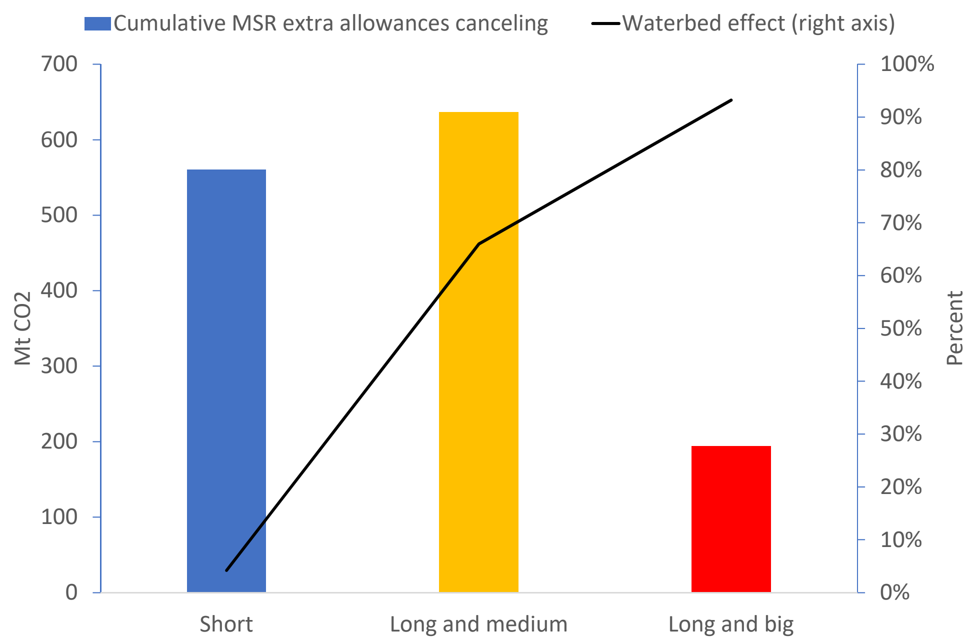

Figure 4: Extra canceling through MSR and waterbed effect

In the "Long and big" scenario, the impacts of future demand reductions are even stronger. The reduced future demand reduces the need for banking, and thus the inflow into the MSR, which now works 'in reverse'. Due to a lower intake, fewer EUAs are canceled, from 640 Mt in the "Long and medium" scenario to only 190 Mt in the "Long and big" scenario (Fig 4, third vs second bar). The waterbed effect is back to almost fully operative, amounting to 96 percent (Fig 4, second y-axis). The price in 2020 falls by 5.6 Euro, i.e., almost as much as the 6 Euro drop without the MSR (Figure 3).

5 Discussion and Conclusions

Let us first summarize our findings. Observations suggest that the 2020 demand drop exceeds the 2009 demand drop, while the 2020 price drop is less severe compared to 2009, and by June 2020 allowances (EUAs) were priced at almost the same level as in January. In that sense, the MSR passes the test: it stabilizes the market. Yet, the stabilization is sensitive to long-term expectations, more than the EU ETS was before the MSR. A mechanism we investigated here concerns the permanence of demand drop, in which case the MSR partly fails its job. Theory and our simulation model show a strong dampening price effect of the MSR on short-lived demand shocks; the MSR effectively cancels the perturbations of EUA demand. For long-lived demand shocks, both theory and our simulation model also show the MSR to be less, or even ineffective. If the market anticipates future demand to decrease as much as present demand, there is a price drop without a reallocation of EUAs over time. The MSR becomes ineffective for such happenings. If, however, the market becomes more optimistic and expects the crisis to be deep but temporary, the MSR does an almost perfect job in stabilization.

Our analysis is also relevent for the effects of an accelerated green transition via e.g. more use of renewables. If this acceleration implies stronger emissions reductions in the short run than in the long run (compared to previous expectations), the MSR may prevent the price from dropping too much, as banking may increase followed by reduced supply of allowances. On the other hand, if the accelerated green transition is mostly expected to influence future emissions, the effects may be reversed as the mechanism of the MSR then works in the opposite direction (i.e., less banking and hence less cancellation). This is documented in Rosendahl (2019) and Gerlagh et al. (2020b), referring to this as a green paradox. Based on somewhat similar reasoning, Gerlagh and Heijmans (2019) shows that the EU ETS through the MSR has become vulnerable to manipulation by unregulated parties.

Analysis through simulation models has various limitations. To mention three, we assume perfect foresight, no changes in context variables such as the rate of return on assets, and no difference between short- and long-run price responsiveness.[13] We also assume no changes in expected policy measures. As the ETS is an artificial market, prices also depend on expectations of regulation.

[13]As price responsiveness is likely higher in the long-run than in the short-run, our model may overestimate the initial price responsiveness and hence underestimate the canceling of EUAs in the persistent scenarios.

Rather than delving into such technical issues, we think it is more important to address an underlying change in perspective. At the onset of the ETS, certainty over quantities was perceived as more important vis-a-vis certainty over prices. Ample experiences with a volatile allowances market has changed the view, so we believe. Both policy makers and the market are increasingly appreciative of more stable prices. It might be time to think about regulations that combine price and quantity information. Gerlagh and Heijmans (2018) and Pizer and Prest (2020) present such alternatives that introduce an explicit price stability mechanism, rather than the implicit current MSR system based on quantities.[14]

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A Extra figure: MSR intake

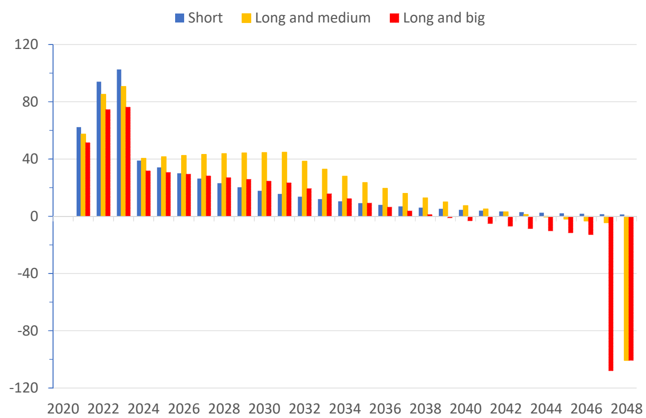

Figure 5: Inflow into the MSR. Differences vis-a-vis the baseline scenario