Shifting concerns for the EU ETS: Are carbon prices becoming too high?

Authors: Reyer Gerlagh[1]*†, Roweno J.R.K. Heijmans[1]†, Knut Einar Rosendahl[2]†

Affiliations:

[1] Tilburg University; Tilburg, the Netherlands.

[2] Norwegian University of Life Sciences; Ås, Norway.

*Corresponding author. Email: r.gerlagh@uvt.nl

†These authors contributed equally to this manuscript.

Abstract:

The EU ETS carbon price has risen from around €5 per ton of CO_2 in 2017 to above €50 in May 2021. One probable explanation is the cancellation mechanism implemented along with the Market Stability Reserve (MSR) of the EU ETS in 2018. We identify realistic conditions under which the MSR results in truly massive cancellation of emissions allowances, pointing to the time-structure of demand for emissions allowances as essential. A flattening of demand implies huge reduction in cumulative emissions, suggesting much higher ETS prices. The concerns about too low and 'ineffective' carbon prices may turn into concerns for too high prices. The results are important for the planned revision of the MSR.

One-Sentence Summary:

We identify conditions for massive canceling of emissions allowances in the EU ETS, leading to potentially very high carbon prices.

Main Text:

The European Union's Emissions Trading System (EU ETS) is the flagship EU climate policy, covering roughly half of the EU's CO_2 emissions (*1*). The EU ETS has had a tumultuous past, with volatile and mostly low prices, especially after the economic recession hit the EU in the aftermath of the financial crisis in 2008. Between 2012 and 2017, the price of an emission allowance hovered consistently below €10 per ton of CO_2, falling short of even the most conservative estimates for the social cost of carbon (*2*). Then, prices started rising – a trend that gained momentum despite the COVID-19 pandemic and led to a (then) record-high of €50 per ton of CO_2 being reached in early May 2021. What happened?

There probably are two main explanations. One is EU's more ambitious emissions reduction target for 2030, strengthened from 40% to 55% (vis-a-vis 1990). The other, which is the focus in this manuscript, is the key reform of the EU ETS in 2018, when a cancellation mechanism was incorporated into the Market Stability Reserve (MSR) of the EU ETS. A major implication of this reform is that cumulative emissions over time are no longer directly determined by preset EU ETS supply schemes but depend on ETS market dynamics. Thus, the EU ETS changed from a dynamic ETS with an exogenous cumulative cap on emissions to one with an endogenous cumulative cap (*1,3–5*). More precisely, the MSR functions like a vault of allowances, taking in allowances as long as the surplus in the market at the end of a year ("total number of allowances in circulation" – TNAC) is greater than 833 million allowances. Supply of allowances to the market (via auctioning) is reduced accordingly. When the MSR in turn holds more allowances than were auctioned in the previous year, the excess is *permanently* canceled, thus reducing the cumulative supply of allowances and thereby the cumulative emissions cap. As demonstrated by recent studies, this regulatory change will likely lead to substantial cancellation of allowances in years to come, implying large reductions in emissions (*7–9*).

Although several studies build models to simulate the cancellation mechanism, there is no overarching picture of what drives the extent of cumulative cancellation in the EU ETS. In this manuscript we highlight a critical yet, to our knowledge, often neglected driver of cumulative EU ETS emissions: the *time-structure* of demand for allowances. We summarize the dynamics of demand in the simplest way possible by addressing a very basic question: will emissions decline more or less gradually over time? As we show, the answer to this question has an unexpectedly strong impact on cumulative emissions over time.

With an exogenous cumulative cap, i.e. without a cancellation mechanism in the MSR, the time-structure of demand does not affect cumulative emissions. A flattening of demand leads to a decrease of current emissions combined with a corresponding increase of future emissions. Graphically speaking, the two emission pathways E1 and E2 in Fig. 1 exhibit the same area under their curves.

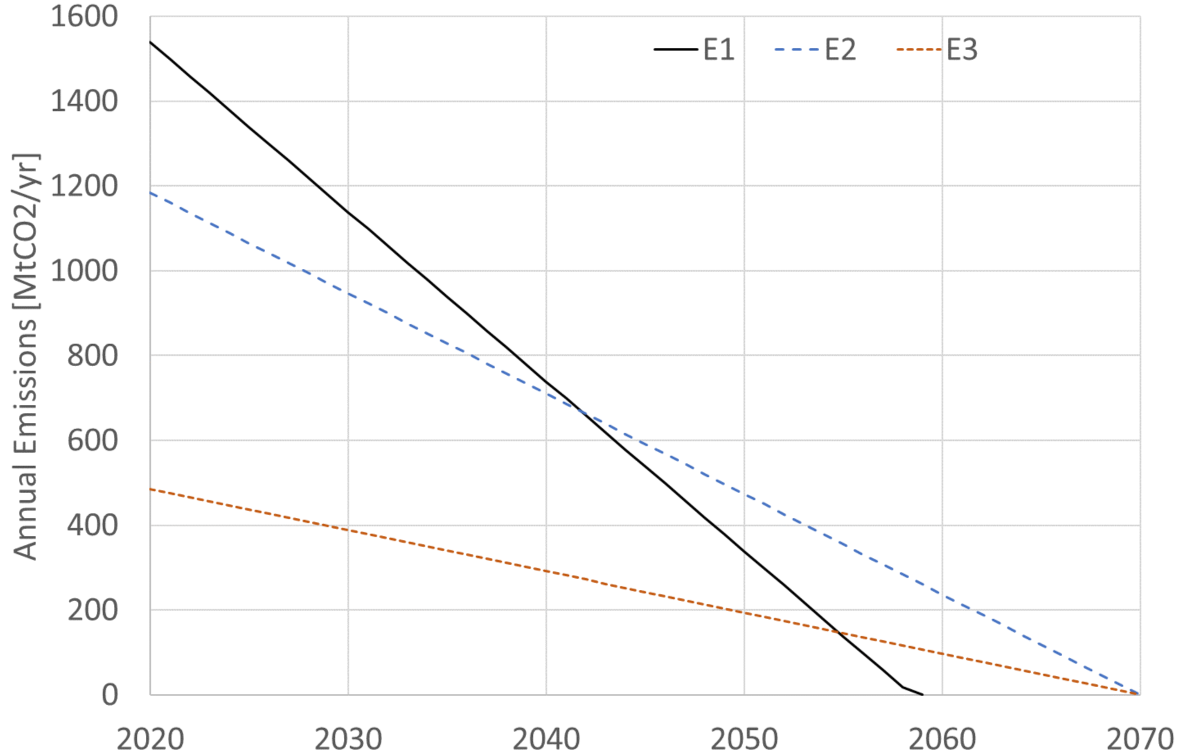

Figure 1. Linearly decreasing demand for emissions over time. Scenario E1: Annual decline in emissions amounts to 2.6% of emissions in 2021. Scenario E2: Annual decline in emissions amounts to 2.0% of emissions in 2021 and same cumulative emissions as E1. Scenario E3: Annual decline in emissions amounts to 2.0% of emissions in 2021 and supply following MSR rules. The area between E2 and E3 measures the increase in canceling of allowances, or the reduction in cumulative emissions, because of the change in the time-structure of demand. E1 and E3 are consistent with MSR rules and also part of Fig. 2; E2 is for illustration.

Things work very differently when the cumulative cap on emissions is endogenous to the time-structure of demand due to the cancellation mechanism implemented in the EU ETS. A flattening of demand leads to a larger surplus of allowances in early years, causing an increased inflow of allowances into the MSR and thus more cancellation of allowances over time**;** the cumulative supply of allowances, and hence emissions, consequently drop. Graphically, we see that the dotted demand curve E3 in Fig. 1 is not only flatter than E1 – it also is substantially lower. Emissions in 2021 must start much lower – otherwise there will be a shortage in the ETS market in later years because of the cancellation mechanism. Both E1 and E3 are emissions pathways consistent with the MSR rules, but the area under the E3 curve is much smaller than the area under the E1 curve; the difference is simply caused by the MSR interacting with a somewhat flatter demand schedule in E3 than in E1. While it is not surprising that the areas differ (cumulative emissions are now endogenous after all), the size of the effect is remarkable.

We report cumulative emissions and emissions in 2021 for various time structures of demand in Fig. 2. If emissions, and thus demand for allowances, are set to decrease by 2.6% annually (i.e., 2.6% of the 2021 level), cumulative emissions add up to 30.4 $GtCO_2$. If emissions are set to decrease more slowly, i.e., by 2.0% of the 2021 level annually, emissions must start at a much lower level in 2021, and cumulative emissions drop to around 12 $GtCO_2$. Cumulative emissions are reduced by more than half following a seemingly modest change in the *time-structure* of demand!

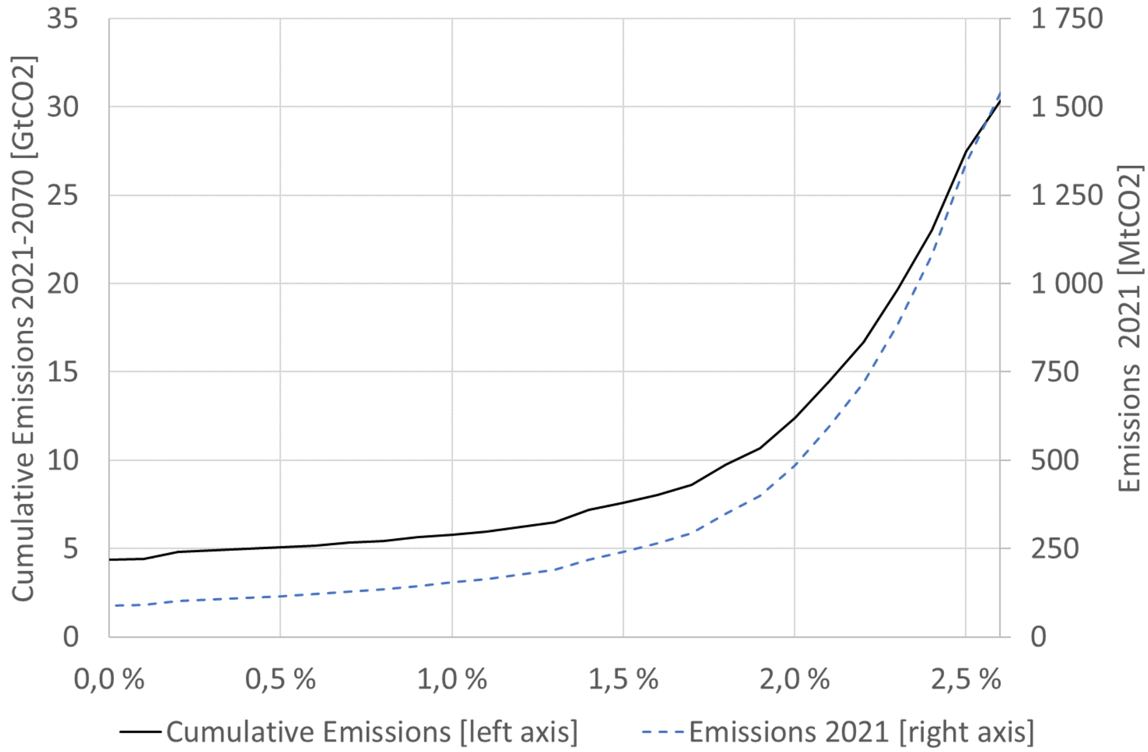

Figure 2. Time structure of emissions (horizontal axis) versus size of (cumulative) emissions (vertical axes). The horizontal axis shows the annual linear reduction rate (as a percentage of simulated emissions in 2021). The left vertical axis shows cumulative emissions over the years 2021-70. The right vertical axis shows simulated emissions in 2021.

We emphasize that our results follow mechanically from the rules of the Market Stability Reserve and do not involve any economic assumptions on the EU ETS market (such as the price-sensitivity of demand). The MSR is a purely quantity-based protocol for taking out and bringing back allowances, and canceling part of these (one potential exemption being Article 29a of the EU ETS Directive, see below). The time-structure of demand, together with the rules of the MSR, are all we need to fully determine the outcomes depicted in Fig. 2. Indeed, the only two assumptions entertained in the analysis are, first, that emissions decline linearly over time, and second, that the EU ETS ends after 2070, meaning that firms will not hold allowances beyond that point in time. Neither of these are important drivers of our results. We discuss the role played by a linear demand reduction below. As to the market ending in 2070, we observe that *if* the EU ETS were to continue after 2070 (so allowances issued before 2057 can be used after 2070), cumulative emissions would be even lower than shown in Fig. 2. Note also that demand decline rates exceeding 2.6% imply allowances borrowing initially, which is not allowed in the EU ETS, so linear demand is incompatible with the EU ETS rules in those cases.

The magnitude of the effect reported in Fig. 2 is astounding. What is the intuition? If emissions decline less rapidly over time, they must start at a lower level. The lower demand in early years implies a larger initial surplus, so more allowances are stored in the MSR. Of those, a substantial fraction gets canceled. It follows that the cumulative supply of allowances decreases and so emissions must go down, including in the early years. But this means we have to repeat our argument, with a larger initial surplus, etc. again and again. This cancellation feedback loop spirals on, many times, and stabilizes only after a massive amount of allowances are canceled. Our calculations thus predict that if or when the market expects a flattening of demand, we should expect to see a markedly upward shift in the ETS price due to the substantial reduction in cumulative supply of allowances.

What do we know about the time-structure of demand? The fact that we are the first to report these results suggests that most studies on the EU ETS have implicitly assumed demand to follow a pattern similar to scenario E1 in Fig. 1, which runs parallel to supply and decreases linearly over time to reach zero shortly before 2060 (*10* – *12*)**.** We however report some observations that are reason to believe that demand is actually flatter over time (*13*). From a polluting firm's perspective, an emission allowance is a non-renewable resource that is perfectly substitutable over time. For this reason, the allowance price must follow Hotelling’s rule and rise with the interest rate (*14*), at least approximately and in expectations. The interest rate has fallen consistently over the last years, reaching negative territory in 2021, implying a near-constant allowance price over time. The latter implication is borne out by the data: EU ETS spot prices for future allowances are close to current prices observed in the market. In the extreme, the MSR thus supports a price path that reaches a constant yet very high level and suffocates demand. Due to this very low level of demand and the implied substantial surplus of allowances in early years, a large majority of allowances will be canceled by the MSR, self-enforcing the extreme price level. This effect does not rely on the precise linear shape of demand. What only matters is that the time-structure of demand is flat relative to the time-structure of supply leading to a surplus of allowances in early years almost all of which is canceled in later years. After a decade of worrying about low allowance prices, the EU may soon find itself otherwise occupied, struggling with a carbon price that spirals out of control.

Our results thus reinforce calls for a MSR revision that incorporates price triggers into the EU ETS. That said, a simple price ceiling or floor (*15*) is not so easily constructed, largely because of the MSR. For instance, Article 29a of the EU ETS Directive stipulates that when over 6 consecutive months prices are more than 3 times higher compared to the average over the previous 2 years, 100 $MtCO_2$ of allowances are moved back from the MSR to the market. Our calculations suggest almost all of these allowances are returned back to the MSR at later stages, implying negligible effect on total cancellations and cumulative emissions.

As a final note, we believe that an ETS would best separate market liquidity targets from its long-term climate targets. Market liquidity is essential for a market to implement allocative efficiency; it is measured by the total number of allowances in circulation relative to the number of allowances demanded. The price of allowances plays no role here. Liquidity can be targeted through an MSR with quantity-based rules that guide the flow between the market and the MSR. Global warming targets, on the other hand, are connected to cumulative emissions, or alternatively, the cumulative canceling of allowances. If prices are low, society can reduce global warming at low costs by canceling allowances. If prices are high, reducing global warming further is costly and there is less room for canceling. Currently, the time structure of demand is the driving factor for cancellation; it seems natural to integrate prices into the decision rules for allowance cancellation (*6*)**.**

References and Notes

1. P. Bayer, M. Aklin, The European Union emissions trading system reduced CO2 emissions despite low prices. *Proceedings of the National Academy of Sciences*. **117.16**, 8804-8812 (2020).
2. R. S. Pindyck, The social cost of carbon revisited. *Journal of Environmental Economics and Management*. ***94***, 140-160 (2019).
3. G. Perino, New EU ETS Phase 4 rules temporarily puncture waterbed. *Nature Climate Change*. ***8*(4)**, 262-264 (2018).
4. R. Gerlagh, R.J.R.K. Heijmans, Climate-conscious consumers and the buy, bank, burn program. *Nature Climate Change*, ***9*(6)**, 431-433 (2019).
5. K. E. Rosendahl, EU ETS and the waterbed effect. *Nature Climate Change*, ***9*(10)**, 734-735 (2019).
6. R. Gerlagh, R.J.R.K. Heijmans, K. E. Rosendahl, An Endogenous Emissions Cap Produces a Green Paradox. *Economic Policy* (2021, forthcoming).
7. G. Perino, M. Willner, EU-ETS Phase IV: allowance prices, design choices and the market stability reserve. *Climate Policy*, ***17*(7)**, 936-946 (2017).
8. S. Kollenberg, L. Taschini, Dynamic supply adjustment and banking under uncertainty in an emission trading scheme: The market stability reserve. *European Economic Review*. ***118***, 213-226 (2019).

9. R. Gerlagh, R.J.R.K. Heijmans, K. E. Rosendahl, COVID-19 tests the market stability reserve. *Environmental and Resource Economics*. ***76*(4)**, 855-865 (2020).
10. RefinitivCarbon, "EUA price forecast: A new era for European carbon or calmer waters ahead?" (Technical report, 2018).
11. S. Borenstein, J. Bushnell, F.A. Wolak, M. Zaragoza-Watkins, M, Expecting the unexpected: Emissions uncertainty and environmental market design. *American Economic Review*, ***109*(11)**, 3953-77 (2019).
12. K. Bruninx, M. Ovaere, M., E. Delarue, The long-term impact of the market stability reserve on the EU emission trading system. *Energy Economics*, ***89***, 104746 (2020).
13. C. Flachsland, M. Pahle, D. Burtraw, O. Edenhofer, M. Elkerbout, C. Fischer, O. Tietjes, L. Zetterberg, How to avoid history repeating itself: the case for an EU Emissions Trading System (EU ETS) price floor revisited. *Climate Policy*, ***20*(1)**, 133-142 (2020).
14. H. Hotelling, The economics of exhaustible resources. *Journal of political Economy*, **39(2)**, 137-175 (1931).
15. J. Abrell, S. Rausch, Combining price and quantity controls under partitioned environmental regulation. *Journal of Public Economics*, ***145***, 226-242 (2017).

Funding: None to be reported.

Author contributions:

Conceptualization: RG, RJRKH, KER

Methodology: RG, RJRKH, KER

Investigation: RG, RJRKH, KER

Visualization: RG, RJRKH, KER

Project administration: RG, RJRKH, KER

Supervision: RG, RJRKH, KER

Writing – original draft: RG, RJRKH, KER

Writing – review & editing: RG, RJRKH, KER

Competing interests: Authors declare that they have no competing interests.

Data and materials availability: All code and data are available in the main text or the supplementary materials.

Supplementary Materials

Supplementary Text