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FOR EARTH SYSTEM RESEARCH
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POLICY BRIEF

EU ETS STABILITY MECHANISM NEEDS NEW DESIGN

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Reforms in 2015 and 2018 fundamentally changed the design of the EU ETS. The Market Stability Reserve (MSR) was created to increase resiliency to demand shocks, deliver investment signals and raise synergies with other climate and energy policies by adjusting both medium-term allowance supply and the long-run cap based on market outcomes.[1] The 2018 reform renewed confidence in the EU ETS, permanently removing historic surplus, curbing emissions substantially[2] and raising prices to the range of 20-40 EUR/ton. Having achieved some key objectives, priorities are likely to change towards sustaining market stability, inducing investment incentives, ensuring synergies with overlapping policies and reducing regulatory uncertainty. However, in Phase IV the current design of the MSR could threaten these objectives and thereby undermine the EU ETS. With the EU poised to step up its climate targets, it is essential that the design of the EU ETS is prepared for the challenges ahead.[3]

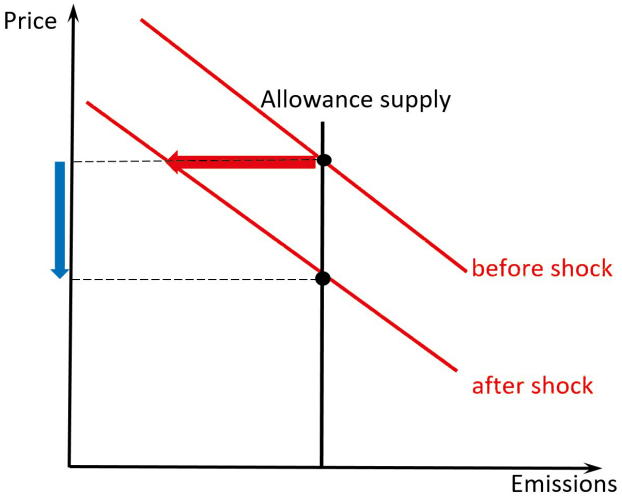
In the following paper we identify the risks that arise from the current design of the MSR and propose a feasible way to address them in the upcoming review of the EU ETS.

RISK 1: TNAC-BASED SHORT-RUN SUPPLY ADJUSTMENT DESTABILIZES THE ALLOWANCE MARKET

TNAC-dependent intake and outtake magnifies the price impact of anticipated changes in market fundamentals, induces multiple and unstable equilibria, and is prone to speculative attacks.

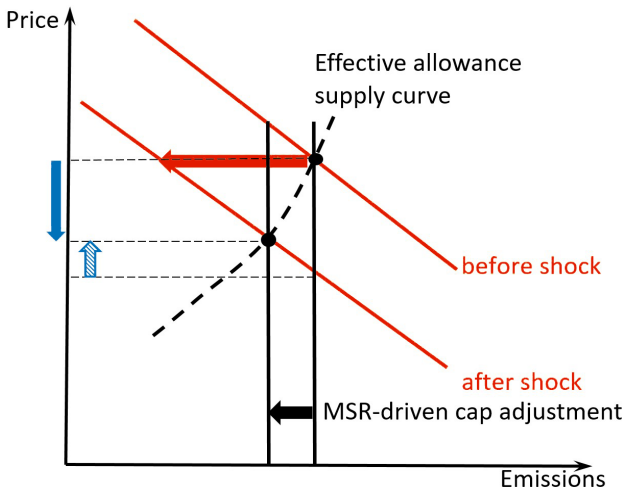
Before the MSR was introduced, the supply of allowances did not respond to market conditions and changes in fundamentals fully translated into price changes (Figure 1, Panel a).
At its core, the MSR aims to adjust the supply of allowances to stabilize and ensure an orderly functioning of the allowance market. It does so based on the 'total number of allowances

Figure 1: Cap Adjustments and (In-)Stability
(a) Fixed Cap



Before 2019 the cap did not automatically respond to changes in demand (red). They translated fully into price changes (blue).

(b) Stabilising Adjustment

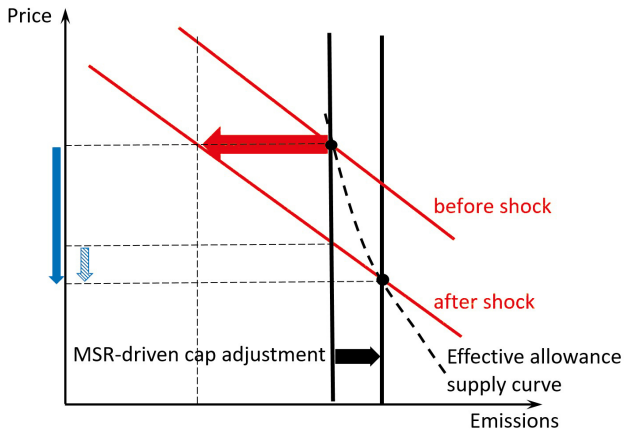


Unanticipated reductions in demand increase the TNAC. The MSR *reduces* the number of allowances auctioned (black) and the price response.

1 EU (2015)
2 Bruninx et al. (2020), Pahle & Quemin (2020)
3 Pahle et al. (2018)

in circulation' (TNAC). The TNAC is the number of allowances banked by firms for future use. The higher the TNAC, the fewer allowances the MSR makes available in future auctions and vice versa. The TNAC is thus used as a measure of allowance scarcity. The principle of scarcity-responsive caps has merits and is well established in the economics literature.[4] However, the TNAC is not a reliable indicator of scarcity. While it is a reasonable first-pass proxy of scarcity induced by *past* shocks (Figure 1, Panel b), it may point in the wrong direction for *anticipated future* changes in market fundamentals (Figure 1, Panel c).[5]

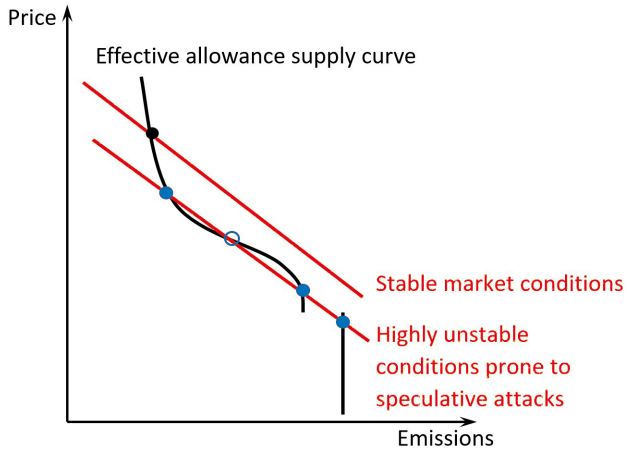
(c) Destabilising Adjustment



An anticipated future reduction in demand can decrease the TNAC. The MSR *increases* the number of allowances auctioned and the price response.

Conditioning the supply of allowances on the TNAC can lead to an unintended and highly undesirable outcome: if anticipated scarcity increases (decreases), firms bank more (less) allowances to re-establish the balance between current and future abatement costs. The MSR then responds by cancelling more (less) allowances further increasing (decreasing) scarcity. The current MSR induces a response to anticipated changes to market fundamentals that mimics a downward-sloping supply curve for allowances (see Appendix). MSR-induced flexibility becomes counterproductive (Figure 1, Panel c) increasing rather than dampening the price impact of anticipated shocks. The risk of policy-induced market instability is further enhanced if there are multiple market equilibria (Figure 2). The TNAC-threshold based MSR activity triggers (currently at 833million and 400million) and non-linear downward-sloping supply curves can induce multiple equilibria.[6]

Figure 2: Multiple Equilibria



MSR induces multiple equilibria (blue). Discontinuity arises from MSR activity threshold. Multiple equilibria are prone to speculative attacks.

The risk of erratic behaviour of market outcomes, especially as the TNAC approaches the MSR activity thresholds, makes the system at large susceptible to manipulation and gaming.[7] Moreover, there is no clear economic guidance for regulating the intertemporal use of allowances relative to predefined thresholds.[8] Practically, a TNAC-based MSR ignores the diversity and endogeneity of banking motives (e.g. passive or active hoarding, hedging, and speculation) that contribute to the TNAC.

The current approach of relying on the TNAC to create a healthy 'hedging corridor' fails as the TNAC is neither an informative measure of allowances available for hedging nor a reliable indicator of allowance scarcity.

RISK 2: TNAC-BASED LONG-RUN SUPPLY ADJUSTMENT UNDERMINES THE 2030 TARGET

Achieving EU climate targets depends on a mix of instruments, many of which overlap with the EU ETS. The MSR renders their emission impacts highly unpredictable and creates substantial risks that overlapping policies increase the supply of allowances and hence emissions.

Prominent climate policies such as coal phase-outs, renewable support schemes and energy efficiency measures induce additional abatement in EU ETS sectors that is independent of the market price of allowances. If most of this extra abatement is expected to materialize in the (potentially distant) future, the MSR tends to increase the supply of allowances rather than reduce it because the need to bank allowances for future use, and hence the TNAC, decreases. In this case there is a so-called 'green paradox' in which the announcement of additional environmental measures increases emissions (see Figure 1, Panel c and Appendix).[9]

While member states (and subnational jurisdictions, environmental NGOs and individual households) believe implementing effective climate policies requires directly inducing abatement, the net impact of these policies might have the opposite effect. The design of the MSR may increase the supply of allowances and thus emissions in response to anticipated supplementary measures. While the MSR aims to foster synergies with other climate and energy policies, its reliance on the TNAC as a measure of scarcity risks undermining additional abatement efforts. This effect is more likely for impacts

4 Roberts & Spence (1976), Burtraw et al. (2020), Traeger et al. (2020)
5 Bruninx et al. (2019), Gerlagh et al. (2021), Perino et al. (2020), Rosendahl (2019), Willner (2018)
6 Gerlagh et al. (2021), Perino et al. (2020)
7 Friedrich et al. (2020), Osorio et al. (2020), Quemin (2020), Pahle & Quemin (2020)
8 Gollier & Tirole (2015), Quemin & Trotignon (2021), Tietjen et al. (2021)
9 Bruninx et al. (2019), Gerlagh et al. (2021), Pahle et al. (2019), Perino et al. (2020), Rosendahl (2019)

in the near future if market participants are myopic.[10]

Most scenarios recently laid out by the European Commission on how to achieve more ambitious targets[11] rely on a mix of overlapping policies. The failure of a TNAC-based MSR to translate additional climate and energy policies into actual reductions in overall emissions jeopardizes the climate goals set out by the EU for both 2030 and 2050.[12]

RISK 3: A DESTABILIZED MARKET EVENTUALLY RESULTS IN ERRATIC REGULATORY PATCHWORK AND FUELS STAKEHOLDER OBJECTIONS

Erratic price signals and excessive complexity impede both investments in low-carbon technologies by regulated firms as well as effective complementary climate policies by member states and sub-national jurisdictions. Ineffective policies and erratic repair attempts undermine trust in the EU ETS, in regulatory competence and ultimately the achievement of the net-zero target.

The rules of the MSR are transparent. However, their effects are highly complex, counter-intuitive and difficult to grasp for market participants, regulators, stakeholders and the electorate[13]. Understanding the MSR and its impacts matters. The climate benefit of efforts made by national and sub-national governments, NGOs and individuals crucially depends on interactions with the MSR. In contrast to the design of other cap-and-trade schemes with flexible, price-based caps such as the Regional Greenhouse Gas Initiative (RGGI) and the California and Québec cap-and-trade programs, the waterbed effect is not determined by the carbon pricing policy but by a complex interaction with overlapping policies[14]. Ignoring these interactions risks rendering policies ineffective or even counter-effective. A prominent example is the German government's attempt to align a national policy with the EU ETS. The recent German coal phase-out law cuts the number of allowances auctioned in line with the policy-induced reduction in demand. However, this approach based on Art. 12(4) EU ETS Directive[15] is highly ineffective under the current EU ETS design as cancellations reduce the TNAC and hence the number of allowances cancelled by the MSR[16]. Pointing out the ineffectiveness of voluntary efforts substantially reduces decision makers' intrinsic motivation.[17]

Second, understanding the MSR and its impacts is important to market participants, most importantly to firms that consider investing in low-carbon technologies. Even under ideal circumstances, the MSR's effects on price volatility[18] and investment incentives[19] are ambiguous – undermining two major selling points of the instrument. With increased ambitions, mandated coal phase-outs and the potential extension of the EU ETS to heating and transportation, the bulk of abatement activity is set to move from short-term, reversible fuel switching to medium and long-term, irreversible investment decisions. Hence, strong and credible price expectations will become increasingly relevant during Phase 4. The price risks induced by the MSR laid out under Risk 1 will become a liability.

The combination of complexity, counter-intuitive impacts and MSR-dependent effectiveness of overlapping efforts creates enormous conceptual and practical obstacles in implementing the policy mix and low-carbon investments necessary to achieve the EU's climate targets.

RISK 4: RISKS 1 TO 3 IMPEDE LINKING TO OTHER TRADING SCHEMES

Linking ETSs can substantially reduce overall compliance costs on the way to net-zero. The current design of the MSR makes the EU ETS an unattractive linking partner.

Linking ETSs across jurisdictions has the potential to reduce the overall costs of achieving abatement targets, but also requires careful consideration to ensure compatibility[20]. While the EU ETS has been a role model for other carbon trading schemes around the world, the TNAC-based MSR impedes linking to other schemes.[21] In fact, the EU ETS is the only system to adopt a quantity-based flexibility mechanism among the existing ETSs. Other schemes use price-based flexibility mechanisms. This holds internationally (see e.g. RGGI, California & Québec) and within the EU as evidenced by the German ETS covering the transportation and building sectors. Price and TNAC-based flexibility mechanisms are not compatible as they pull in different directions whenever the TNAC fails to capture changes in allowance scarcity (Risk 1 and 2) and foster the potential for an uncontrolled transfer of taxpayers' money from one jurisdiction to another.[22]

Linking is a lengthy process that requires substantial trust and may incite strategic behaviour among partners.[23] However, linking is likely to become increasingly important in Phase IV, with ETSs both in Europe such as the UK and German ETSs and overseas. Therefore, learning from other schemes and gradually aligning some features of the EU ETS to their designs[24] would increase the EU-ETS' attractiveness as a linking partner. A TNAC-based MSR and a perceived general aversion against price-based mechanisms are likely to be a substantial liability on the ETS dating market.

10 Quemin & Trotignon (2021), Schmidt (2020)
11 EC (2020)
12 Bruninx et al. (2020), Carlén et al. (2019), Herweg (2020)
13 Bruninx et al. (2019), Perino (2018, 2019), Quemin & Trotignon (2019), Wet testad & Jevnaker (2019)
14 Perino et al. (2020)
15 Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC, last changed by Commission Delegated Decision (EU) 2020/1071 of 18 May 2020.
16 Gerlagh & Heijmans (2019)
17 Ockenfels et al. (2020)
18 Perino & Willner (2016), Holt & Shobe (2016), Kollenberg & Taschini (2019)
19 Perino & Willner (2019)
20 Borghesi & Zhu (2020), Mehling et al. (2018)
21 Switzerland is an exception as it is tiny compared to the EU ETS.
22 See Galdi et al. (2020), Verde et al. (2020) and Vivid Economics (2020), for a discussion on linking between ETSs with different flexibility mechanism and different ambition levels, respectively.
23 See Borghesi and Zhu (2020), Doda et al. (2019) and references therein.
24 Burtraw et al. (2013)

Below we propose a design that is more compatible with abatement efforts from member states and intrinsically motivated actors. The design would provide a more reliable price and investment signal, and promote other core EU values such as cooperation, cohesion and the subsidiary principle.

SOLUTION: A PRICE-BASED FLEXIBILITY MECHANISM

Allowance prices are a more reliable indicator of (expected) changes in scarcity than the TNAC. Conditioning allowance supply on prices has the potential to contain the risks outlined above, stabilize the market and specify how changes in market fundamentals translate into changes in total emissions and allowance prices transparently and reliably in the EU ETS Directive.

The cause of most – if not all – of the issues identified above is that the TNAC is an ill-suited indicator of scarcity due to its nature, and because it can be measured only once a year with a delay of several months. Fortunately, a robust real-time measure of scarcity exists: the allowance price. It responds both to current and anticipated future changes in scarcity in the same way. Tagging the adjustment of the cap to the price of allowances would provide what the current MSR is aiming for but falls short of achieving: price stability, productive coexistence with other climate and energy policies, predictability and hence reliable investment signals. Price-based adjustment of an emission cap (a) is quantity-based regulation given that a finite upper bound on emissions is in place at any point in time, (b) tackles the trade-off between additional abatement and a reduction in compliance costs head on and (c) corresponds to a classic market feature: the quantity supplied contracts if prices drop.

Replacing the TNAC with the allowance price will allow policy makers to gain better control of key features of the EU's flagship climate policy.[25] If the costs of achieving the original abatement target drop (graphically represented by a left shift in allowance demand), one can either implement a more ambitious abatement target or ease the financial burden on firms and consumers – or split the gains between the two. Defining the shape and in particular the slope of an allowance supply function in the EU ETS Directive, would transparently control the EU ETS price and emissions response to market interventions (coal phase-outs, renewables and energy efficiency expansion) and shocks (financial crises, pandemics). Figure 3 provides illustrations of how different price-based flexibility mechanisms translate a change in market fundamentals into a price and an emission response. Specifying this trade-off is at the heart of the political challenge facing our societies. Once the EU has legislated this, national and subnational governments, NGOs and private households have a clear basis on which to tailor policies, campaigns and voluntary efforts accordingly.

Furthermore, an explicitly defined allowance supply function increases price stability, reducing reasons for and vulnerability to speculative attacks. Containing exposure to price variability reduces firms' need to hedge. *A Price Stability Reserve* (PSR) facilitates full and partial linking of the EU ETS to other schemes in Europe and beyond. One option would be a partial link to a potentially forthcoming separate ETS for the buildings and transport sectors. Contingent on price differences a pre-defined number of allowances could be moved from one scheme to the other thereby reducing overall compliance costs. In case an additional European ETS is set up, both systems need to be designed in a way that facilitates convergence in the medium run. A PSR would be an important milestone.

Several proposals for how to design an ETS featuring an allowance supply curve linked to a reserve already exist, including the two aforementioned North American schemes.[26] The EU could adopt a similar approach while making use of the reserve built up by the current MSR. Adopting a price-based flexibility mechanism could be more effective than a quantity-based MSR in preventing the short-term consequences of a sudden shock to carbon markets and would be more compatible with an efficient and revenue maximizing allowance auction design.[27]

Figure 3 illustrates four different PSR versions out of a large number of possible designs. All specify a cap based on the allowance price level. All four panels show an identical shift in allowance demand (red arrow) and the corresponding price (blue arrow) and quantity (black arrow) adjustments. The versions differ in how they split the effect of lower demand between reduced prices and emission reductions.

In panel a) the slope of the initial section of the allowance supply function is flat – hence the shift in allowance demand induces a large change in the number of allowances issued but a small price response. In other words, the underlying cause of the demand shift, such as a coal phase-out in a large member state, induces a sizeable reduction in supply and hence emissions. In panel b) the slope is steep and the impact on prices and hence marginal abatement costs is large while emissions are only reduced by a small amount. This reveals the crucial role of the slope of the allowance supply function for the 'additional abatement or lower cost' trade-off. In a PSR this parameter is directly controlled by the political process. In the current design of the MSR it is the result of a complex interaction between the parameters of the MSR and the details (in particular the timing) of the shift in allowance demand.[28]

Panel c) depicts a stepwise allowance supply curve featuring a price floor, inspired by the combination of an emissions containment reserve and an auction minimum reserve price in RGGI.[29] Panel d) is a simpler version of c) with a single step – a variant often labelled 'cap-and-trade with price corridor'. Note that in the variants presented in panels a) – c) there is an identical binding upper bound on total emissions. Hence, they guarantee achieving a particular climate target expressed in terms of cumulative emissions. On the other hand, the

25 Perino et al. (2020)

26 Acworth et al. (2020), Burtraw et al. (2020), Flachsland et al (2020), Hepburn (2006), Newell et al. (2005), Perino et al. (2020), Pizer (2002), Roberts & Spence (1976), Traeger et al. (2020), Yu & Mallory (2015)

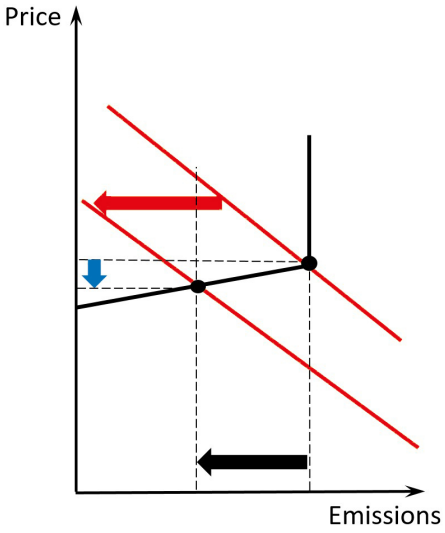
27 See Galdi et al. (2020) and the literature cited therein on carbon price shocks and Khezr and MacKenzie (2021) on auction design.

28 Perino et al. (2020)

29 Burtraw et al. (2020)

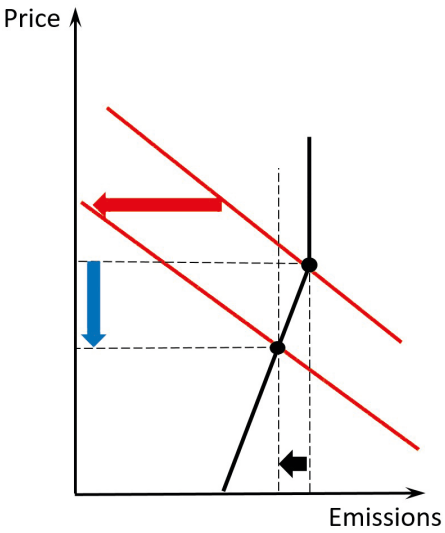
Figure 3: Variants of Price Stability Reserves

a)



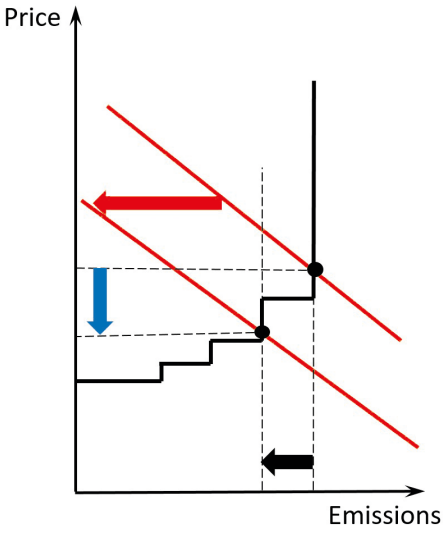
Binding target with flat allowance supply

b)



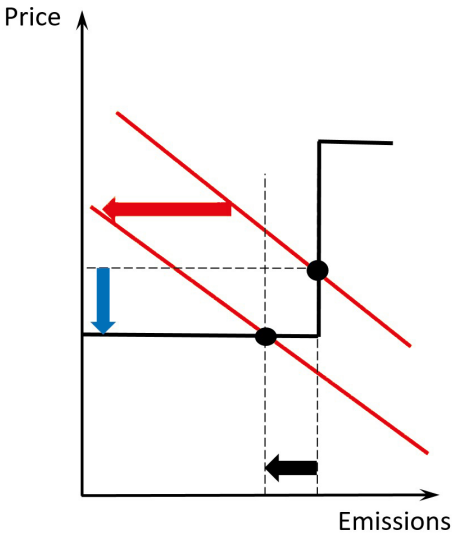
Binding target with steep allowance supply

c)



Binding target with step-wise allowance supply

d)



Target with price-corridor. If the price ceiling is combined with an offsetting mechanism, the target remains binding.

version in panel d) features an upper bound on marginal abatement costs and thereby effectively contains the costs faced by industry and consumers. If the proceeds from issuing additional allowances at the price ceiling are used to pay for credible additional abatement of at least the same magnitude in other sectors, or other jurisdictions, then such a design is consistent with a binding climate target. Such an offsetting mechanism linked to a price ceiling is implemented both in the California in the German ETS. In the latter, it will become operational once it moves from a fixed-price to a cap-and-trade with price corridor design in 2025.

As these illustrative examples demonstrate, a PSR provides amble flexibility to control market responses to changes in fundamentals. The use of design elements such as stepwise, linear or non-linear components, minimum prices, binding targets and offset mechanisms are deliberate choices by the regulator to accommodate a wide range of political priorities. A PSR gives control of these important aspects back to the political process.

LEGAL ASPECTS OF A PRICE-BASED FLEXIBILITY MECHANISM

A price-based flexibility mechanism can be introduced without the unanimity requirement of Art 192(2) TFEU. To do so it should aim at stabilizing the EU ETS and prices continue to be determined by market forces.

A price-based flexibility mechanism – irrespective of its concrete design – will likely be based on Article 192 TFEU. Its political feasibility hinges on the assessment whether it falls under the ordinary legislative procedure (Art. 192(1) TFEU) or the special legislative procedure (Art. 192(2) TFEU). The latter – as an exception to the principle of majority voting – requires unanimity in the Council of the European Union. It applies when the Council adopts, inter alia, provisions primarily of a fiscal nature (Art. 192(2)(a) TFEU) or measures significantly affecting a Member State's choice between different energy sources and the general structure of its energy supply

(Art. 192(2)(c) TFEU). To avert the burden of unanimity in the Council, the design of a price-based flexibility mechanism should avoid falling under one of these exceptions.

Since Art. 192(2)(a) TFEU has never been used as the legal basis of a provision until now, the Court of Justice of the EU (CJEU) has not issued a concrete definition of provisions of fiscal nature so far. However, it does not seem implausible to interpret it quite strictly. Art. 192(2)(a) TFEU is on the one hand an exception to a principle.[30] On the other hand, the relevant provision has to be *primarily* of a fiscal nature. Although the exact scope of the "fiscal nature" of a provision is hard to determine,[31] the sole aspect of generating revenues does not seem to be enough to characterize a provision as primarily fiscal.

The Court ruled in 2010 that the EU ETS does not constitute a duty, tax, fee or charge.[32] Transferring the crucial elements mentioned in the Court's judgement it seems important, that the aim of the price-based flexibility mechanism is the stabilization of the ETS as a whole, and not the achievement of (higher) revenues as such. Market forces must determine the price of allowances, since the determination of the assessment parameters, especially the price itself, in advance could change the character of the provision. Lastly, the price-based flexibility mechanism should not restructure the EU ETS in a way, that it constitutes an obligatory levy in favour of the public authorities.[33]

With regard to the exception regulated in Art. 192(2)(c) TFEU, which addresses a Member State's choice between different energy sources and the general structure of its energy supply, the Court stressed that the primary outcome sought by any measure has to be the significant effect on the aforementioned choice of Member States.[34] The legal basis for an EU measure must rest on objective factors amenable to judicial review, which include the aim and content of that measure.[35] The Court concluded that the MSR does not constitute such a measure, basing it, inter alia, on the following criteria: the aim of the MSR is to remedy existing imbalances with quantitative mechanisms; with regards to its content, it does not intervene directly to set the price of allowances and the price of allowances has no influence on the functioning of the MSR.[36] These elements should be kept in mind when designing a price-based flexibility mechanism, to avoid (re-)opening a discussion on whether the mechanism significantly impacts a Member State's choice.

SUMMARY

There are good reasons for the EU to move to a *Price Stability Reserve*. Most price-based mechanisms are likely to improve effectiveness, efficiency and predictability compared to the current design given that stringency is tailored to the EU's climate targets. The MSR will be reviewed in 2021 along with other key features of the EU ETS and the EU's climate policy at large. We want to raise awareness on how important a fundamental change in the design of the MSR is for achieving the EU's new ambitious climate targets. The MSR is more than a technical detail to fine-tune the allowance market. With its ability to substantially adjust medium-term supply and the long-run cap, as well as the way it shapes (and potentially confuses) market expectations and policy outcomes, it is a powerful tool that needs to be designed well to ensure market stability, low-carbon investments and achieving climate targets. The set of available design options for a price-based adjustment of allowance supply seems rich enough to combine its ability for more effective market stabilisation with political feasibility, i.e. the requirements for the ordinary legislative procedure. The simultaneous review of the MSR and the revision of the EU climate policy framework provide a unique opportunity to increase the coherence and effectiveness of EU climate policy substantially. Moving from a TNAC-based to a price-based stability reserve would be a major step forward.

ACKNOWLEDGMENTS

We gratefully acknowledge very helpful comments from Simone Borghesi, Mirjam Kosch and Emma Krause. Funding from the Kopernikus-Projekt Ariadne (FKZ 03SFK5A) by the German Federal Ministry of Education and Research is gratefully acknowledged. This paper also contributes the Cluster of Excellence 'Climate, Climate Change, and Society' (DFG project 390683824) at Universität Hamburg.

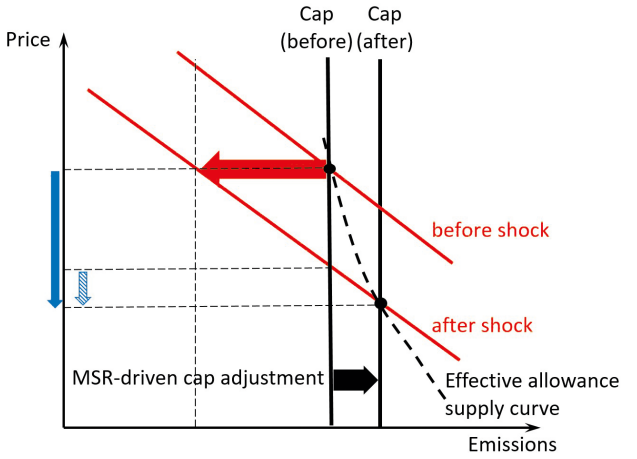
30 Regarding both alternatives it is important to note that the case-law of the Court of Justice of the EU (CJEU) requires such provisions that are exceptions to principles to be interpreted strictly, see CJEU, C-5/16, Para. 45.
31 For a comprehensive interpretation see Fischer et. al. (2019).
32 CJEU, C-366/10, para. 143
33 CJEU, C-366/10, para. 143, 145.
34 CJEU, C-5/16, para. 46.
35 CJEU, C-5/16, para. 46 f.
36 CJEU, C-5/16, para. 51 ff.

APPENDIX: EXPLANATION OF DOWNWARD-SLOPING SUPPLY CURVE

Many of the risks identified in the main text originate from a counter-productive feature of the MSR, captured by the creation of a downward-sloping allowance supply curve. Here we briefly explain how this comes about. While the phrasing in terms of slopes of effective allowance supply curves has quite recently been introduced by Perino et al. (2020), the key mechanism is due to Rosendahl (2019) and has been confirmed by a series of papers.[37]

The MSR affects the long-run cap via two antagonistic effects. The first and better known is the direct and increasing effect on the TNAC caused e.g. by additional abatement activity while the TNAC is above the upper (833 million) threshold. As a result, the MSR takes in and ultimately cancels more allowances. Here, additional abatement results in a tighter long-run cap. This effect is smaller the shorter the number of years between the increase in the TNAC and the end of the MSR's intake period.[38]

Figure 4: Derivation of downward-sloping allowance supply curve



An anticipated change in market fundamentals, e.g. due to overlapping policies, shifts total allowance demand (red lines) to the left (red arrow). If the shock is sufficiently backloaded relative to the planning horizon of market participants, then the MSR magnifies (blue dashed arrow) the price decrease (blue arrow), TNAC decreases, and MSR intakes and ensuing cancellations drop. The net effect is an increase in the long-run cap compared to the situation without the shock (black arrow).

Second and far less known is an indirect effect based on anticipation and price responses. If additional abatement (or any other change in market fundamentals such as expected state of technology, growth, ETS linking or other policy measures) is anticipated, then market participants adjust their expectations regarding future scarcity. This puts downward pressure on current prices. Emissions increase and the TNAC drops. As a result, the MSR takes in and cancels fewer allowances. Compared to a situation without the anticipation effect, the cap increases because the number of allowances cancelled drops. The external abatement initiative therefore ultimately results in more, not less overall emissions (Figure 4). This has been called the 'green paradox'[39] and 'Rosendahl effect'[40] in the literature.

In a standard market without a supply-side mechanism, the supply curve is fixed and vertical. In response to a shift in the demand curve, the equilibrium moves vertically along the supply curve. With the MSR in place, a shift in the demand curve induces a shift in total supply: if the indirect (direct) effect dominates, the long-run cap increases (decreases). We interpret the new equilibrium to result from a movement along a downward-sloping (upward-sloping) 'effective' supply curve. Which effect dominates depends on the timing of the change in allowance demand relative to market participants' planning horizon. The direct effect is strongest for unexpected shifts in allowance demand occurring right now (or even better – that have occurred in the past). The indirect effect is strongest for anticipated shifts that occur far in the future but within participants' horizon, or that occur after the MSR has stopped taking in allowances. In the latter case, there is no direct effect.

37 Bruninx et al. (2019), Gerlagh et al. (2021), Pahle et al. (2019), Perino (2019), Perino et al. (2020), Schmidt (2020).
38 Perino (2018)
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