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Governance of CO_2 markets: Lessons from the EU ETS

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This article attempts to identify the conditions for making the coming years of the EU ETS a success. It draws historical lessons from the eight years the scheme has been in operation, and then analyzes, using the ZEPHYR-Flex model, the various interventions by the public authorities currently under discussion in order to revive the market. These simulations reveal the risk of carrying forward problems to the future, with further clouding of the visibility needed by ETS actors in the long term.

Finally, the article proposes to draw lessons from monetary policy by outlining what might be the mandate of an Independent Carbon Market Authority, with responsibility for the dynamic management of the supply of allowances, and whose main mission would be to ensure the optimal linkage between the different temporal horizons of the climate strategy.

Keywords: Emission trading, EU ETS, governance.

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Abstract

The European emissions trading scheme (EU ETS) is the centrepiece of Europe's climate policy. The system has been undermined variously by the weakness of its regulation, an undesirable overlap with other public policies and the far-reaching economic and financial crisis that caused the market price of allowances to plunge. This article attempts to identify the conditions for making the coming years of the EU ETS a success. It draws historical lessons from the eight years the scheme has been in operation, and then analyzes, using the ZEPHYR-Flex model, the various interventions by the public authorities currently under discussion in order to revive the market. These simulations reveal the risk of carrying forward problems to the future, with further clouding of the visibility needed by ETS actors in the long term. Finally, the article proposes to draw lessons from monetary policy by outlining what might be the

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Research Highlights

- History suggest that ex ante expectations tend to overestimate the constraint
- Economic conditions, policy overlaps, and Kyoto credits cause the current weakness
- "Set aside" or "backloading" does not resolve structural issues
- Changing/extending the reduction target is necessary but not sufficient
- An Independent authority could ensure the credibility of the constraint over time

Introduction

The economic literature differentiates "command and control" policies, in which the public authority set up standards and rules to directly reduce environmental damages, from policies based on "economic tools" aiming at internalizing the cost of environmental damages. There is a large consensus among economists to favor "economic tools" that aim at protecting the environment in the most efficient way, i.e. by minimizing the total cost of pollution abatement. Despite those recommendations, most of the environmental policies conducted in the real world continue to favor "command and control" policies.

There are two ways of introducing these economic instruments: price-based regulation and quantity-based regulation. The case of the European Union Emission Trading Scheme (EU ETS) provides to date the most complete experience of carbon pricing through a quantitative tool, a cap-and-trade program. Covering more than 12,000 industrial installations in 30 European countries, responsible for almost half of European CO_2, it entered into force in 2005 to facilitate the achievement by European Member States of the targets set by the Kyoto Protocol for the period 2008-2012. The rules are set up in the EU ETS directive; see European Parliament and the Council of the EU, 2003. The launching of this instrument and its functioning during the first trading period (2005-2007) has been analyzed by Ellerman et al., 2010, who considered this experience as a major innovation in the field of climate policies, that could inspire the development of other schemes in the world.

However, since the publication of this first *ex post* evaluation, the EU-ETS has faced new challenges: the unexpected economic recession strongly affected the

industries under the cap and contributed to reduce their CO_2 emissions; the market was hit in 2008 and 2009 by large scale frauds that affected its reputation; the large possibility of using offset contributed to reduce the severity of the cap defined for the second trading period which ended with a carbon price collapse. At the current price, less than 5 Euros per ton of CO_2, most observers consider that the EU ETS does not send the right incentives to reduce emissions both in the short and the long term. This raises the issue of the rules that should govern the market.

Since the end of 2011, the EU ETS is subject to this debate. In July 2012, The European Commission made a proposal dedicated at reducing the supply of allowances in the market between 2013 and 2015 (European Commission, 2012a). This so called "back loading" proposal has not yet been implemented. Nevertheless in July 2013 the European Parliament approved the proposed amendment with some modifications and voted to open talks with the Council aimed at reaching agreement on this basis. In addition to the "back loading" proposition, the European Commission published in December 2012 a report on the state of the European carbon market, which outlines options for a structural reform of the EU ETS (European Commission, 2012b).

This article is an attempt to contribute to this debate. Contrary to most of the views it doesn't take for granted that the current price on the EU ETS is "too low" because of an existing "surplus" of allowances on the market. By nature, the EU ETS aims at minimizing the cost of reaching a certain predefined emission target. The carbon price has a major role to play, in influencing the decisions of economic players both in the short-term management of their

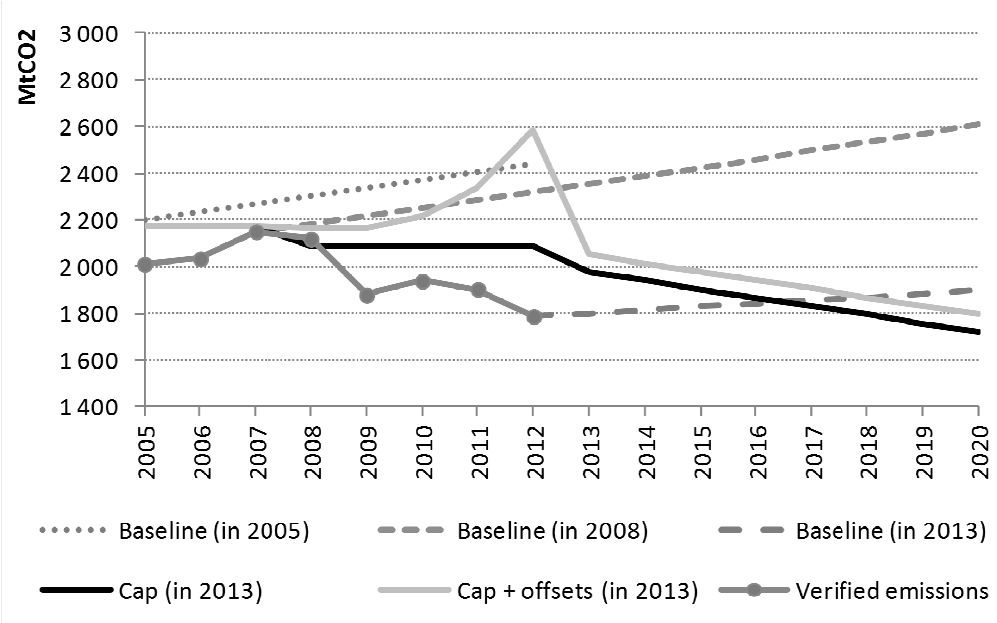
existing assets, and in the longer term direction of their investments. The economic efficiency of the policy is thus dependent on the EU ETS capacity to establish rules that will modify the short term behavior of agents as well as their investments decision, which requires changing their medium to long term anticipations. The major implication of the choice of quantitative instruments is that the price associated to carbon emissions will not be fixed by the authority but will be revealed by the market. It will reflect the current and anticipated scarcity of emission allowances, so that the economic efficiency relies not on a subjective desirable price level but on actors' anticipations of the medium to long term emission constraint, and especially how these expectations evolve over time. This lead us to recommend very different measures than the "backloading" or the so called "structural measures" proposed by the European Commission to reanimate the European carbon market.

In the first section, we analyze the key role of anticipations in a cap-and-trade program by comparing the past expectations to actual EU ETS developments. Section 2 identifies the three major causes of the current EU ETS' weaknesses, and distinguishes among these the economic influences from the effects of other structural settings. In section 3 we examine with our EU ETS simulation model ZEPHYR the options for structural reform made by the European Commission. None of the options appears to completely remedy the issues identified previously. Section 4 tries to build on these lessons and proposes the improvement of the current governance framework with the creation of an Independent Carbon Market Authority (ICMA), whose mandate would allow participants to build sound expectations over time. The last section concludes in trying to precise the general lessons that can be drawn from the EU-ETS case.

1. Expectations tend to overestimate the constraint and ignore future uncertainty

On a cap-and-trade scheme with unlimited banking (participants can hold unused allowances for a later use) the allowance price depends on the current and anticipated scarcity of emission allowances. This perceived constraint associated to the cap can be measured *ex ante* as the difference between business-as-usual emissions of covered sectors and the allowance cap, over the same period. The figure below represent, in the case of EU ETS, how those expectations evolved between the beginning of Phase 1 (in 2005), the beginning of Phase 2 (2008), and the beginning of Phase 3 (in 2013). For these calculations, we assume an elasticity of baseline emissions to growth of 0.5, and GDP scenarios of 3%/yr (in 2005 and 2008) and 1.5%/yr in 2013, according to Trotignon, 2012b.

Figure 1 –EU ETS ex ante anticipations compared to ex-post observations



Source: authors and CITL, 2013

2005 was the first year of EU ETS, Phase 1 (2005-2007) being a trial period. At that time, very few information was available on the emissions of covered installations, as well on the probable scarcity of allowances, and it was not yet clear if banking into Phase 2 was going to be allowed in some Member States or not. Accounting for a sustained economic growth and positing emission levels around the cap in 2005, a certain scarcity of EUAs was anticipated.

It eventually turned out that verified emissions for the year 2005 were lower than initially expected, and the market price immediately integrated this new information at the time of publication in April 2006. It progressively dropped to zero in 2007 as it became clear that the quantity of allowances was sufficient to cover verified emissions over the period, and that banking between Phase 1 and Phase 2 had been definitely forbidden.

2008 is marked by the vote of the European Climate Energy Package, a set of directives and regulations aiming to reach the 2020 objectives (targets for greenhouse gas emissions, renewable energy, and energy efficiency). In particular, the EU ETS directive was extended to 2020 by taking into account the emission reduction target announced by the European Council, 2007; European Parliament and the Council of the EU, 2009. A calculation accounting for sustained economic growth and an equally spread use of offsets over time would show a large anticipated deficit of allowances until 2020. Most price forecast at the time were counting on a EUA price in 2012 of around 35€/tCO_2.

Again, expectations did not come true and in 2012 the carbon price had dropped below 10€/tCO_2. The unforeseen financial crisis and the degraded growth outlooks are indeed responsible for part of this change in anticipations,

but there are, as we are going to see in the next section, other reasons which are as important if not more.

Figure 1 also presents anticipations to 2020 as they can be represented at the beginning of Phase 3. The ability to bank unused allowances, more than 2,000 Mt according to our most recent calculations, appears to allow for very little reduction effort to 2020, in the current context of low growth.

The first lesson we draw from this analysis is that the anticipations made in 2005 and in 2008 have turned out to be wrong. One can observe a strong tendency for participants and observers to overestimate the constraint *ex ante*. As a matter of fact, this is a lesson that is not specific to the EU ETS. It has been the case for the US SO_2 trading program, where unanticipated cost savings have been obtained due for example to the deregulation of railroad rates, allowing for more low-sulphur coal substitution than expected; see Schmalensee and Stavins, 2013. In the Regional Greenhouse Gas Initiative, emissions were lower than previously anticipated due to low natural gas prices prompting a conversion to the lower-emitting fuel, and to a lesser degree energy conservation and the economic downturn. This lead to a revision of the system with a view on tightening the cap, see RGGI, 2013. This phenomenon also took place in the Kyoto Protocol emission trading system, which turned out to be much less constraining than initially anticipated.

These historical lessons highlight that there seems to exist a general tendency for any authority implementing an emission trading system to overestimate the constraint *ex ante*. The interesting question arising is that of the capacity for the

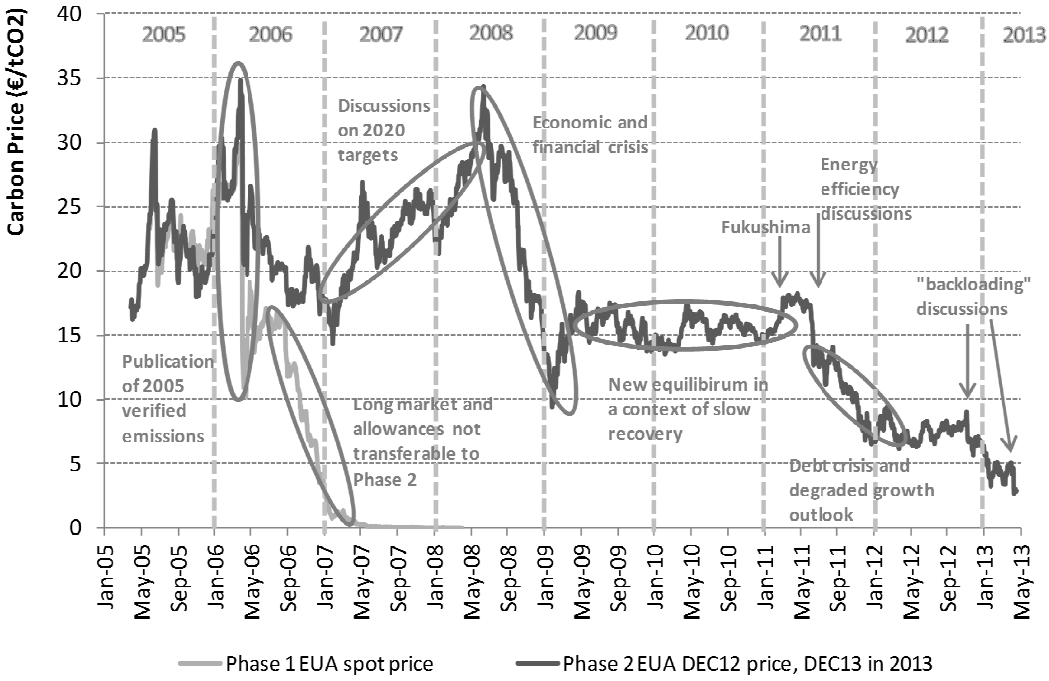
public authority to establish a coherence between the short term and the longer term constraint that will be robust over time, in this context of uncertainty.

2. The three causes of current market weaknesses

Most observers (as well as the European Commission in its report on the state of the carbon market), attribute the current weakness of the EU ETS to the economic crisis that strongly affected industrial output and induced a "surplus" of allowances. As we are going to see in this section, this observation is incomplete and does not allow to draw the correct lessons from the functioning of the market and thus to propose adequate recommendations.

There are three main causes for the current malfunctioning of the market (see the observed EUA price on Figure 2 below). The first is effectively the unforeseen decline in industrial activity since the 2008 crisis, and future prospects perceived as unfavorable. The second is the high use of carbon offsets over a short period of time resulting from the unforeseen evolution of the international Kyoto system in conjunction with the time-flexibility left to participants for using offsets. The third reason is the interactions between the allowance system and other energy and climate policies, mainly renewable energy and energy efficiency policies that can drive EU ETS emissions down independently of the EUA price.

Figure 2 – Observed EUA price since 2005



Source: authors and CITL, 2013

The first cause is economic conditions, which had a strong influence on the change of expectation occurring over Phase 2, in the short term (production decrease) as well as in the longer term (degraded growth outlooks). Between 2008 and 2009, the production levels of the covered sectors dropped on average by 10%, with stronger decreases in industrial sectors like cement and steel. But ultimately those influences of economic conditions on the price are desirable. Part of the economic efficiency of a cap and trade scheme comes from this flexibility that makes the price lower if economic conditions degrade, the cap remaining unchanged.

On top of this desirable influence, the system suffered from undesirable weaknesses that came for structural reasons. The effects on the market of other

climate and energy policies (energy efficiency, renewable energy) and the unforeseen use of carbon credits over time, resulted in a strongly decreased demand for EUAs in the market in the short term, as well as blurred anticipations in the long term.

Weigt et al., 2012 evaluate the effect of renewable energy support in Germany to be responsible for a reduction of 10 to 16% in the German electricity sector's emissions. In the same way, energy efficiency policies can reduce the demand for electricity generated by EU ETS covered sectors, thus implying emission reductions independently of the carbon price. If those structural weaknesses are not controlled in some way, this process of increasing interaction will automatically lead to the marginalization of the ETS, because the emission base of the system will be eroded by other policies. The fact that both the environmental and economic effectiveness of cap and trade programs can be significantly compromised by interactions with other regulations is crucial, and has been pointed out as a key element for the implementation of cap-and-trade programs by Goulder, 2013. It is much harder for participants to make sound expectations for the future in a context of uncontrolled policy super-imposition.

As far as the market is concerned, there is only one cap that matters in the end, it is the total domestic cap plus the allowed offsets over the period. The rules for using offsets in the EU ETS fixed the amount that could be used over 2008-2012 to approximately 1,400 Mt. This limit was then extended to around 1,600 Mt over 2008-2020 when the Climate Energy Package was voted, see European Parliament and the Council of the EU, 2009. This provision leaves most participants free to decide the timing at which offsets will be used (the right to

use offsets can be banked to later years). Between 2008 and 2009, around 80 million offsets per year have been used in the EU ETS; see Trotignon, 2012a. But in 2010, the European Commission announced qualitative restrictions on certain offset types that represented the majority of existing offsets, stating that the restriction would apply only from 2013 onward; see Hedegaard, 2010. As a consequence and by anticipation of the future restriction, the use of those offsets surged over the rest of Phase 2 to represent a cumulated amount of around 900 Mt over five years. The price of those largely available offsets dropped to less than 1 €/t, allowing participants to comply with the ETS constraint at very low cost, because of the unforeseen evolution of the Kyoto trading system. It was first anticipated that Europe would not be the only buyer of offsets, but no other large scale source of demand eventually emerged.

The lesson is that if the domestic cap is unchanged but the authorized use of offsets over time is changed, this is strictly equivalent to changing the cap. If the public authority leaves too much flexibility for using offsets, then the anticipations of the future constraint over time can be blurred, and the public authority can lose part of its sovereignty in deciding the reduction effort that will be effective domestically over a certain period. In proposals for cap-and-trade programs outside of Europe, this uncertainty has been accounted for by measures such as conversion rates between offsets and allowances, or price threshold above which more offsets become allowed in the system (option discussed in RGGI for example).

Of course, a cap-and-trade alone cannot do everything by itself, and other targeted policies are probably needed to support specific goals, which will have

an impact on EU ETS emissions. As a consequence, there will be policy interactions between the EU ETS and other policies. European climate energy policies are concerned, but also unilateral national policies. The United Kingdom's tax on electricity sectors emissions is a good example; see United Kingdom's HM Revenue and Customs, 2013. If such measures are taken individually by Member States, the economic efficiency of the EU ETS will suffer from it, because the advantage of having a uniform CO2 price falls when individual countries or sector "force" a carbon price that is higher than the market price. In the next section we are examining whether the solutions on the table today would be able to solve those identified weaknesses.

3. Evaluation of the Commission's proposals with the ZEPHYR model

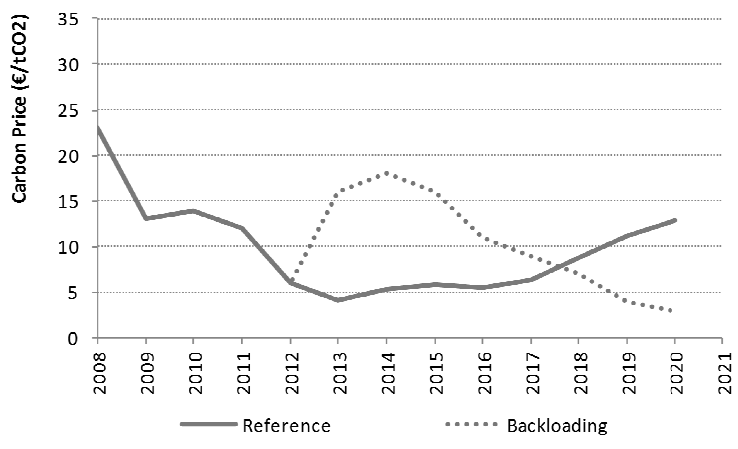
The European Commission took two parallel measures to try to solve the current weaknesses. The first is a short term action, called *backloading;* see European Commission, 2012a. This measure consists of delaying the auctioning of 900Mt taken from the 2013-2015 allowance cap, which would be injected back in the market through the 2019-2020 auctions. In that way the overall cap over Phase 3 would not be changed but the timing of auctions would shift volumes towards the end of the period. The second measure was to launch discussions on the so called "structural reform" of the EU ETS, following the publication of the Commission's report on the state of the European carbon market; European Commission, 2012b. This report proposed six different options for extending or strengthening the system. The backloading proposal as well as different options from the report have been tested with our EU ETS

simulation model, ZEPHYR-Flex. The model simulates the compliance behavior of EU ETS installations in each sector and calculates annual supply-demand equilibrium up to 2020, based on scenarios for growth, offsets and the future cap, see Trotignon, 2012b and De Perthuis and Trotignon, 2012. In the reference scenario, that describes the situation before any intervention, the annual reduction factor of the cap is set to -1.74% and is supposed constant up to 2030 (continuity of current trajectory), banking is allowed from Phase 3 into Phase 4, and we assume a complete use of offset limits up to 2020, and no offsets after 2020. The baseline emission growth is derived from a GDP growth scenario of 2%/yr from 2013 to 2020. In this reference scenario, the resulting EUA price would be around 6€/tCO_2 in 2015 and 13€/tCO_2 in 2020.

3.1 "Set aside" or "backloading" does not resolve structural issues

Two extreme cases can be represented. In the first situation, the change in the timing of auctions is perfectly anticipated by participants. In that case, there is no change compared to the reference scenario, because the overall cap is not changed by the backloading. In the opposite situation, participants do not anticipate the lower short term cap, and the price rises quite abruptly before plunging again when volumes are re-injected in the market. The Figure 3 below represents a central situation between the two extremes described above. In this scenario, the price would rise to 16€/tCO_2 in 2015 and drop down to 3€/tCO_2 in 2019.

Figure 3 – Results in the backloading scenario



Source: Climate Economics Chair, ZEPHYR-Flex model

These simulations show that backloading alone does not rectify the market in the medium to long term and leads to even greater confusion in terms of market participants' expectations. The price rise induced by such a short-term measure leads in the medium term to an even lower price than today, as long as the allowances cap remains unchanged.

3.2 Changing/extending the reduction target is necessary but not sufficient

Options from the Commission's report have also been tested. The two that seem best able to correct the market would be options giving more clarity on the longer term constraint: option (a), which consists of raising the 2020 reduction target to 34% and a linear extension of the reduction after 2020; and the combined option (b) + (c), which involves a cancellation of allowances in Phase 3 and a revision of the linear reduction factor of the cap in Phase 4, equivalent to a Roadmap trajectory implemented from Phase 3. In both cases, the ZEPHYR model indicates a price that could go up to around €25/tCO_2 in 2020. Only those

options which make the allowances cap visible in the longer term seem to be able to remedy the current situation in the market.

3.3 Other proposals from the Commission and summary of our results

The Table below summarizes our results and comments the different options.

Table 1 – Summary of our analysis of the Commission's proposals

Scenario	Carbon price in 2015	Carbon price in 2020	Comments
Reference	€6/tCO_2	€13/tCO_2	Current situation (continuity of linear reduction factor in Phase 4)
Backloading	€16/tCO_2	€3/tCO_2	Perfect expectations: no effect on the price (no change in the Phase 3 cap) Imperfect expectations: effect on the short-term price leading to an even lower price in the medium term
(a): 34% reduction target in 2020 for EU ETS sectors	€17/tCO_2	€27/tCO_2	Revision of the objective from 2013, in practice impossible Overly ambitious linear trajectory with regard to the 2050 objective Does not allow dynamic management of interactions
(b)+(c): Withdrawal of allowances in Phase 3 and revision of the linear factor in Phase 4 (in line with the Roadmap 2050)	€16/tCO_2	€24/tCO_2	Appears attractive but requires working on actors' expectations and a complicated political process Does not allow dynamic management of interactions
(d): extension to other sectors	Not tested		Only option proposed that concerns demand for allowances Extends the carbon price to diffuse emissions A good way reforming the market in theory; probably complicated in practice Does not allow dynamic management of interactions
(e): limiting access to international credits in Phase 4	In all our scenarios: no credit accepted in Phase 4		Use of carbon credits or international allowances in Phase 4 could have a (strong) effect on prices from Phase 3 Difficult to ensure good expectation conditions for actors
(f): price control mechanisms	Not tested		Would allow management of interactions Difficult for the public authority to decide on the "right" carbon price over time Risk of disconnecting the carbon price from market fundamentals in relation to the achievement of the reduction objective at least cost

Source: authors, ZEPHYR model

But in the light of the issues discussed in the previous section, none of the routes proposed by the Commission in its consultation paper seems completely satisfactory, because the question of market governance remains a taboo that is not explicitly addressed.

If we stay within the current system of governance, the most appropriate action would be to speed up the adoption by the 27 EU Member States of a credible goal for 2030. Backloading accompanied by an emissions reduction target of 40% in 2030 could raise the price of CO_2 allowances to €16/tCO_2 in 2015 and €24/tCO_2 in 2020. In the current governance framework, such a decision is very difficult to obtain because a lot of time and efforts are necessary for Member States to agree on the general climate targets and then to negotiate the distribution of efforts between the different policy tools and countries.

In the event of the adoption of a clearer long term reduction target, retaining the current governance would, however, leave a rigid system unable to adapt to shocks which are unpredictable today but are certain to occur between now and 2030. We propose exploring an alternative route to the options currently on the table, in which an independent carbon market authority would be established.

4. The case for an Independent Carbon Market Authority (ICMA)

A cap-and-trade program is fundamentally an instrument of public policy, consequently is will not be revived unless there is a strong political involvement, especially in determining its long term emission reduction target. The negotiation of a Climate Energy Package for 2030 is currently underway following the publication of the European Commission's green paper on a framework for climate and energy policies; European Commission, 2013. A

decision on a longer term reduction target is thus an important prerequisite to the propositions of governance improvements detailed hereafter.

The experience from eight years of market history previously analyzed shows that the current governance framework does not enable participants to shape sound expectations over time. Over the long term, the most inconvenient influences are not those of economic conditions but those induced by structural weaknesses linked to climate-energy policies overlap and to uncontrolled international linking (offsets + non-EU allowances). Dealing with those two uncertainties requires a more flexible intervention framework than the one available today. It would be extremely inefficient for Europe to engage in years-long debates such as the backloading negotiations every time something unexpected happens.

The recovery of the market calls for strong political support at a European level and a commitment to reform its governance, involving the establishment of a predictable and dedicated intervention framework. This mandate could be entrusted to an independent carbon market authority, which would ensure the consistency and credibility of the allowances system in the short to long term through the dynamic management of the supply of allowances. This framework is inspired by the example of monetary policies, with which emission trading has many similarities, as shown by Whitesell, 2012. In particular, Whitesell underlines that in both systems the public authority tends to be naturally subjugated by short term market conditions and is less inclined to ensure the credibility of the long term target over time.

4.1 A possible mandate for the Independent Carbon Market Authority (ICMA)

In our proposal, the role of the political authority remains unchanged: namely, to define detailed policy objectives for emissions reduction at a European and national level; and to select the range of public policy instruments to achieve these objectives.

ICMA's mandate (detailed in Table 2) is to maintain the credibility and political ambition of the policy over time by a dynamic management of allowances supply, from the short term (through the timing of auctions) to the long term (through the revision of EU ETS' cap).

In the short term, it would be a matter of being able to adjust the timing of auctions so as to ensure proper functioning and liquidity in the trading market. In the medium and long term, it would be a matter of being able to adjust the allowances cap in order to control interactions with other climate and energy policies and with international carbon credits.

To motivate and justify its actions, the independent authority should implement fair and transparent monitoring of the system (monitoring of transactions, compliance behaviour, low-carbon investment, emission trajectories, effects on competitiveness). It should also report regularly and publicly on its actions to the Council and the European Parliament.

At an institutional level, the mandate of this authority could either be assigned to a new agency, or the powers of the existing energy markets authority could be extended.

Table 2 – Outline of the mandate of the Independent Carbon Market Authority

Function	Associated action
Regular monitoring and transparency of information	Collecting, analysing and sharing information on: • Transactions on the ETS market • Emission trajectories • Compliance behaviour • Low-carbon investment • Effects on competitiveness Motivating and justifying its decisions.
Liquidity and good functioning of the market in the short term	Primary market: time management of allowances auctions. No need for intervention in the secondary market.
Credibility over time of the medium-to-long-term constraint	The public authority determines the detailed emissions reduction objectives and the policy instruments to achieve these objectives. The independent carbon market authority implements this policy objective in the sectors covered and can dynamically adjust the allowances cap in two cases: • To maintain consistency with other climate and energy policy instruments • To control interactions with carbon credits and international allowances. No need for a price corridor or cost control reserve.
Reporting and compliance with the mandate	Periodic hearings by the European Parliament and the European Council. Frequent public reporting.

Source: authors

In practical terms, it may be wondered how such an authority would have reacted to the recent market malfunctioning. In the short term, the question of backloading would no longer arise because of the mandate given by the European Parliament and the Council to the Independent Carbon Market Authority for the dynamic management of auctions. Faced with the three

previously identified causes for the fall in the market price, the independent carbon market authority would not have made any changes to the cap following the economic recession (in view of the normal and desirable adjustment of the equilibrium price after an economic shock). It would, however, have investigated the impact of changes in the functioning of the international Kyoto credit market and the impact of other Climate and Energy Package directives, with a view to tightening the cap. This tightening would involve returning to the constraint level initially assigned by the public authority to the sectors covered.

4.2 Is there a need for a price floor or a price collar?

In our vision, ICMA's means of action should be based on quantitative instruments, and there is no explicit need of introducing a long term price floor or a price collar as it is the case for example in California's cap-and-trade program; see California Air Resources Board, 2013.

But the public authority could decide to increase the visibility of the carbon price signal by introducing such price targets. Would these decisions solve the problem and make the creation of an ICMA unnecessary?

If the public authority decides to introduce a price floor without changing the current governance of the market, it bears a risk of disconnecting the price signal from quantity-based market fundamentals. For example, in the case of a price floor, if the market conditions bring the carbon price to the floor, the unbalance between supply and demand will increase as the cap entities will be incited to continue to abate emission by an artificial price which doesn't reflect market conditions. Instead of correcting the initial unbalance, the price floor will exacerbate it and the price signal will be blurred.

If the public authority wants to give a long term signal with explicit price target trajectories in the medium and long term, the only practical way to implement it is to introduce a dynamic supply management of allowances to adapt the quantitative parameters of the market. This requires a change in the way the market is managed today. In other words, our proposal doesn't require explicit price targets. But if these price targets have to be introduced, the only way to manage the situation would be to establish an ICMA and to add to its mandate these additional provisions.

Conclusion

The historical development of cap-and-trade programs reveals a strong tendency to over-estimate the constraint *ex ante*, by fear of high prices, which leads to the implementation of flexibility measures and additional policies aiming at containing the costs associated to the cap-and-trade constraint. What is observed *ex post* is very different from initial expectations, with prices generally much lower than expected. The key point to keep in mind is that the public authority and market participants will never know and anticipate perfectly in advance the future developments that will determine the actual constraint.

It is thus very hard for the public authority to ensure the predictability of the constraint in a context which is very uncertain by nature. This awkward situation requires a governance framework that can express very clearly the medium to long term targets of the policy, and at the same time has a capacity to react in the short term to unanticipated situations.

One of the ways to reconcile both requirements is to have the public authority determine the long term goals and the policy mix allowing reaching these goals, while entrusting to an independent authority the means to maintain this constraint over time in function of the uncertainties. The job of the ICMA is to give credibility and robustness over time to the reduction constraint set by the public authority. There are three pillars for such a framework to be effective: the existence of a precise mandate that determines the independence of the ICMA, the level of expertise of the ICMA, and the reporting and accountability rules of the ICMA.

In the short term, the question of backloading would not be asked anymore because of ICMA's mandate on the timing of auctions. In the longer term, the ICMA would also have the mandate to adapt the ETS cap, not in reaction to a change in economic conditions, but when unexpected events such as policy instruments overlap would require an intervention to maintain the credibility of the scheme to reach both short term and long term goals of greenhouse gas emission reductions.

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