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ICPIA – Coping with Complexity in the Evolving International Climate Policy Institutional Architecture

Carbon Authority as Price Stabilising Institution in the EU ETS

Claudia Kettner, Angela Köppl, Stefan Schleicher (WIFO)

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Abstract

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Abstract

Several years of experience with the EU ETS and various adaptations of the regulatory framework are accompanied by discussions whether an institutional setting to stabilise carbon markets is needed.

This paper discusses imperfections in market forces – contrary to theoretical assumptions – especially with respect to the implications of the use of marginal abatement cost curves as well as the role of stable price signals for investment decisions.

We argue that the gap between ex ante information when emission caps are set and ex post outcomes might be one of the reasons for price variability in the EU ETS.

This divergence between ex ante and ex post information illustrates that the theoretical assumptions on emissions trading are not matched by a real world setting. We conclude that this weakens the potential role of carbon prices for investment decisions. In order to improve the functioning of the EU ETS we reiterate the arguments for a carbon authority put forward in the literature and extend them by the argument that the concept of abatement curves is only of limited value in the context of CO_2 emission reductions where marginal abatement costs often are ambiguous and time variant.

Keywords: EU ETS price variability, carbon authority

JEL codes: Q54, Q58

1 Introduction

2005 marked the start of the EU Emission Trading System (EU ETS). Since this cap-and-trade system came into operation one can group it into three sub-periods: the learning phase (2005 - 2007), the Kyoto commitment period (2008 - 2012) and the revised system for the third period starting in 2013. The EU ETS exhibits the largest cap-and-trade system worldwide and represents the core instrument in EU climate policy.

Prior to the introduction of the EU ETS a number of papers addressed theoretically and empirically the issue of cost effectiveness and economic efficiency of emission trading systems. These arguments were re-emphasised as advantages of the market-based instrument by the European Commission and economists when the EU ETS came into force: Once the emission cap is determined, market forces will set the allowance price and achieve the desired reduction target at least cost. Several years of experience with the EU ETS and various adaptations of the regulatory framework – especially with respect to the upcoming trading phase 2013 - 2020 – still leave some unease with respect to a too strong reliance in market forces. The need for provisions to stabilise carbon markets and the setting of institutional flexibility with respect to market intervention measures have been discussed previously to the start of the EU ETS (e.g. Helm et al. 2003).

The trade-off between longer term emission reduction commitment and lack of flexibility in order to respond to a strong variability in allowance prices e.g. due to an over-allocation as experienced in the pilot phase of the EU ETS (2005 - 2007)[1] or unexpected events as e.g. pronounced changes in economic development were also discussed intensively during the negotiations of the EU Climate and Energy Package (COM 2008(30)). Several Member States took up the issue of price fluctuations. Carbon price developments and their effects on the efficiency of emissions trading schemes are also discussed in economic theory (see e.g. Grubb 2008, Philibert 2008, Pizer 2002) as well as provisions for some flexibility in order to strengthen the role of carbon prices as investment and innovation signal (see e.g. Fankhauser – Hepburn 2010, Hood 2011).

This paper discusses imperfections in market forces – contrary to theoretical assumptions - especially with respect to the implications of the use of marginal abatement cost curves as well as the role of stable price signals for investment decisions. The paper starts out with a short summary of the characteristics of the EU ETS. We then discuss the rationale for price stabilising measures as derived from experience with the EU ETS so far. This is followed by confronting theoretical assumptions on emissions trading with some realism that curtails confidence that the EU ETS sets a credible and reliable framework for a transformation towards a low carbon economy, if no additional institutional provisions are implemented. This reasoning is complemented by a discussion of the potential role of a carbon authority for price stabilisation as put forward in the literature. The last section concludes.

[1] For an analysis of the performance of the EU ETS see e.g. Kettner et al. (2011a).

2 Regulatory provisions

The EU ETS has a surprisingly short history. Following the Kyoto Protocol in 1997 (UNFCCC 1998) the EU started an internal process of analysing policies and measures in order to reach the set emissions reduction targets. In 2000 a green paper on emissions trading in the EU was issued (EC, 2000) and several design characteristics for a trading system were analysed (Stewart – Sands, 2000). Directive 2003/87/EC (European Commission, 2003) that was adopted by the European Parliament and the Council on 13 October 2003 finally established a European Emission Trading Scheme and defined the benchmarks and criteria used to operate the system and identifies the framework governing national legislation.

2.1 Provisions in the Pilot Phase and the Kyoto Period

Since the beginning in 2005, the European Union regulates CO_2 emissions from energy-intensive industries in the framework of the EU ETS based on Directive 2003/87/EC with the following key design elements for the first two trading periods.

Limitation to selected industrial sectors

In the pilot phase the EU ETS was limited to CO_2 emissions in four emissions-intensive sectors:

- energy activities;
- production and processing of ferrous metals;
- mineral industry; and
- other activities (i.e. pulp and paper).

For the second trading period some Member States (France, the Netherlands and Austria) unilaterally also included installations emitting nitrous oxides (see Capoor – Ambrosi 2008, BGBl. II Nr. 279/2007).

Cap-and-trade

Each Member State decided on the total amount of national emission allowances to be allocated to the installations included in its National Allocation Plan (see below). EU allowances (EUAs) that were issued for the pilot phase were tradable between 2005 and 2007. EUAs issued for the Kyoto commitment period 2008 - 2012 are also tradable in the post-Kyoto period, that means from 2008 on banking of allowances between trading periods is allowed. At least 95 per cent of allowances in the first trading phase and 90 per cent in the second trading phase had to be allocated free of charge in accordance with the installations' historical emissions ('grandfathering'). The rest of the certificates could be auctioned by the Member States[2].

[2] Effectively, in the first trading phase only four countries – Denmark, Hungary, Ireland and Lithuania – decided to auction a small portion of allowances amounting to less than 0.2% of total EU allowances (Fazekas). For the

National Allocation Plans

In the pilot phase and the Kyoto commitment period the Member States are responsible for allocating emission allowances to sectors and installations in a National Allocation Plan. The EU provides guidelines (COM(2003) 830) for the allocation process, but leaves the allocation details up to Member States. Nevertheless, National Allocation Plans must be approved by the Commission, which sets criteria with respect to the allocated quantities of allowances in Annex III of Directive 2003/87/EC. These criteria include consistency of the cap with the Member State's emissions target and projected progress towards fulfilling the target, considerations of the activities' (technical) potential for reducing emissions, consistency with other Community legislation and policy instruments, avoidance of unduly favouring certain undertakings (related to State aid provisions), required information on the treatment of new entrants, and early action.

For the second trading period (2008 - 2012) Member States' National Allocation Plans were cut by 10.4 per cent in the Commission review. Only the caps of four countries (Denmark, France, Slovenia and UK) were not revised. Caps proposed by the new Member States were most strongly corrected downward (see Capoor – Ambrosi 2008).

2.2 Provisions for the Period 2013 - 2020

The evaluation of the pilot phase led to an essential revision of the EU ETS for the period 2013 - 2020 in the context of the EU Energy and Climate Package (European Commission, 2008) and Directive 2009/29/EC (European Commission, 2009) respectively. The revision of the trading system accounts for lessons learnt in the first trading phase (2005 – 2007). Directive 2009/29/EC includes the following major changes compared to the first two trading periods.

An EU-wide ETS Cap

The overall 2020 GHG reduction target of 20 per cent compared to 1990 is split between the sectors in the European emissions trading system – the ETS sectors – and the remaining Non-ETS sectors. For the Non-ETS sectors an overall emissions reduction of 10 per cent compared to 2005 and for the EU ETS sector an emissions reduction of 21 per cent were proposed by the Commission and adopted by the Council and the Parliament in December 2008. A major change compared to the first two trading periods is the proposed EU-wide cap from 2013 on instead of national caps to achieve the EU reduction target.

Allocation principles

Article 10 of Directive 2009/29/EC defines auctioning as the dominating allocation method. In the allocation of allowances sectoral differences in particular with respect to the potential

second trading phase eleven countries have planned to auction allowances according to their National Allocation Plans; in total 3.76% of EU allowances should be auctioned (Ellerman – Joskow 2008).

exposure to carbon leakage are however taken into account. Directive 2009/29/EC differentiates between three groups of sectors and respective allocation procedures:

- *power sector* – with full auctioning from 2013 on;[3]
- *'normal' sectors* – without potential carbon leakage and 80 per cent free allocation in 2013 which is reduced to 30 per cent in 2020;
- *'exposed' sectors* – with potential carbon leakage and up to 100 per cent free allocation.

These differences in the allocation method on the one hand reflect competitiveness concerns of the Commission and on the other hand aim at preventing GHG shifts – carbon leakage – to countries outside the emissions trading system of the EU. Free allocation of allowances will be based on Community-wide benchmarks. The power sector is the only sector subject to full auctioning from 2013 on (except for some new EU Member States) as it is assumed that cost increases of energy due to emissions trading can be passed on into prices. Exceptions from full auctioning are made for highly efficient cogeneration and district heating.

Exclusion of small installations

Evidence from the first trading period showed that a large number of small installations was included in the EU ETS that accounted only for a small share in total GHG emissions (see e.g. Kettner et al. 2008). In the third trading phase Member States therefore may exclude small installations from the ETS if equivalent emission reduction measures are applied.

An installation is considered small if it emits less than 25,000 t of CO_2e per year; for combustion installations the rated thermal input in addition has to be below 35 MW.

Provisions against excessive price increases

In Directive 2009/29/EC a rather weak formulation in order to insure against excessive price increases is included (Art 29a). It states that if the allowance price for more than six month exceeds the average of the last two years, Member States might be allowed to bring forward the auctioning of some allowances or auction up to 25 per cent of the allowances of the new entrants reserve.

The provisions for trading phase three to intervene in the market in case of excessive price increases can be seen as a one-sided means to limit high price variability as experienced in previous trading periods and as described in the following.

[3] With exceptions for some new Member States and highly efficient CHPs.

3 A rationale for price stabilising provisions

Stabilising emission prices are often discussed as a prerequisite for ensuring environmental effectiveness and for providing investment and innovation incentives for low carbon technologies.

3.1 Price developments in the EU ETS

Experience in the EU ETS shows a high variability in the price for EUAs in particular in the first trading phase[4]. Various drivers for these price fluctuations can be distinguished and have been analysed in a number of papers (e.g. Kettner et al. (2011b) and the literature cited therein):

- Stringency of the cap
- Economic business cycles
- Fuel prices
- Fuel switching options
- Abatement options
- Weather conditions
- Market conditions and speculation
- Regulatory decisions

These factors have to a varying degree influenced price development for EUAs in the period 2005 - 2011 as illustrated in Figure 1.

Within a short time period the carbon price rose from about 7 € in the beginning of 2005 to above 30 € in April 2006. This rise reflects on the one hand e.g. uncertainties, incomplete information prevailing in the market mainly regarding the stringency of the cap. On the other hand increasing natural gas prices contributed to this trend by incentivising the use of coal instead of gas. With the publication of verified emissions for the first trading year in spring 2006 it became apparent that allocation of allowances had been overly generous[5]. A steep collapse of the CO_2 price to below 10 € occurred within three days. It recovered to around 15 € for several months due to the power sector's short position[6] (Kettner et al. 2010) before in 2007 spot prices dropped practically to zero, as the overall long position for the whole EU in the pilot phase became evident. As no banking of allowances between Phase 1 and Phase 2 was permitted surplus allowances became literally worthless. Futures prices for Phase 2 however remained at a level of 15 – 20 €.

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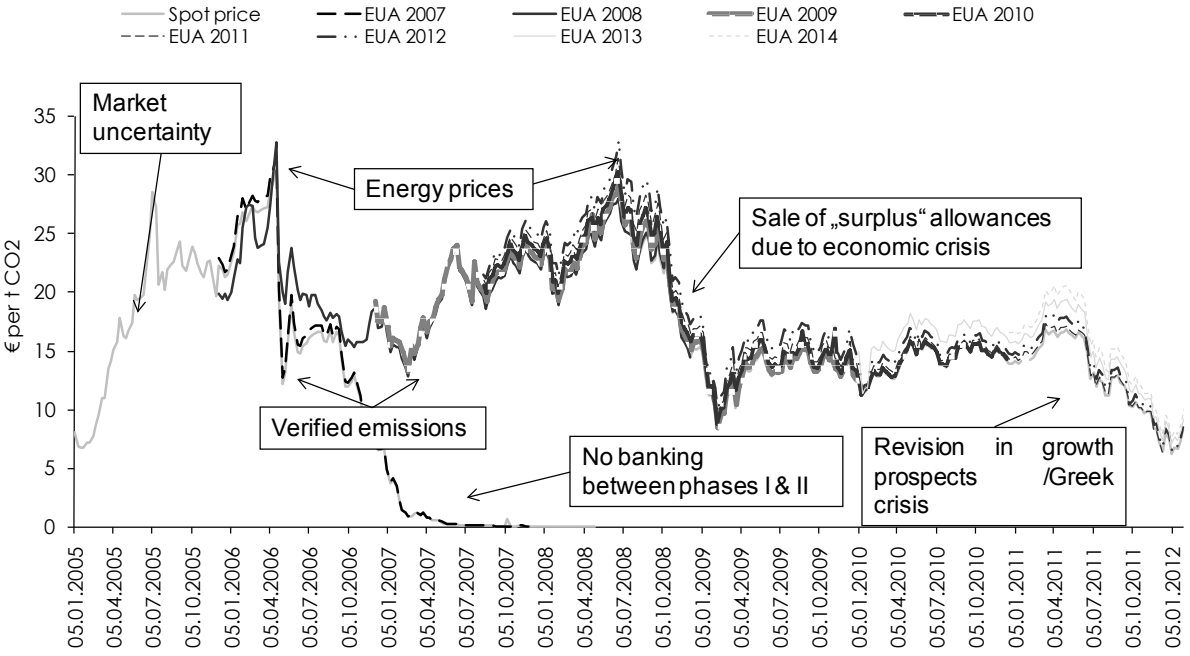
[4] On price management features – apart from an institutional setting of a carbon central bank – that could be integrated into an emission trading system see Kettner et al. (2011b).

[5] As Hintermann (2010) points out, the over-allocation was merely a result of incomplete information on the side of the regulators (basing allocation on industry forecasts) rather than being intentional.

[6] Short position is defined as verified emissions exceeding the amount of allowances allocated to a sector.

Figure 1: Development of OTC closing prices in the EU ETS (2005 – 2012)



Source: Point Carbon, author's supplements. EU ETS OTC closing prices.

The first half of 2008 was characterised by high economic activity and rising prices for oil[7] as well as for emission allowances. After the onset of the economic recession a large amount of allowances was sold – either in anticipation that they will not be required for compliance due to decreasing production especially in manufacturing or because firms intended to improve their cash-flow. This sale of surplus allowances led to a drop in prices from more than 30 € in September 2008 to 8 € in February 2009. Afterwards prices recovered slightly again and remained relatively stable (with spot prices between 11 € and 15 €) until the end of 2010. Prices in 2011 and in the beginning of 2012 show again a downward trend in the second half of the year that goes in line with revised more pessimistic growth prospects for the coming years.

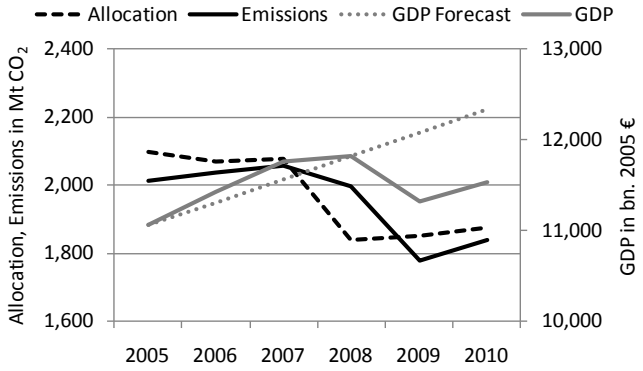
In Phase 2 of the EU ETS it became once more obvious that the ex-ante perceptions of the stringency of the cap and ex-post outcomes deviate from each other. As illustrated in Figure 2, when emission caps were determined average annual GDP growth rates of 2.2%[8] were assumed for the second trading phase. Under these presumptions and the stronger intervention of the EU Commission in National Allocation Plans the cap was set well below the

[7] With the peak of 147 $/barrel in July 2008.

[8] Average annual GDP growth rates assumed in the PRIMES reference scenario (DG TREN, 2007).

cap of the pilot phase, in a way – it was thought - that would guarantee scarcity of emission certificates in the second trading period. However instead of positive GDP growth, negative average annual GDP growth rates of -1.3% in the period 2008 - 2010 were realised because of the financial and economic crisis. The economic downturn has been particularly pronounced in lower manufacturing output as well as in the development of (EU ETS) emissions (see also Kettner et al. 2011a). A drop in EUA prices was the consequence (see Figure 1). This illustrates that exogenous shocks that lead to a change in fundamentals like economic growth have a considerable impact on the stringency of the (ex ante set) cap and hence on price development.

Figure 2: GDP forecast and development of GDP, allocation and emissions (2005 - 2010)



Source: Own illustration based on CITL, WIFO database and PRIMES 2007 GDP forecasts.

From the analysis of price development in the EU ETS between 2005 and 2011 one can conclude that in Phase 1 fluctuations were mainly caused by incomplete information at the beginning, adjustments after the emergence of verified emission data and endogenous i.e. regulatory mechanisms (no banking between Phase 1 and Phase 2)[9].

However, the price development in the second trading phase reveals the strong influence of diverse fundamentals exogenous to the CO_2 market on emission prices. This includes the effects of high fossil energy prices as well as the impacts of unpredictable shocks like the financial and economic crises and restrained growth prospects that effectively loosen the (ex ante) emissions cap. All these influences however have to be seen in light of a different regulatory regime compared to Phase 1, as Phase 2 allows banking of certificates for compliance in the third trading phase (2013 - 2020).

[9] Phase 1 developments show the problems connected with a new and immature market (Rickels et al., 2010). However, they highlight certain interrelations and mechanisms that are of importance for the functioning of a carbon market.

3.2 Attempting to understand the carbon market

Evidence from the EUA price development in the period 2005 to 2010 is in stark contrast to the simplistic economic paradigm of the carbon market. We therefore argue for a more realistic view on the principles underlying the carbon market and price finding mechanism[10].

The simplistic carbon market paradigm

Starting point for an understanding of the mechanisms of the carbon market is the assumption in environmental economics that a quantity cap and abatement costs determine the market price for emission allowances as depicted in Figure 3.

The theory on emission trading rests on a number of rather strong assumptions: All actors in the market (regulator and regulated entities) know the marginal abatement costs and there are no barriers with respect to the necessary abatement investments and price adjustments.

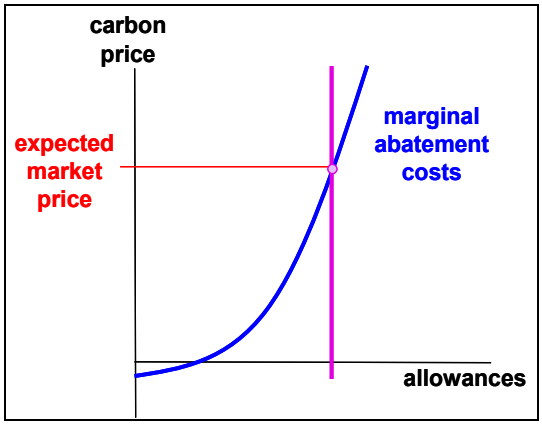
The economics of emissions trading furthermore states that in a perfect market situation the allowance price is identical with an (optimal) environmental tax that equalises (known) marginal abatement costs and tax rate. The underlying assumption for this is that all market actors have equal information and uncertainty is of minor importance. With respect to the carbon market this might be questioned due to the evidence on the performance and price development of the EU ETS so far and as described above. From this experience we argue:

The long-term cap might not be binding. This fact was already observed in the first trading period of the EU ETS and led to carbon prices near zero (see above). Evidence for the current second trading period also shows that a decline in overall economic development translates rapidly into a loosening cap. This change in economic fundamentals already shows in a downward carbon price movement in the EU ETS. Given other presumptions on the functioning of an emissions trading system prevail, the fact of highly variable prices translates into unstable abatement signals during the trading period. This can pose a problem for long-term investment by enterprises and may lead to carbon intensive technology lock-ins.

In addition different market actors may have different information about the carbon market or different possibilities to influence the carbon market. Again this can lead to more flexible carbon prices than theory would predict with possible adverse effects on abatement investment and technological change. We take up these arguments in more detail by proposing a more realistic view for understanding the carbon market.

[10] The basic ideas have already been put forward in Kettner et al. (2009).

Figure 3: The simplistic carbon market paradigm



Source: Own illustration.

The carbon market and a bit more reality

All assumptions that constitute the theoretical carbon market paradigm[11] are worth to be looked at in light of a real world setting. Most vulnerable is the assumption of well known marginal abatement costs to all actors in the market.

A first crucial argument is that abatement reflects investment costs which in turn are influenced by all kinds of prices, like interest rates and rates of depreciation. Furthermore it is very likely that asymmetries between regulator and regulated entity with respect to knowledge on technological abatement options pertain. That is, it is highly questionable whether all market participants share the same information on the prerequisites that represent the underlying fundamentals for marginal abatement costs. We therefore propose to use the term of perceived marginal abatement costs which might vary not only between actors but also over time.

Second, the concept of marginal abatement costs can be easier understood when abatement technologies are so-called add-on technologies, i.e. the additional technological costs can be more directly attributed to avoided emissions. For CO_2 abatement this does not apply in most cases, where lower emissions typically result from integrated technological transformation that have advantages additional to lower CO_2 emissions. Cost assignments to CO_2 emission reductions in such a setting are thus highly unfeasible and the application of marginal abatement curves is limited.

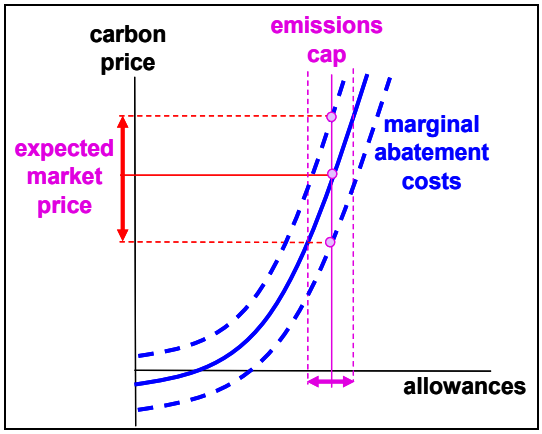
Third, it should be mentioned that whenever a so-called joint production structure is in place, i.e. when multiple outputs are produced, it is not possible to attribute the costs of technology changes uniquely to the various outputs. An example for this phenomenon is the switch from stand-alone to co-generation production of heat and electricity.

[11] A critical view on theoretical assumptions of pricing instruments in a real world setting is also mentioned in Hood (2011).

Fourth, it is crucial to account for changes in cost curves or abatement curves over time. In the short term abatement costs for CO_2 emission reductions could be the decision between higher or lower production. In the short to medium term possible fuel shifts could represent abatement activities. Finally investment in integrated new technologies that may involve major changes in production processes gain in importance. These technological changes are not simply the consequence of carbon prices, although carbon pricing may be one among various decision factors.

These arguments outline some of the difficulties to interpret marginal abatement curves in the context of CO_2 emission reductions. The impact of this informational uncertainty may result in price variability as visualized in Figure 4.

Figure 4: The impact of differences in perceived abatement costs

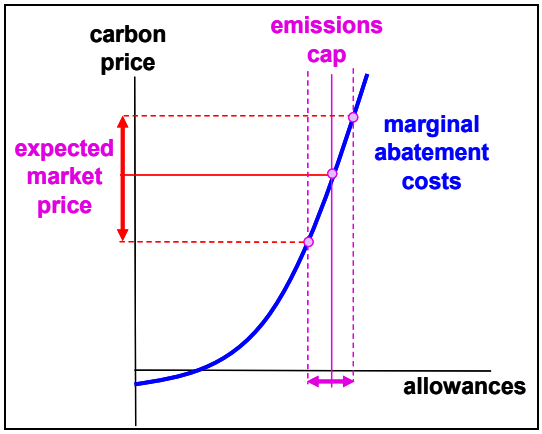


Source: Own illustration.

Another issue concerns knowledge about the amount of allowances. Although all market participants should know the exact amount of allowances that determine the emissions cap this number might not match the perceived available allowances on the market. This might be due to strategic traders who either buy excessive amounts of allowances for pushing up the price or sell allowances for lowering the price.

Uncertainties on the cap also prevail between the trading phases, when at the beginning of the pilot phase it was not clear what the cap for the Kyoto period will be, or the time span until the cap for phase three was decided. Even once the cap is decided the perceived stringency is likely to change over time as discussed and depicted above.

Figure 5: The impact of differences in perceived supply of allowances



Source: Own illustration.

Finally, actors in the market may face difficulties to aggregate information they observe from other actors correctly to an aggregate total. An example of this potential information failure are the experiences from Phase 1, when information on verified emissions for the first trading year lead to a considerable fall in prices in spring 2006.

The divergence between the ideal theoretical setting for an emission trading system on the one hand and the experience from real world development on the other, initiated the debate on supplementary institutions within the EU ETS. One idea put forward is the establishment of a Carbon Central Bank or a Carbon Authority.

4 The role of a Carbon Central Bank

Evidence from the first trading phase stimulated discussions about the introduction of price stabilisation mechanisms in the EU ETS framework. During the negotiations of the EU Energy and Climate Package (EC 2008) a number of Member States, in particular Poland and at a later stage the French Presidency, suggested actions for preventing excessive price volatility. These actions included regular reports about the carbon market by the Commission and a price corridor with a minimum and a maximum price (Bloomberg 2008).

In a memo (MEMO/08/796) the Commission took up the issue of price variability in the EU ETS stating the following main positions. Changes in allowance prices occur as a consequence of changing market fundamentals and as a result of policy uncertainty. Market interventions that disturb the adjustments to changing market fundamentals would cause distortions and therefore inefficiencies. The Commission argues that a well designed regulatory framework avoids price volatility due to policy uncertainty.

This position of the Commission is underlined by a number of new design elements for the EU ETS market in Phase 3 as:

- Banking of allowances is ensured from the second to the third trading period.

- A predictable cap is fixed well ahead before the beginning of Phase 3 in 2013 that covers 8 trading years.

The debate about price volatility intensified again after the December 2008 decisions in view of the rapid decline of carbon prices that started in the last quarter of 2008 as a result of the downturn in the real economy following the financial crisis.

EDF Energy, e.g., warned that "speculators risked turning carbon into a new category of sub-prime investment" (The Guardian, 30 January 2009). Evidence is reported from big companies that cash their carbon credits in order to bolster their balance sheets (The Guardian, 27 January 2009).

In a guest commentary in Point Carbon on 30 January 2009 Jos Delbeke from the EU Commission reiterated the position of the Commission that there is no role for public authorities to intervene in the carbon market.

However the discussion whether the EU ETS constitutes an effective instrument to reduce carbon emissions remains. On the one hand doubts are expressed that the high variability in carbon prices represents an improper signal for abatement investment and may even lead to investment delay or technological lock-in investments in fossil technologies if carbon prices are low. On the other hand the institutional inflexibility of the prevailing system of the EU ETS to react to unexpected events as the financial and economic crisis of 2008/2009 that translated into a pronounced decline in carbon prices, fostered the call for institutional changes and the creation of a carbon authority. The prevailing low level of carbon prices since the economic crisis stimulated members of the European Parliament to engage in ETS market intervention. A so-called set-aside provision should help control oversupply of allowances in the third trading period (Point Carbon, 15 and 16 February 2012).

4.1 New calls for a Carbon Authority

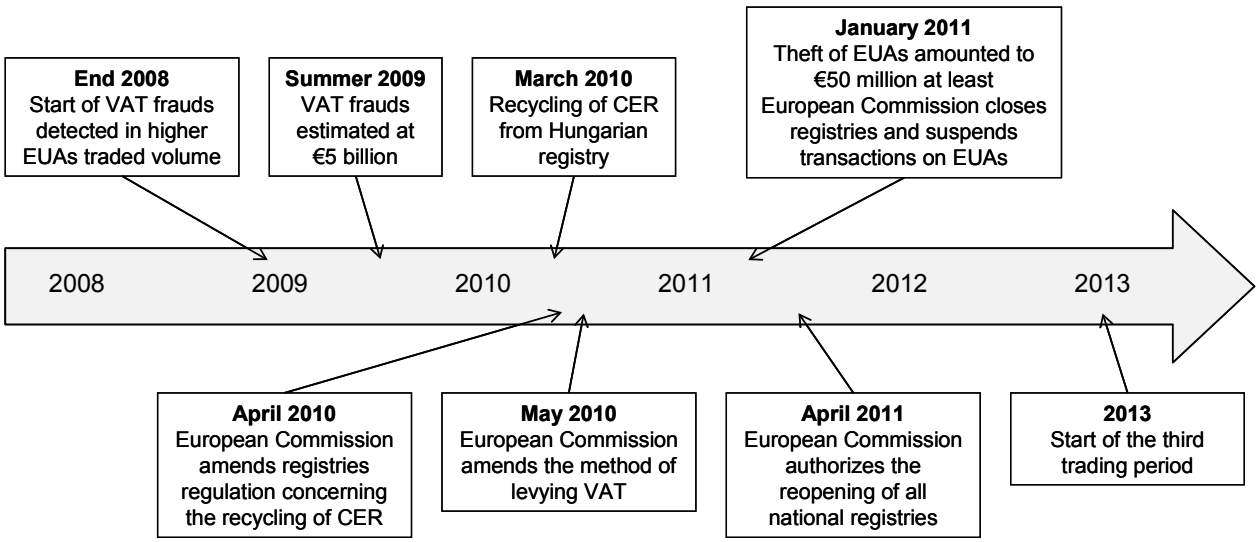
The discussion again was taken up in summer 2011 when in an article by Point Carbon (2011) the request for a carbon central bank was reiterated. The article refers to a proposal by IDEAcarbon (2011) that argues that such an institutional setting could restore faith in the EU ETS. The mandate for such an institution would be the achievement of the EU 20-20 targets and the main instrument would be to leave it to the decision of the bank when and how much of the allocated allowances given at the beginning of the compliance period it will auction. The decision making on auctioning would go hand in hand with regular meetings of the Board of Directors, thorough monitoring and regular reporting.

The proven sensitivity of carbon prices to various endogenous and exogenous influences and the resulting lack of relatively stable investment incentives for market participants are arguments put forward when advocating an independent carbon authority or CO_2 Central Bank in order to provide an institutional setting to intervene in the carbon market and to influence the expectations of economic actors.

Perthuis (2011) strengthens the arguments for a CO_2 Central Bank with major disruptions and regulatory failures of the current system. He favours an independent carbon authority that monitors the carbon market and acts independently from short-term policy considerations. This setting according to Perthuis could enhance the long term credibility and effectiveness of the emission trading system.

Perthuis' arguments for strengthening the regulatory framework are derived from the observable failures in the European carbon market as summarised in Figure 6. VAT frauds, CER recycling and organised theft of allowances from national registries showed that the existing system is vulnerable from different angles. To some of these problems the European Commission has already reacted with regulatory changes that aim to regain confidence in the system (e.g. introduction of a European emission registry).

Figure 6: Failures in the European carbon market



Source: Climate Economics Chair, CERA (2011), adapted in Perthuis (2011).

4.2 Design of a Carbon Authority

Apart from other regulatory proposals Perthuis (2011) takes up the idea of a CO_2 Central Bank similar to a central bank for the monetary system as already discussed in Helm et al. (2003) and mentioned in Brunner et al. (2011). The main arguments by Helm et al. for an independent carbon authority are time inconsistency problems[12], pertaining uncertainty with

[12] In short, the time inconsistency problem refers to the sequence of decision making: Firms make irreversible investment decisions according to their expectations about future policy developments before policy-makers act. Time inconsistency in this context means that policy-makers with conflicting objectives (e.g. emission reduction targets and the provision of cheap energy) may have different incentives before and after the investment

respect to climate change issues and political risk. These problems could be narrowed by an independent agency that could improve credibility of carbon policy in analogy to the role of central banks for monetary policy. Two differences to central banks are emphasised by Helm et al. (2003): first, the trade-off between energy prices and emissions is long term (compared to the trade off between inflation and growth targets) and second, expectations about carbon prices influence investment that may last for several decades and may result in a carbon intensive technological lock-in. The long term aspect even aggravates the problem of policy credibility that could be overcome by institutional design and delegation to an independent agency

Perthuis (2011) sees similarities between central banks and a CO_2 central bank as CO_2 allowances could be seen as new currency in order to pay for emissions and that is created by public authority through the allocation process. The currency however loses its value once it is surrendered for compliance. The value of the currency depends on scarcity or abundance of allocation and available allowances in the market. Abundance reduces incentives to invest in abatement activities whereas scarcity increases the costs of compliance and may result in detrimental effects for the overall economy. In contrast to central banks that regulate overall money supply a CO_2 central bank does not control the overall cap and thus the overall supply of allowances. The mandate for a CO_2 central bank refers to the management of the supply of allowances in the primary market and the potential to intervene in the secondary market by withdrawing or adding allowances in order to reduce price variability. This then would stabilise expectations of investors and foster investment decisions into low carbon technologies.

The constraint for a CO_2 central bank to create new allowances in a tight market situation could be overcome by the right of the CO_2 central bank to auction borrowed allowances from future periods that need to be paid back in consecutive periods. This would ensure that the long term cap is still effective.

The necessity for regularly and transparent reporting on market conditions, prevailing carbon prices and attainable abatement is accentuated by Perthuis in order to inform the public and public authorities on the progress towards a low carbon economy.

In the US the discussion on the management of carbon markets is embedded in a broader debate on instrument choice. Mason (2009) argues that the implementation of a carbon authority or carbon central bank entails large problems. He underlines his arguments with examples from market intervention by central banks in order to influence monetary parameters. His reasoning however mainly focuses on the argument that a carbon tax is more favourable than a cap and trade setting. Once an emissions trading system is realised as in the EU the question still remains how to improve the institutional setting in order to

decisions of the firms and may hence act differently. For a detailed discussion of the time inconsistency problem see Helm et al. (2003).

enhance the effectiveness and efficiency of the carbon market that departs from the ideal assumptions of a perfect market.

5 Conclusions

Evidence on EUA prices shows so far high variability since the introduction of the EU ETS. We argue that the gap between ex ante information when emission caps are set and ex post outcomes might be one of the reasons for this price variability. This divergence illustrates that the theoretical assumptions on emissions trading are not matched by a real world setting. This further weakens the potential role of carbon prices for investment decisions. In order to improve the functioning of the EU ETS we reiterate the arguments put forward in literature for a carbon authority and extend them by the argument that the concept of abatement curves is only of limited value in the context of CO_2 emission reductions where marginal abatement costs often are ambiguous and time variant.

If the observed carbon price does not reflect the long-run fundamentals this might be at least for two reasons a cause for concern:

- Market prices may lose their credibility in terms of providing signals for long-term decisions. This has a particular bearing for investment decisions that have an impact on the supply and use of energy and may lead to technological carbon lock-in.
- As a consequence this may lead to wrong investment decisions – in some cases with long term consequences – which create excessive costs.

These arguments underpin the discussion in research and policy to look for opportunities to empower the carbon market against these potential market inefficiencies from price variability. One option could be the implementation of an independent Carbon Authority.

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