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EMISSIONS TRADING SYSTEMS WITH DIFFERENT PRICE CONTROL MECHANISMS: IMPLICATIONS FOR LINKING

REPORT FOR THE CARBON MARKET POLICY DIALOGUE

LIFE DICET

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Emissions trading systems with different price control mechanisms: implications for linking

Report for the Carbon Market Policy Dialogue

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Abstract

This report was prepared to inform the Carbon Market Policy Dialogue (CMPD) between the European Commission, as the regulator of the EU Emissions Trading System, and the regulatory authorities for the emissions trading systems (ETSs) of California, Québec, China, New Zealand, and Switzerland. In this report, we propose a conceptual framework to characterise price control mechanisms (PCMs), i.e. the design features of emission trading systems (ETSs) meant to tackle price uncertainty. We present the PCM features of the six ETSs involved in the CMPD according to the conceptual framework and illustrate some insight from the scientific literature on linking ETSs with different PCMs. Finally, we discuss the main issues emerging from this report and provide out concluding remarks.

Keywords: price control mechanisms; market stability mechanisms, emission trading systems; linking; carbon markets

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1 Introduction

Price uncertainty constitutes a disadvantage for quantity-based carbon pricing instruments, such as Emissions Trading Systems (ETSs). Whether allowance prices are too high or too low, price uncertainty risks undermining the cost-effectiveness of an ETS. By price uncertainty, note, we refer not to the short-term volatility of allowance prices, which by itself is not a threat to the functioning of the EU ETS. Rather, we refer to the predictability of allowance prices, i.e. whether or not they can be kept within a determined range.

If allowance prices are too low, the incentive to decarbonise is not sufficient to prompt investments. Myopic behaviour or other discounting factors might induce firms to underestimate emission abatement costs in the future, thus leading to intertemporal inefficiency for the ETS. Excessive allowance prices are detrimental, too. If compliance costs for firms climb too high, the ETS might lose political support and be removed from government programmes. In order to ensure that allowance prices do not lead to any of the above scenarios, all extant ETSs include some form of Price Control Mechanism (PCM), i.e. a feature which steers the allowance price into a more desired range. PCMs reduce uncertainty for investors but may also hinder linking among ETSs with different PCMs. Since one PCM would also carry over its effects to the prospective partner ETS, negotiations for a linkage are particularly difficult when prospective ETS partners have different PCMs. As linking provides economic, political, and administrative benefits to partner ETSs, it is crucial to understand PCM incompatibilities and possible harmonisation pathways.

In this report, we present the main implications of PCMs for ETSs linkage. In Section 2 we characterise PCMs and identify which features are most relevant for linking according to the scientific literature. In Section 3 we inform on the PCMs of the ETSs participating in the Carbon Market Policy Dialogue (CMPD). In Section 4 we identify and discuss the most crucial issues and make some final remarks.

2 ETS Integration and Price Control

2.1 Conceptual framework

The fact that every ETS in operation today includes some form of Price Control Mechanisms in its design proves the importance of limiting allowance price uncertainty. Beyond the jurisdictions whose ETSs are involved in the Carbon Market Policy Dialogue (i.e. the EU, China, New Zealand, Switzerland, California, and Quebec), operating carbon markets are also to be found in South Korea, Kazakhstan, Mexico, Nova Scotia (Ca), and several eastern states in the US. Each jurisdiction faces specific economic, climatic, and political challenges to carbon market stability. The diversity of the PCM features implemented by worldwide regulators reflects this heterogeneity of challenges. Regulators seeking to link their ETSs need to take into account that full harmonisation might not be a feasible short–term goal. One strategy would be to prioritise the harmonisation of those features which pose the greatest hindrance to linkage prospects (Kachi et al., 2015). Another strategy would be to pick the 'low hanging fruit' first: by this logic harmonisation would start with the features that require least effort (Burtraw et al., 2013). In this perspective, the establishment of a harmonisation process between the ETSs would provide some immediate administrative and informative benefits for the parties, and a stepping-stone towards further harmonisation on thornier features (Lazarus et al., 2015). The California-Quebec and the EU-Switzerland linkages followed just this kind of gradual harmonisation process. It is relevant to remark that the California-Quebec carbon markets were closer in terms of size and that both parties harmonised towards common rules. By contrast, the EU-Switzerland linkage shows how a smaller partner, in this case Switzerland, tends to converge to the design features of the larger partner, in this case the EU.

In order to provide a reference framework, we present a characterisation of PCMs according to five dimensions. We sketch the reasons why differences in these dimensions might affect carbon market linkages. A thorough review of the implications of PCMs for linkages is provided in the literature survey that follows this conceptual framework.

2.1.1 Purpose

Price Control Mechanisms are meant to prevent prices from straying outside a desirable range. However, some PCMs are implemented with the purpose of supporting allowance prices when they are too low, whereas others are aimed at containing them when they are too high. An instance of the former is the Auction Reserve Price, which suspends auctions whenever the bids fall below a determined price threshold. Withheld allowances may then be: reinjected into a later auction; put in a reserve; or permanently removed from the system. The RGGI[1] and the ETSs in California and Quebec are examples of ETSs including an auction reserve price. The Fixed Price Option (FPO) of the New Zealand ETS might, on the other hand, stand as a useful example of a PCM meant to contain allowance prices. Entities under the NZ ETS may choose between purchasing an allowance at the market price or paying a fixed fee to the regulator.

While considering linkage between two ETSs, it is important to see whether the ETSs have a price support or a price containment mechanism (or both). An ETS with a price floor can be linked with another with a price ceiling without immediate consequences (given that the ceiling is higher than the floor). By contrast, if the PCMs of partner ETSs share the same purpose, one may become obsolete as the other supersedes it.

2.1.2 Discretion of Decision

A second key dimension of a PCM is its degree of discretion. On the one hand, the response of a PCM might be automatic: there is a predetermined rule. This is the case, for instance, of the FPO in New Zealand and of the Cost Containment Reserve (CCR) in the Californian ETS. The New Zealand FPO requires regulators to sell additional permits at a fixed price whenever a regulated

[1] Regional Greenhouse Gas Initiative is an ETS active in several north-eastern states in the US: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia.

entity wishes to purchase it; whereas the CCR injects a determined number of allowances into the market if the price reaches a predetermined threshold[2]. In both instances there are no margins for the regulators to influence the PCM response. By contrast, in most Chinese ETS pilots, when the price exceeds the desired boundaries, the regulator is called on to intervene by purchasing or selling an undetermined amount of allowances in order to stabilise the market. In the forthcoming Emissions Containment Reserve (ECR), to start in the RGGI in 2021, states have the possibility of withholding up to 10% of their budgets if the price falls below a given threshold[3]. It is up to the state regulators to determine the amount, from 0% to 10% of the budget, to be withheld. Both the Chinese pilots and the RGGI ECR are examples of PCMs with discretionary response.

The extent to which the decision is discretionary is a fundamental dimension in which ETSs should harmonise before linking. Indeed, in a linked carbon market where one ETS has an automatic rule, whereas the other leaves some degree of flexibility to the regulator, the second could take advantage by, for instance, increasing the supply of allowances. Almost all PCMs are automatic, i.e. rule-based, as this reduces policy uncertainty from regulatory intervention.

2.1.3 Trigger

PCMs may be divided into price-based and quantity-based mechanisms, depending on whether the PCM is triggered by a price or a quantity indicator. Intuitively, a price trigger is represented by a price threshold: when the allowance price hits such threshold, it activates the PCM, e.g. a price ceiling or a price floor. Alternatively, the trigger might be an indicator of the supply of allowances: if there are too many or too few allowances in circulation, the PCM kicks in. The EU Market Stability Reserve (MSR) is currently the only quantity-triggered PCM, which subtracts or injects allowances into the market according to whether a two-year lagged supply indicator is, respectively, above or below the set boundaries.

We included this among the key dimensions to consider because a difference in the trigger type might induce the PCMs of two linked ETSs to react in opposite directions (Evans et al., 2020). Let us consider the case of increased expectations of future high allowance prices driving current prices to rise to the price trigger of one of the two PCMs. The price-triggered PCM, e.g. a Cost Containment Reserve, would inject new allowances into the market. On the other hand, increased banking by regulated entities could induce the quantity-triggered PCM, e.g. the EU MSR, to cut allowances to reduce oversupply. PCM trigger harmonisation would prevent this kind of occurrence.

2.1.4 Bounds of intervention

This dimension relates to whether the PCMs are ‘soft’ or ‘hard’, i.e. whether they apply only to primary market or also to the secondary one, respectively. Hard PCMs enforce more rigid

[2] The California CCR is a stepwise mechanism with three price thresholds of increasing value; a third of the allowance reserve is auctioned by the regulator for each price threshold hit. The precise amount is published on the regulator’s website at least 30 days before the auction. This PCM will soon be updated by new legislation.
[3] The threshold is set to be $6, increasing at a rate of 7% annually.

boundaries for the allowance price (or supply, in case of a quantity-based PCM). A soft price ceiling will increase the allowance supply by a predetermined amount if the price hits an upper threshold, relieving, to some extent, excess demand within that compliance period. However, if the allowance demand is sufficiently high, prices might rise again and crash through the price ceiling. An example of a soft price ceiling is provided by the Allowance Price Containment Reserve (APCR) of the California-Quebec ETS, whereas its Auction Reserve Price represents a soft price floor. By contrast, hard PCMs effectively enforce the price boundaries: whenever the price hits a hard price ceiling, for instance, the regulator sells all allowances requested at that price. This is what happens with the abovementioned Fixed Price Option in the NZ ETS. A hard price floor is adopted by the Beijing pilot ETS and the regulator commits to purchasing all allowances below a set price threshold. Although hard PCM boundaries for allowance prices are stronger, they also represent a budgetary commitment for the regulator and, in case of ceilings, a potential threat to environmental integrity.

If PCMs with different bounds of intervention interact in a linked carbon market, the soft PCM could become ineffective. By contrast, combining soft PCMs could give rise to a multi-stepped allowance supply curve that increases allocative efficiency. Indeed, the combinations of soft PCMs that activate at different trigger levels would form a demand curve that is more responsive to shocks (we expand on this in the next section).

2.1.5 Impact on emissions cap

The last dimension we propose is whether PCMs affect the emission cap of jurisdictions. This connects with the previous dimension. If a regulator implements a hard price ceiling, it will be forced to sell allowances, even if these allowances are in excess of the originally defined cap. This undermines the environmental integrity of the ETS and potentially increases regulatory uncertainty if the inability of the ETS to induce emission abatements undermines its political support. Whether a PCM has an impact on the emissions cap of an ETS depends on whether the allowances it injects (in case of a hard price ceiling) or subtracts (hard price floor) modify overall supply temporarily or permanently. The Auction Price Reserve of the California-Quebec ETS suspends allowance auctioning if the price falls below a threshold, but stores allowances for reinjection in future auctions for when prices rise back up. By contrast, the Emissions Containment Reserve of the RGGI permanently removes a share of state allowances if a lower price threshold is hit, effectively reducing the cap of the system by the same amount. Analogously, the Fixed Price Option (FPO) of the NZ ETS acts as a (hard) price ceiling, selling any number of allowances requested at the determined price, even if such allowances are in excess of the original system cap. In this case the cap would be effectively increased by the PCM. While reducing the allowance cap of an ETS might help counterbalance unexpectedly low abatement costs, due, for instance, to significant innovations, relaxing it upwards might compromise the efficacy of the system.

The implications for linking derive from noting that the environmental integrity of an ETS might be compromised if a linkage partner includes a PCM which supplies allowances in excess of the predetermined cap. For instance, if one ETS with a PCM similar to the NZ FPO were to link with another ETS, it would be the linked carbon market to increase its cap in the case the FPO is triggered. Harmonisation on this dimension is, then, of the utmost importance for a successful linkage, though it represents a politically difficult issue because of the fiscal and environmental consequences for the linked ETS (Burtraw et al., 2013).

2.2 Literature review

The 2008 economic crisis struck world carbon markets very hard, driving down allowance prices and prompting regulators to reform their ETSs to lift prices towards more desirable levels. As it happens, concerns over compliance costs for firms, had, from the very starts of ETSs, pushed regulators to include PCM features that would limit allowance prices. However, each ETS includes a unique PCM that reflects jurisdictional specifics, so that each ETS differs from the others along one or more of the dimensions that we presented. This diversity of PCM features may offset the benefits from a linkage or constitute a hindrance to its achievement. For this reason, it is fundamental to identify which PCM features should be aligned before ETSs can be linked. Likewise, it is important to individuate which features do not constitute an immediate obstacle to linking (Kachi et al., 2015).

2.2.1 Interactions of PCMs in linked ETSs

Price collar setting

One of the major issues of linking ETSs with PCMs is determining the price collar of the linked system. In other words, if two ETSs have price ceilings and floors, which would be the effective price ceiling and floor of the linked system? The answer depends on the bounds of intervention of the PCMs involved, i.e. on whether the PCMs are of the hard or soft type. Should the linking ETSs both have hard price boundaries, the narrowest collar applies: the only effective PCMs are the higher of the two floors and the lower of the two ceilings (Burtraw et al., 2017). Indeed, if the hard price floor of ETS X is higher than the hard price floor of ETS Y, then the regulator of ETS X is forced to buy all allowances whose price lies below its own floor, even those issued in the partner's jurisdiction. In this scenario, the price floor from ETS Y would never be triggered as the floor of ETS X would prevent the price from reaching its price threshold. An analogous form of reasoning applies when two ETSs with hard-price ceilings link. On a side note, a narrower price collar does not necessarily imply a greater likelihood of hitting the boundaries (Jotzo and Betz, 2009), as it also depends on the overall variability of the linked system and the levels of the price collars.

By contrast, should all linked ETSs have soft price boundaries, all PCMs are preserved and effective. For instance, in a linked system in which ETS X has an Auction Reserve Price at $10 and ETS Y has an Auction Reserve Price at $15, both soft price floors would be effective. If the price fell below the $15 threshold, ETS Y would suspend auctioning allowances, effectively reducing supply. If the price decreased even more, reaching the $10 threshold, ETS X would suspend its auctions, too. The supply of allowances would thus not be completely rigid, i.e. vertical or inelastic, but would rather be represented by a multi-stepped curve, so that the quantity of allowances in the market varies according to the demand. We can see that linking ETSs with soft PCMs could actually make the allowance supply curve more responsive to shifts in demand, improving the allocative efficiency of the linked market.

Finally, PCMs of linking ETSs could differ on the bounds of intervention, with ETS X having a hard price floor and ETS Y having a soft one. In this case, if the soft price floor is higher than the hard one, both PCMs are preserved. Otherwise, the soft PCM is made obsolete by the hard PCM. With price ceilings the process works, of course, in the opposite direction.

Wealth and abatement effort transfers

Hard PCMs in linked markets also have, from the fiscal and financial point of view, consequences for partner jurisdictions. On the one hand, ETSs including a hard-price floor, would need to be ready to buy back allowances issued in the partner jurisdiction if they fall below the price threshold in the secondary market, thus exposing their balance to price uncertainty in linked carbon markets. On the other hand, if a partner ETS has a hard (and effective) price ceiling, then domestic firms might decide to purchase their allowances from the partner jurisdiction when domestic prices rise above said ceiling. In both cases, there would be negative effects on the auction proceeds for the domestic jurisdiction. Understanding such interactions is fundamental for determining the harmonisation processes that should precede linking.

Before a common carbon market is established, each jurisdiction has its own allowance price, i.e. its autarky price. Since the price in the linked ETS is likely to be somewhere in between the autarky prices of prospective ETS partners, firms in the jurisdiction under a higher autarky price would benefit from the reduced price of a linked market. Analogously, firms in the other jurisdiction will have a greater incentive to sell allowances rather than surrendering them for compliance. A difference in autarky prices increases efficiency gains that can be derived from linking. However, if autarky prices differ notably from each other, then there could also be a considerable transfer of wealth from the jurisdiction where the autarky price is higher to the jurisdiction where it is lower. To limit the extent of such transfers, linking ETSs might decide to set a maximum share of foreign allowances, i.e. an import quota, that can be used for compliance. Alternatively, they might set an exchange rate, e.g. set how many allowances of ETS X are required for compliance in ETS Y (Burtraw et al., 2013).

Transfers are bound to be particularly relevant should one of the linking partners have an absolute cap while the other has a relative, i.e. output-based, cap. In this case, it might be hard to determine the exact volume of the allowance supply in the linked market. In addition, one of the partner ETSs may differ in the decision dimension introduced in the previous section. If one ETS leaves some degree of discretion to the functioning of its PCM, e.g. whether to reinject or cancel allowances withheld by an Auction Price Reserve, there is the risk that this discretion is exploited to the detriment of the partner ETS. This dynamics is known as 'secondary free riding' (Weitzman, 2019). ETSs adjust their supply to increase their gains from the linkage, in this case exploiting the slack given by a discretionary PCM.

An analogous effect to wealth transfers, but opposite in sign, might occur in a linked ETS. The transfer of allowances from one jurisdiction to the other implies abatement efforts being transferred from the buyer to the seller. By selling their allowances, firms in the first jurisdiction are effectively reducing the maximum amount of pollution in their own jurisdiction. Purchasing firms are, on the other hand, increasing yearly emissions in their own jurisdiction. If a jurisdiction becomes, then, a net exporter (importer) of allowances, its emissions cap is also effectively reduced (increased) by the amount of allowances exported (imported).

Shocks carry-over

When two or more ETSs link, shocks in one jurisdiction carry over to the jurisdictions of its partners, potentially affecting price variability. Although the price variability of individual partners may increase, the price variability of the linked ETS is always, on average, lower. These risk-sharing gains more than offset negative effects from potential increases in domestic variability (Doda et al., 2019, Doda and Taschini, 2017). Furthermore, the effort-sharing gains deriving from gaps in environmental ambition of linking ETSs are roughly the size of the risk-sharing ones. Finally, price variability makes linking more convenient for all jurisdictions as opposed to an equivalent case without price variability. This is due to risk pooling across jurisdictions where shocks are not perfectly correlated (Doda et al., 2019).

2.2.2 Underlying challenges of price control for linkages

Several aspects of PCM diversity can represent an obstacle for linking carbon markets. Here we discuss the most salient and offer some insights from the scientific literature.

Cooperation issues

We have seen how PCMs in prospective ETS partners play a significant role in determining the price collar and potential wealth transfers. These features provide regulators with incentives to have the lowest floor and ceiling, in order to benefit fiscally from the linkage. This constitutes a problem for cooperation efforts as jurisdictions are tempted to exploit free-riding opportunities and adjust either their caps or their PCMs (Weitzman, 2019; Mehling et al., 2018; Flachsland et al., 2009; Helm, 2003). In general, the presence of a PCM makes convergence towards a linked carbon market slower and more complex (Evans et al., 2020; Jotzo and Betz, 2009; Tuerk et al., 2009). Some scholars suggest that delegating the regulation of a linked carbon market to a supranational authority would significantly limit free-riding between members, while also reducing regulatory uncertainty (Tuerk et al., 2009). Indeed, delegating the regulation of the linked ETS to a supranational authority would prevent swings in national politics, with rapid policy changes or even the removal of the relevant policies. Finally, Doda et al. (2019) note that the efficiency gains from linking more than offset negative effects from any free-riding attitudes of ETS partners towards cap setting.

Companion policies

The harmonisation process between PCM features should also take into account the climate policy frameworks in the partners' jurisdictions. Indeed, there are usually other policies in place beyond emissions trading, whose main objective might not be to reduce emissions, but that may nonetheless affect regulated emissions and hence allowance prices (see Marcantonini et al., 2017 for a review). They are referred to as 'companion policies' in the scientific literature. A common illustrative example is represented by policies incentivising Renewable Energy Sources (RES). A subsidy for RES deployment may displace most carbon-intensive energy producers, ultimately lowering the demand for allowances from the energy sector. Each jurisdiction has a different set of companion policies in place and might include PCMs in order, specifically, to contain their effects. The harmonisation process of PCM features should thus take into account how the allowance price of the linked carbon market might be affected by climate policy frameworks in linking jurisdictions.

Regulatory uncertainty

Price control has its own costs, which regulators take into account before intervening to steer either the allowance price or its supply into the desirable range. In particular, the intervention of regulators could increase regulatory uncertainty. A few scholars argue that the associated loss in cost-effectiveness could more than offset the gains from reducing price uncertainty (Boute and Zhang, 2019). The choice of the specific PCM might make the trade-off between regulatory and price uncertainty more convenient. PCMs whose parameters are either automatically adjusted or that need no regular adjustment at all should be preferred to PCMs which require constant monitoring and parameter revision by regulators, e.g. the EU MSR (Evans et al., 2020; Burtraw et al., 2018). Furthermore, a price-based PCM, such as a price corridor, could reduce price uncertainty more than a quantity-based counterpart (Kerr and Leining, 2019).

3 Data from the ETSs in the CMPD

3.1 California-Quebec

3.1.1 State of play

Cost containment provisions and design elements that allow firms flexibility to achieve the lowest cost GHG reductions are central components in the California and Québec Cap-and-Trade systems. Emissions trading, temporal flexibility in banking, borrowing, and multi-year compliance periods, compliance offsets, and complementary policies reduce the overall cost of emission reductions in the California and Québec Cap-and-Trade Program. In addition, the California and Québec Cap-and-Trade Program has a price collar, which plays a key role in regulating the price of allowances in the system. The California and Québec Cap-and-Trade systems were developed following recommendations of the Western Climate Initiative (WCI), which released Design Recommendations for regional Cap-and-Trade programs in 2008. While PCMs were discussed in the document by member jurisdictions and stakeholders it was left to each jurisdiction to implement through price PCMs through their regulatory processes with the recognition that harmonization of PCMs would be critical for linking systems.[4]

The California and Québec Cap-and-Trade Systems have a harmonised auction reserve price – required for linkage of the systems. This PCM is the minimum price at which allowances will be sold at auction and is defined in both the California and Québec regulations. The auction reserve price increases 5% plus inflation each year and is updated annually and in 2020 is $16.68 USD and $16.34 CAD. For each auction, the auction reserve price is the higher of California and Québec's auction reserve price after the auction exchange rate is applied.[5] If an auction is

[4] https://wcitestbucket.s3.us-east-2.amazonaws.com/amazon-s3-bucket/documents/en/wci-program-design-archive/WCI-DesignRecommendations-20090313-EN.pdf

[5] https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auction/2020_annual_reserve_price_notice_joint_auction.pdf

undersubscribed the treatment of unsold allowances is determined by each jurisdiction. In California and Québec, allowances are offered for sale at future auctions if the settlement price is above the auction reserve price for two consecutive auctions. If allowances remain unsold for 24 months, they are placed in the Allowance Price Containment Reserve. In California, starting in 2021 these unsold allowances will instead be moved to price containment points where covered entities can purchase these allowances at predetermined prices below the hard price cap.

The California and Québec Cap-and-Trade systems also have price caps that set a maximum price that covered entities pay for allowances needed for compliance. While there is coordination across jurisdictions to ensure that the price caps do not impact market functionality, the treatment of price caps is different across the two jurisdictions. From 2013-2020 each jurisdiction has an Allowance Price Containment Reserve (APCR) which contains a percentage of allowances set aside from under the emissions cap of each jurisdiction that will be offered for sale if the allowance price hits specific price points. APCR allowances are offered for sale by each jurisdiction only to covered entities who must use these allowances for compliance. In Québec, APCR allowances are divided into three tiers and offered through sales of mutual agreement at $60.79 CAD, $68.38 CAD, and $75.97 CAD in 2020. These prices increase annually by 5% plus inflation. Through 2020, California APCR allowances are divided into three tiers and sold through reserve sales at $62.29 USD, $70.09 USD, and $77.86 USD.

Due to a legislative mandate in California, starting in 2021 the price cap provisions in the California program will change and the APCR allowances will be divided into two price containment points, $41.40 USD and $53.20 USD in 2021. Covered entities can purchase allowances at these prices if needed for compliance. In addition, a hard price ceiling will be established at $65 USD in 2021 (the prices rise each year at 5% plus inflation). At this price a covered entity can purchase allowances up to their compliance obligation. If there are not sufficient reserve allowances at the price ceiling, entities can purchase price ceiling units for compliance. California will use revenue from the price ceiling units to achieve GHG emission reductions on a tonne for tonne basis maintaining the GHG reductions of the program.

The shift in California's PCM was predicated by concern that rising allowance prices would cause entities to demand more allowances than were held in the APCR. The hard price ceiling ensures that all California covered entities can fulfil their compliance obligation at a maximum price of $65 USD per tonne in 2021. The legislation requiring a hard price ceiling did not specify the level of the price ceiling which was determined through a public regulatory process and through coordination with Québec to ensure that the new PCM would not impact the functioning market for allowances or undermine the GHG emissions targets of the jurisdictions.

1.1.1 Relevant experience

As the California Québec Cap-and-Trade Program transitions to the post-2020 period, there have been discussions about both the supply of allowances and the overall cost of the Program. In California, Assembly Bill 398 required a hard price ceiling in the California Cap-and-Trade Program, resulting in changes to the legislation that will go into effect in 2021.[6] In addition, the

6 https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398

legislation created the Independent Emissions Market Advisory Committee (IEMAC) to evaluate the emissions and economic impact of the program. The IEMAC has evaluated issues related to PCMs, including the price containment points, price ceiling, and the supply of allowances. The California Air Resources Board, the agency that implements the California Cap-and-Trade Program has committed to evaluate any allowances that remain in the system from the 2013-2020 and their potential impact on achieving California's 2030 emissions target.[7] The jurisdictions will continue to work in coordination to address any issues with allowance price and supply to ensure that the 2030 GHG emissions targets can be achieved in a cost-effective manner.

3.2 China

3.2.1 State of play

In 2019, the Ministry of Ecology and Environment issued the *Carbon Emissions Trading Management Provisional Regulations (draft)*. In these *Provisional Regulations*, it is put forward that administrative department should strengthen emission trading risk management. According to the regulations of economic operations and the needs of carbon emissions trading market stability, a series of regulatory regimes will be established in national ETS. These regimes will cover price limit, risk warning, abnormal transactions, handling violations of regulations and laws, handling transaction disputes and so forth. But, as yet, no detailed national price control mechanisms has been published. The main price control mechanisms adopted in China's pilot carbon markets include setting the auction reserve price, allowance buy-back and new allowance issuance.

(I) Beijing pilot

In 2014, *Measures for Operation and Management of Beijing's Open Market for Emissions Trading (Trial)* was issued, which stipulated that: 1) Beijing Municipal Commission of Development & Reform (BMCDR) should set up an allowance reserves account to store the allowances for auction and the allowances transferred through buy-back; and 2) BMCDR should, in consultation with the department of finance and other relevant departments, determine the management and use of funds involved in open-market operations. No more than 5% of the total annual amount of allowances available can be reserved for auction; and the number of allowances for each auction shall be decided by BMCDR depending on market conditions. When the daily weighted average price of allowances is higher than Renminbi (RMB) 150 /tonne of CO_2 for ten consecutive trading days, BMCDR may organise temporary auctions. Before each auction, BMCDR shall set a reserve price according to the market. Unpaid allowances shall be kept in the allowance reserves account for subsequent auctions. After the end of the compliance period in each year, all remaining allowances for that year in the account shall be cancelled. When the daily weighted average price of allowances is lower than RMB 20/tonne of CO_2 for ten consecutive trading days, BMCDR may organise an allowance buy-back. However, the Beijing carbon price has not yet met the triggering conditions of allowance buy-back or new allowance issuance from the reserve account, thanks to a constant monitoring and a design which fosters price stability.

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[7] https://ww3.arb.ca.gov/regact/2018/capandtrade18/reso1851.pdf

(II) Hubei pilot

An allowance auction was held before the market officially started in 2014. The reserve price was RMB 20, but the auction volume was only two million tonnes, compared with the cap of 324 million tonnes. After the system started operations, Hubei set up an allowance reserve for price regulation and price discovery, and stipulated that the reserve should not be more than 10% of the cap, in which at least 70% of this reserve is reserved for price regulation. The allowances are sold by public bidding, which comes from the reserved allowances each year. The trigger conditions for allowance issuance and buy-back are as follows: (1) the allowance closing price has reached the highest or lowest price of the daily bargaining range for six consecutive trading days (110% or 90% of the closing price of the previous trading day); (2) the relationship between market supply and demand is seriously out of balance, and liquidity and continuity are insufficient; and (3) other conditions affecting the operation of the market. Specific measures have been set up to prevent excessive fluctuation of the carbon price in the short term. These are: 1) a limit of daily bargaining range has been set for daily trading, and the bargaining range shall not exceed ±10% of the closing price of the previous trading day; 2) the price declaration range shall be implemented for block trade and the relative declaration range shall not exceed ±30% of the negotiated transfer closing price of the previous trading day, otherwise, the offer shall be invalid. These two mechanisms were not actually implemented, but they played a role in assuring market confidence.

(III) Guangdong pilot

Allowance allocation in Guangdong includes free distribution and auctioning. Auctioned allowances accounted for 3% of total allowances available in 2013. After 2014, auctioned allowances for the power industry accounted for 5%, while that for the steel, petrochemical and cement industries accounted for 3% of total allowances. In 2013, enterprises had to purchase 3% of their total allocation before obtaining the remaining allowances for free. However, after 2014, this requirement was abandoned and the enterprises could decide whether to purchase allowances in the auctions or not. A total of five auctions were held in 2013 and one auction was held every quarter in 2014 and thereafter. The auction reserve price in 2013 was RMB 60 /tonne of CO_2. The reserve prices of four auctions in 2014 were RMB 25 /tonne of CO_2, RMB 30 /tonne of CO_2, RMB 35 /tonne of CO_2 and RMB 40 /tonne of CO_2. After 2015, the auction reserve price was calculated according to 80% of the weighted average market price of Guangdong's allowance listing selection or bidding in the first three natural months from the bidding announcement date. Reserve allowances were also set for new entrants and price regulation. From 2013 to 2016, the total reserve allowances (and its share in the total amount of allowances each year) were 38 million (9.8%) for 2013-2015 and 21 million (5.4%) for 2016. The remaining allowances in the first two auctions each year can be used for market adjustment. Facing a shortage of allowances or abnormal price fluctuations, the Provincial Development and Reform Commission may use these allowances to increase the quantity and frequency of auctioned allowances.

(IV) Shenzhen pilot

Shenzhen set up a price stabilization allowance reserve and stipulated that the quantity of allowances in the reserve should not exceed 2% of the total annual amount of allowance available in the system. The reserve allowances for price stabilization can be sold only at fixed prices and can only be used for compliance; they cannot be traded on the secondary market. Administration departments can buy back allowances from the market according to the pre-defined scale and conditions every year to reduce market supply and stabilise market prices. The buy-back conditions mainly depend on the reduction target. The scale of allowance buy-backs each year by the administration departments shall not be higher than 10% of the number of valid allowances for that year.

(V) Shanghai pilot

Shanghai allowed allowance banking in the 2013-2015 period. But in 2016, Shanghai announced a new allowance banking method, which meant it adopted compliance allowances adjustment as the price regulation method. Following new regulations, allowances in 2013-2015 can no longer be used for trading or compliance from 2016 onwards. In 2016, enterprises were asked to bank surplus allowances from 2013-2015 to 2016-2018, and these surplus allowances need to be spread equally over the three years from 2016 to 2018. As such, Shanghai adjusted the value of surplus allowances to regulate the market.

(VI) Other pilots

Fujian's trigger conditions for allowance issuance and buy-back are as follows: (1) the cumulative increase or decrease in ten consecutive trading days reaches a certain proportion; (2) the relationship between market supply and demand is seriously out of balance, and liquidity and continuity are insufficient; or (3) other conditions affecting the operation of the market. Tianjin stipulated that when the market price fluctuates greatly, the reserve allowances auction or a fixed price for sale could be used to stabilise the market price. However, the triggering conditions and the ways of implementing the mechanisms were not specified. For Chongqing, no price control mechanism is mentioned in *Interim Measures for the Administration of Carbon Emission Trading in Chongqing*.

3.2.2 Relevant experience

The total number of traded allowances were 69.6 million tonnes carbon dioxide equivalent in 2019, and the transaction amount reached RMB 1562 million in 2019, which represent an increase of 11% and 24% with respect to the volume and price in 2018. Figure 1 shows total trading allowances and transaction amount of the eight pilots from Jan. 2014 to Apr. 2020. The gap of total trading allowances and transaction amount among the pilots has further widened. The total trading allowances and transaction levels of Hubei and Guangdong are the largest, while those in Tianjin are the lowest.

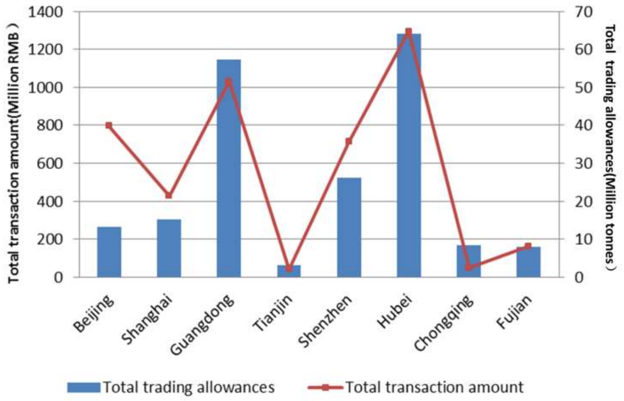

Figure1 Total trading allowances and transaction amount of the pilots from Jan. 2014 to Apr. 2020

Figure 2 shows the daily transaction prices of the eight pilots in 2019. In 2019, the carbon price in Beijing was much higher than in the other pilots, and the lowest daily price in Beijing was higher than the highest price in other pilots. The carbon price in Chongqing was the lowest, reaching below RMB10/tonne of CO_2 with a minimum of RMB 3.38/tonne of CO_2 in the first three quarters. The carbon price in Shenzhen fluctuates violently and frequently, reaching RMB 3.3/tonne of CO_2 at the lowest and RMB 35.64/tonne of CO_2 at the highest. The possible reason is perhaps early participation by individuals or investors and strong interactivity between companies and government energising businesses. Except for the impact of extreme individual values, the prices in other pilots are relatively stable.

Figure 2 Transaction price of the pilot carbon markets in 2019

Figure 3 shows the daily transaction prices of the eight pilot carbon markets from Jan. 2014 to Apr. 2020, whereas Figure 4 shows the carbon price volatility of the pilots, computed as the difference between the highest and the lowest yearly price. The annual carbon price volatility of the seven pilot carbon markets from 2013 to 2019 is shown in figure 4. As Fujian was started in 2016, it was excluded from figure 4. The price volatility of Shenzhen is the largest among the seven pilots. The price volatility of Guangdong rose from 2013 to 2014 and then fell to about RMB 20 /tonne of CO_2. Beijing is relatively stable at about RMB 35 /tonne of CO_2 except 2013 and 2017, with RMB 10 /tonne of CO_2. The price volatility of Tianjin has gradually decreased since 2016, and was less than RMB 10 /tonne of CO_2 in 2019. Shanghai is the most stable among the pilots and the volatility was stable at about RMB 20 /tonne of CO_2 in 2019. Hubei changed little with about RMB 10 /tonne of CO_2 from 2014 to 2017, and began to rise gradually after 2017, reaching about RMB 30 /tonne of CO_2 in 2019. The price volatility of Chongqing increased to the highest level in 2016 and reached about RMB 30 /tonne of CO_2 in 2019.

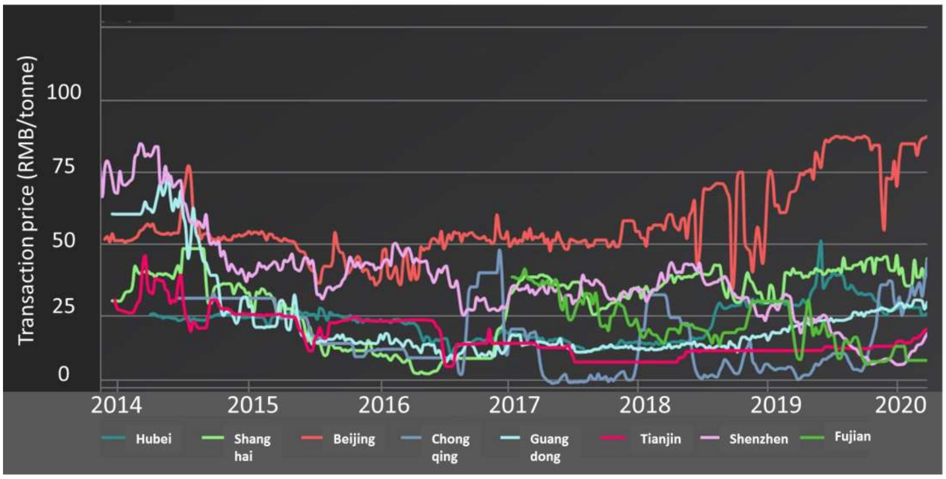

Figure 3 Transaction price of the pilot carbon markets from Jan. 2014 to Apr. 2020[8]
Source :http://www.tanpaifang.com/tanhangqing/

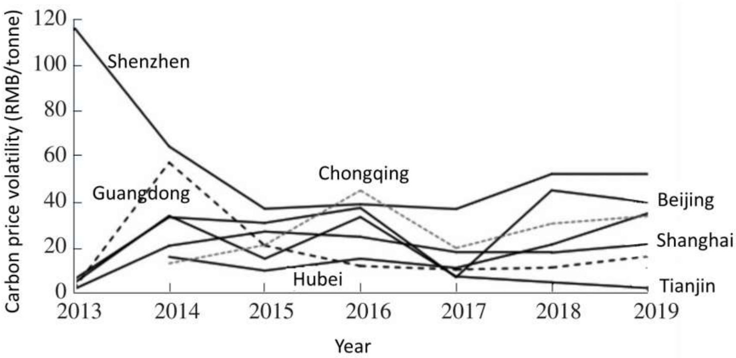

Figure 4 Annual carbon-price volatility of the seven pilot carbon markets from 2013 to 2019[9]

It will be seen that China's carbon pilot markets have volatility and stability issues. Research into the factors which affect the carbon price in the pilots has important meaning for the future development of the pilot ETS and the establishment of the national carbon market. First, it was found[10] that short-term market fluctuations caused by an imbalance between supply and demand had a certain impact on the carbon price fluctuations of each pilot market and that this impact was more significant before and after the compliance period. Second, it should be pointed out that

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[8] International institute of green finance, central university of finance and economics. Summary of China's pilot carbon market in 2019: further increase of market transaction price (in Chinese) [EB/OL]. 2020.3.2. http://shoudian.bjx.com.cn/html/20200302/1049659.shtml

[9] Wang Ke, Liu Yongyan. China's Carbon Market: Reviews and Prospects for 2020. Journal of Beijing Institute of Technology (Social Sciences Edition) (in Chinese) [J]. 2020, 22(2): 10-19.

[10] Institute of Energy, Environment and Economy, Tsinghua University. World Bank PMR Project - China Carbon Market "Research on Coverage, Cap Setting, Allowance Allocation Methods and Supplementary Mechanism" (in Chinese) [R]. Beijing. 2018.

significant policy adjustments have greater impacts than short-term market fluctuations, which are the dominant driver in the Shanghai and Beijing pilots. In the short-term, new policies can rapidly lead to strong carbon price volatility, but it can also reduce abnormal volatility with the spread of price information. But the ETS policy adjustments were more common in the early stages of the carbon market. Shanghai is a useful example. Shanghai allowed using CCER for compliance in 2015. The CCER offset mechanism reduced the demand for carbon allowances for enterprises, resulting in lower carbon prices. When Shanghai launched forward trading of carbon allowances in 2016, this led to a gradual rise in carbon prices. Forward trading not only helped the market participants to avoid carbon-price fluctuations, but it also increased the willingness of market participation and the liquidity of the spot market. Third, LIU Jian used a leverage stochastic volatility model to characterise price volatility. The pilots have different degrees of leverage, with a "positive leverage effect" in the Shenzhen, Guangdong, Shanghai, Beijing and Tianjin markets and an "anti-leverage effect" in Hubei and Chongqing. These results imply that the Shenzhen, Guangdong, Shanghai Beijing and Tianjin markets are more sensitive to bad news, while Hubei and Chongqing are more sensitive to good news. Finally, with the continuous improvement of carbon market design, the long-term trend in carbon pricing might come to reflect the relationship between supply and demand. The long-term trend plays a decisive role in the Shenzhen, Guangdong and Hubei pilots. The price stabilization mechanism has proved critical in avoiding a severe imbalance between supply and demand over the long term.

3.3 European Union

3.3.1 State of play

The need to enforce some measure of price control was first acknowledged in the EU in the aftermath of the 2008 financial crisis. The lack of allowance demand, due to shrinking consumption, led the price to fall from a maximum of roughly €29 in July 2008 to a minimum of slightly less than €3 in April 2013. The European Commission intervened, stalling the auctioning of 900 million allowances. This intervention was designed to be temporary, with the allowances to be reinjected once market conditions became more favourable. However, as allowance prices continued below €10, the European Commission committed to more structural price-control efforts, introducing, in 2015, the Market Stability Reserve (MSR) to which backloaded allowances were redirected. The MSR is a quantity-based PCM, as it absorbs or reinjects allowances into the system according to a quantity indicator of excess supply.

Currently, the MSR is the only quantity-based PCM and, this is unlikely to change in the near future, as forthcoming ETSs are, also, converging towards price-based mechanisms. The choice of a quantity-based mechanism for the EU ETS derived mainly from the EU legislative processes, which requires a unanimous vote on fiscal subjects. The very choice of the EU ETS as the main EU-wide carbon pricing policy, *vis-à-vis* a carbon or energy tax, is attributable to the fact that it does not require unanimity to be implemented (Delbeke and Vis, 2015). A price-based PCM, effectively imposing a price floor (e.g. an Auction Reserve Price), might have been interpreted as a tax and would thus have needed to pass a unanimous vote. For this reason, the MSR was the preferred instrument to limit price instability.

The MSR began operating in January 2019, with backloaded allowances as its initial reserve. The MSR stabilisation features activate whenever the Total Number of Allowances in Circulation (TNAC, hereafter), that is a quantity indicator, strays outside determined boundaries. The TNAC is computed as the excess supply of allowances:

$$TNAC = Supply - (Demand + MSR)$$

where the supply is given by: the total number of allowances issued under the EU ETS from Phase III; plus the ones banked from Phase II; and the international credits (CERs) exercised by installations up to 2018. The demand side is represented by the allowances and credits already surrendered for compliance or cancelled, plus the allowances withheld in the MSR (European Commission, 2015).

The MSR is set to withdraw allowances from the system at a feeding rate of 12% if the TNAC is over 833 million allowances. The Commission decided to temporarily double this feeding rate for the period 2019-2023. By contrast, when the TNAC falls below the bottom threshold of 400 million allowances, the MSR is set to inject 100 million allowances into the system. The EU ETS thus ordinarily operates when the TNAC is between 400 and 833 million allowances. The allowances absorbed through the feeding rate are stored in the MSR until they are either reinjected, if the bottom threshold is hit, or until they are cancelled. Indeed, whenever the amount of allowances is greater than the previous year's auction volume, the excess is cancelled, i.e. the allowances are permanently removed from the system, effectively reducing the cap. This cancellation feature will be operational from 2023.

All the MSR parameters mentioned above are subject to revision in regular European Commission reviews. The first review is planned for 2021, with each successive review taking place at five-year intervals thereafter. In this way, the European Commission will be able to update the parameters of the MSR to the current conditions of the EU carbon market (e.g. price, competitiveness effects and excess supply).

Finally, we also want to highlight that there is an additional clause within the EU ETS for reducing allowance price uncertainty, in the upward direction. Indeed, the EU ETS regulation includes the following provision: "[if], for more than six consecutive months, the allowance price is more than three times the average price of allowances during the two preceding years on the European carbon market, the Commission shall immediately convene a meeting of the Committee". In this meeting, the Committee may decide to grant Member States the possibility of taking special measures to contain prices. However, the triggering condition has not yet been reached, though it was nearly met towards the end of 2018.

3.3.2 Relevant experience

In mid-March, many EU Member States adopted public health measures restricting economic activities, for the sake of tackling the coronavirus pandemic that spread across the EU. As a consequence, in all countries production significantly slowed, with a few countries shutting down their production in some sectors. This event considerably affected the European carbon market, with allowance prices falling from the €25-28 pre-pandemic levels to hit a low of €14.34 on 23 March, which means that European allowances lost almost half their value in the direst period.

Following the gradual reopening of economic activities across Europe, the allowances regained much of their value, hovering between €20 and €22 in late May.

The economic crisis connected to the pandemic brought the scope of the MSR into question. Thought of as an instrument to absorb past oversupply, it appears to be ineffective in protecting prices from major swings due to sudden events like the recent production fall. The main issue undermining its efficacy is the two-years lag with which the MSR curbs the allowance oversupply. Indeed, data regarding the excess supply in year *t* is available and released in year *t+1*, so that the feeding rate actually starts absorbing allowances only from year *t+2* (FSR Climate, 2019; Edenhofer et al., 2014). This lag in the activation of the MSR response led many scholars to call for a price-based PCM to complement or substitute the quantity-based MSR (Flachsland et al., 2020).

As far as linking is concerned, the EU ETS was involved in several linking negotiations, which all had different developments (see Ranson and Stavins, 2016). First of all, the EU ETS could be considered a linkage in its own constituency, as it involved the cooperation of 27 EU Member States. It later expanded to include the ETSs of the EEA (Norway, Lichtenstein, and Iceland) in 2007 (effective in 2008). In 2013, linking talks with the California ETS regulator stalled due to excessive price uncertainty in the European carbon market (Rans and Stavins, 2015; ClimateWire, 2013). Finally, the EU successfully struck an agreement with the Australian government in 2013, though the agreement was scrapped following national elections in Australia, before the linkage could become effective.

3.4 New Zealand

3.4.1 State of play

Transitional measures – the fixed price option

The ETS was established by legislation in 2008. Forestry was covered immediately. Obligations – first to report emissions and then to surrender units – for non-forestry sectors were to be progressively introduced over several years. Following a change of government in late 2008, further legislation was passed that delayed some of the introduction dates. As part of this legislation the government also put two 'transitional measures' into the ETS to reduce the cost for business in the context of the global financial crisis and the need for economic recovery:

- A discounted surrender obligation of only one emission unit for every two tonnes of actual emissions; and
- A NZ$25 fixed price option (FPO), which is an option for any entity that has a surrender obligation in the ETS to buy NZUs at a fixed price of NZ$25 each for immediate surrender. Units that are bought using the FPO cannot be traded.

Although these two provisions were fixed in legislation and could only be changed by the NZ Parliament, the intention was that further legislative change would result in their being phased out by about 2013. The one-for-two surrender obligation was phased out 2015 to 2018, and all surrenders in the ETS are now at a rate of one unit for one tonne of CO_2-equivalent emissions.

However, the FPO was not phased out, and is still in place at the time of writing. The rate of the FPO was set in legislation. At the time the government set its rate, the ETS was linked to the Kyoto unit market and eligible Kyoto units were available at prices up to about NZ$22. Both Kyoto units and NZUs consistently traded below NZ$25 until long after 2013. Therefore, if the transitional measures had been phased out as originally intended, it is unlikely that there would have been any large-scale FPO use by participants.

New legislation

In 2019 New Zealand passed 'Zero Carbon' legislation, with broad support across nearly all parties in Parliament. This Act sets a national target for 2050 and provides for five-year national emission budgets and plans to manage the transition needed to reach the target. The Act also establishes the independent Climate Change Commission in advising the government on budgets and reduction plans, and on ETS settings. The government followed this up with legislation to reform and to update the ETS. This Emissions Trading Reform Act puts in place a comprehensive reform of the ETS, including new price control measures for replacing the FPO. It was presented to Parliament in October 2019, and passed into law in June 2020 (NZ Parliament, 2020).

Price containment measures in new legislation

The Emissions Trading Reform Act legislates for a new approach to price control comprising:

- A legislative requirement to set aside units as a cost containment reserve (CCR) which would start to be released to the market if a trigger price were reached.
- Provision for a reserve price to be specified when units are auctioned. The legislation does not mandate setting a reserve price, but allows one to be set by regulation. There are no legislated restrictions on the reserve price level.

There may be more than one trigger price for the CCR, with additional reserve amounts released for sale if NZU prices continue to increase. If units are sold from the CCR and the total supply exceeds the cap, the Bill requires the government to back this amount by securing reductions elsewhere. The relevant settings – level of the trigger price(s), amounts to be held in the CCR, and the level of the reserve price – will be set by regulation five years ahead, and updated every year, along with the caps on supply and other ETS settings.

3.4.2 Relevant experience

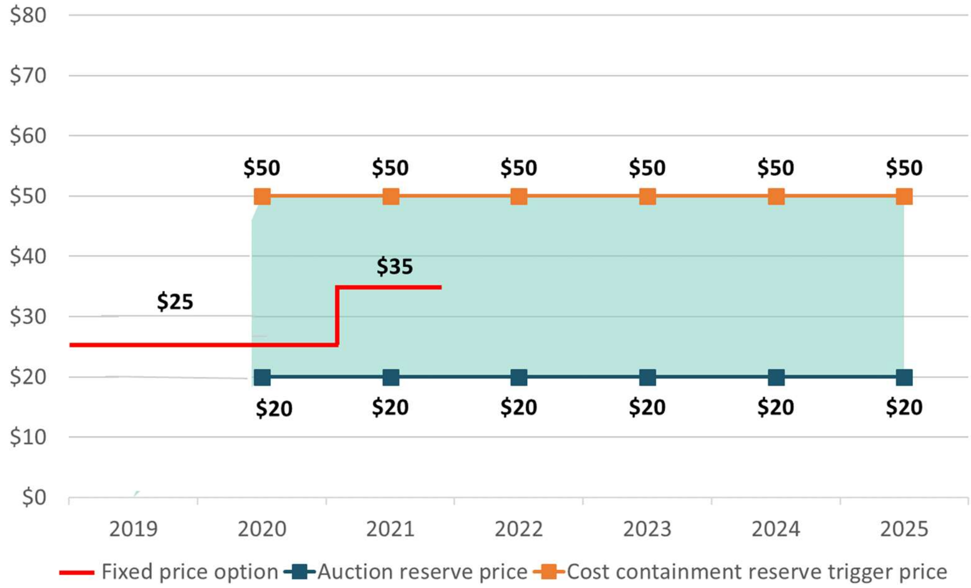
Operation of the fixed-price option

The FPO has been used by participants, from time to time, to cover any small shortfall in meeting a surrender obligation. It is quicker and may save transaction costs to use the FPO for a small quantity rather than to go to the market and buy a few units, even if the price of the units would be lower. This is not the intended purpose of the FPO, but it has been useful for some ETS participants. Between 2013 and 2015 emission prices were low both internationally and for New Zealand ETS participants. The surrender of imported Kyoto units was stopped from 1 June 2015, i.e. immediately after the deadline for surrenders covering calendar 2014 emissions. From 2016 the traded prices of NZUs rose steadily. The NZU price reached NZ$25 in mid-2018, and from that time it has been high enough to incentivise many participants to use the FPO to meet their 2018 and 2019 surrender obligations. Between 25% and 30% of all non-forestry compliance in these two years has come from use of the FPO. The remainder were units allocated or bought from the secondary market. Traded NZU prices generally tracked quite close to NZ$25, but at times NZUs have traded at higher prices because traders expected their market value to rise in the future. Prices spiked to over NZ$25 in late 2018, and then, from December 2019 onward, they reached over NZ$29 on expectations of changes to the FPO.

Proposed price control settings for 2021–25

The government released a consultation document in December 2019[11] that proposed a provisional national emission budget and ETS settings for the five years from 2021 to 25[12]. On 2 June 2020 the government announced the settings that will be put into effect by regulation. There will be a single trigger price set for the cost containment reserve, initially set at NZ$50, and a reserve price at all auctions, initially set at NZ$20. These dollar amounts will be adjusted, from year to year, to take inflation into account.

Figure 1: Trigger price and auction reserve[13]



As indicated in Figure 1, there will be a transition from the FPO to the new price control settings. In making the transition, consistent rules are applied for all surrenders, based on the compliance period to which they relate, rather than to when the actual surrender occurs. Components of the transition include:

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[11] Consultation closed at the end of February 2020.

[12] https://www.mfe.govt.nz/consultations/nzets-proposed-settings

[13] This graph is taken from the consultation document linked above. It does not show any adjustment for inflation, which is likely to increase the dollar amounts 5-6% by 2025.

- Forestry surrenders that relate to compliance periods up to and including calendar 2019 will still be allowed to use the FPO at NZ$25. Some of these transactions may continue to occur in 2021 or later.
- The FPO at NZ$35 will be available for all surrenders covering calendar 2020 emissions. Non-forestry participants have until 31 May 2021 to surrender units for calendar 2020, but some forestry surrenders will occur after that date.
- The first quarterly auction will be held on 17 March 2021. If for any reason the start of auctioning is delayed, the NZ$35 FPO will be made available for any full compliance year(s) before the first auction.

This means that there will be some overlap in time, with participants able to make surrenders using the NZ$35 FPO for (in most cases) six weeks after 17 March 2021 though the NZ$50 CCR and $20 reserve will also apply for the auction held on that day.

A total of 35 million NZUs will be made available for the cost containment reserve. This comprises:

- 27 million which are included in the ETS cap for the five years. This amount is equal to the stockpile reduction – the amount withheld to force a reduction in the current over-supply of units banked from previous periods.
- An additional eight million, i.e. 5% of the total cap which is 160 million.

Therefore, up to 27 million units may be taken from the CCR and auctioned, without breaching the cap. If more than 27 million CCR units are used, the cap will be breached and the government will be required to secure additional reductions outside the ETS to make up for this. These settings have been based on analysis of abatement costs and projections of emissions and removals.[14] However, they will remain provisional. The Climate Change Commission will be given the task of carrying out more extensive analysis and may recommend revised settings. The parameters will need to change if agricultural activities are brought into the ETS and will have to meet surrender obligations during the period.

3.5 Switzerland

3.5.1 State of play

In the Swiss ETS, there are no price or volume control mechanisms. However, there is a 'hardship' provision in the law. In the transition period before the linking with the EU ETS at the beginning of 2020, an ETS company was able to submit a request for assessment as a hardship case if the purchase of emission allowances to meet its obligations in the Swiss market "substantially impairs its ability to compete" on said market. The Federal Office for the Environment (FOEN) approves such a request if the company can prove that it has used all the options available to it to meet its obligations (FOEN 2019).

[14] https://www.mfe.govt.nz/overview-reforming-new-zealand-emissions-trading-scheme

Since the beginning of 2020, the CH ETS and the EU ETS linking has been in force. With this, the EU ETS' Market Stability Reserve (MSR) will also affect the prices for allowances in the CH ETS. No domestic price or volume control system is planned for the CH ETS. Given the linkage, this would not be feasible.

3.5.2 Relevant experience

The linking brought together two ETSs of very different orders of magnitude: The EU ETS includes just under 11,000 installation operators, representing emissions of around two billion tonnes of CO2 equivalent (CO2eq), as well as over 500 aircraft operators, which lead to about 65 million tonnes of CO2eq. Compare this to some 50 installation operators forming the CH ETS, with total emissions of about five million tonnes of CO2eq, the equivalent of about 0.25% of the EU ETS' total emissions.

Given these numbers it will be clear that the CH ETS has become a mere 'price taker' from the EU ETS. For any price or volume control mechanisms, Switzerland depends on the proper functioning of the EU ETS's MSR.

This is particularly relevant in the context of the net-zero-decarbonization pathway. Switzerland is currently developing a long-term strategy of reaching a net-zero-goal for 2050, as is the EU with its Green Deal. What has not yet been fully realised is that with the linking of ETS the climate policies of the two authorities become more intertwined. For instance, Switzerland may find itself in a situation where it cannot decarbonise its heavy industries (iron and steel, cement, pharmaceutics, refineries etc) as fast as it would like to. Imagine, for instance, that Germany phases out its coal power plants (*Kohleausstieg*) depressing price levels in the EU ETS (if no adequate volume control measures are taken) and, therefore, also lowering CH ETS prices before 2035 in such a way that there is no sufficient incentive to invest in low carbon technologies for Swiss installations. In this situation, the linking might need modifications with a kind of 'safety valve', e.g. a gateway that allows only for the transfer of allowances as long as a minimum price level is achieved in the transferring ETS (see e.g. Fuessler et al. 2016).

4 Discussion and conclusions

We drew insights from existing linkages and past linking talks to understand how to deepen internal cooperation on emissions trading. However, as linking attempts are not yet common, *ex-ante* inquiries on the key issues of PCMs remain essential in delineating a clearer picture of their role in linkages. Here we discuss what we deem the most crucial aspects, leveraging on both experience and theoretical considerations.

4.1 Environmental ambition and PCMs

We have seen that hard PCMs can have an impact on the allowance cap of their ETSs. When one ETS in a prospective linking has a hard PCM, there are potential consequences for the partners in terms of national budgets and environmental integrity, as discussed in the conceptual framework.

This means that the environmental ambition of the linked market might be heavily affected by its PCM features. To prevent the ineffectiveness of some PCMs arising from the linking, prospective partners could converge towards PCMs with soft bounds of intervention, as part of a preliminary harmonisation process. However, amending hard PCMs (where they exist) might prove difficult. Hard PCMs signal a strong commitment of the regulator to either sustain low-carbon investments or to contain compliance costs for firms (or both), so that their amendment needs sufficient political support.

In the linkages achieved to this date, none of the ETSs had a hard PCM, so that experience does not provide lessons on managing hard PCMs in a linkage. This could also be due to the unpopularity of hard PCMs, that are infrequent in existing ETSs. However, in the next section we will see how hard PCMs have affected linking attempts in the past.

4.2 Attractiveness of PCMs

Assessing whether a PCM facilitates or hinders ETS linking is not a straightforward matter. On the one hand, the PCM of one ETS would carry over its effect to the partner's jurisdiction. To the extent that this affects the functioning of the partner ETS (by changing effective triggers, for instance), this carry-over effect is likely to be a hindrance to linking (Evans et al., 2020). This became, for instance, an issue in the attempt to link the EU and Australia schemes. Before the Australian ETS was repealed in 2014, several talks between the two parties took place in order to harmonise the two ETSs in view of linking. The main issues proved to be the presence of a price floor and the lack of limits to the use of Kyoto credits in the Australian ETS. The Australian government eventually agreed to remove the price floor and to put a 50% limit on the share of Kyoto credits to be used for compliance[15].

On the other hand, PCMs reduce price uncertainty, which reportedly deterred talks on linking the EU ETS and the California ETS (Ranson and Stavins, 2016; ClimateWire, 2013). Allowance prices in the EU were subject to major variation during the earliest years of the programme, mainly due to price discovery and oversupply. The presence of PCMs, while making the normative framework more complex, could have made prices more stable. They would have assured potential partners of the robustness and maturity of the system. A similar case concerns the potential linking between the RGGI and the California ETS, which did not occur mainly due to excessively low RGGI prices (Burtraw et al., 2013).

4.3 Recalibration of PCM parameters

As many PCMs are parametrised according to their market, extending the effectiveness of a PCM to the market of a partner requires parameter adjustments. One example is the MSR of the EU ETS, whose upper quantity trigger of 833 million allowances of excess supply was set considering the volume bandwidth within which the European market had operated in an orderly fashion. A linking of the EU ETS with another system would increase the overall size of the common market, thus making the present parameters inappropriate for the expected operational volumes. A CCR injecting allowances into the system, when an upper price threshold is hit, would create a similar

[15] Joint press release by the European Commission and Australia (2012). Available at the following link: https://ec.europa.eu/commission/presscorner/detail/en/IP_12_916

issue: the supply increase that represents its response is calibrated on the autarky market and could, therefore, be insufficient in mitigating allowance prices in a linked market. Harmonisation on the parameters should be pursued to maintain PCM effectiveness, save in the unlikely case in which the prospective partners have identical PCMs and analogous size.

4.4 PCM triggers

In the conceptual framework, we sketched the potential drawbacks of linking ETSs whose PCMs differ in the trigger dimension. If one PCM is activated by a price threshold, whereas the other is activated by a quantity indicator, the response of the two PCMs might have opposite signs. In the example provided, expectations of a price increase lead to larger banking by subject entities. They, thus, push the price upwards. On the one hand, increased banking would increase the quantity indicator (for instance, the TNAC in the EU ETS), thus possibly prompting a cut in excess supply. On the other, increased prices might hit a soft ceiling (as in a CCR), prompting the injection of allowances into the market. We can see that the two PCM responses have opposite signs on the supply of allowances. For this reason, it seems crucial to harmonise the type of trigger or at least to consider this aspect, as well, when adjusting the parameters of PCMs in view of a possible linking (Evans et al., 2020).

Recent calls for price-based PCMs

Finally, one last consideration concerns the recent call from parts of the scientific community and of the political world to amend the quantity-based MSR in the EU ETS, complementing it with price-based PCMs (Flachsland et al., 2020; Osorio et al., 2020; Flues and Van Dender, 2020; Carbon Pulse, 2020; Euractiv, 2020; Kerr and Leining, 2019; Newbery et al., 2019; Flachsland et al., 2018). There are several considerations that fuel this debate. Firstly, Flachsland et al. (2020) maintain that the legal limitations to the introduction of a price-based PCM are overestimated (see Section 3.1) and that it would indeed be feasible to introduce a price floor. Secondly, a claim shared by the cited literature is that a lower price threshold is either necessary or more effective than the MSR in increasing the environmental ambition of the EU ETS and in preventing the short term effects of sudden shocks to the carbon markets. Finally, a speculative rally occurring during the first week of July reportedly made some EU lawmakers consider a price ceiling, as the MSR is ineffective in sheltering the allowance price from short-term speculation (Carbon Pulse, 2020). These considerations concerned the EU ETS and its MSR, which is currently the only quantity-based PCM. But this experience is relevant for all forthcoming ETSs and gives a sense of the general preference towards price-based PCMs.

4.5 International credits

Although international emission credits are not real PCMs, their effect on allowance prices marks them out as a fundamental negotiation issue for potential linking partners. We recall that European Commission recognised the implementation of a limit to the use of emissions credits as a requirement for linking the EU ETS to the Australia ETS. As the overflow of Kyoto credits has proved (Trotignon, 2012; Stephan et al., 2014), these offsets can have a strong impact on allowance prices, while also representing an indirect form of linking (see, for instance, Lazarus et al., 2015).

However, in the European case the fall of allowance prices was made possible by the absence of any PCM and it would seem to be possible for regulators to design PCMs in order to reduce the effects of credits. It should also be remarked, though, that emissions credits can also undermine the environmental integrity of a system, i.e. relaxing the cap upwards by allowing additional emissions to be compensated for with the purchase or with the surrendering of credits[16].

4.6 Restricted linking and PCMs

The definition of the price collar in a linked market leads to the troubles discussed in section 2.2.1, whereby one of the PCMs can become ineffective. This happens whenever a hard PCM of a partner ETS defines a narrower collar (that is, a lower price ceiling or a higher price floor) with respect to the domestic ETS. Forms of restricted linking, such as the implementation of exchange ratios or quotas among ETS partners (see Lazarus et al., 2015), could somewhat limit the implications stemming from the linking of ETSs with different PCMs[17].

Exchange ratios of allowances

An exchange ratio is a provision that gives allowances from one system a different value with respect to the allowances of a partner, analogously to exchange rates among currencies. It could be the case that two ETSs, e.g. A and B, decide that one allowance in system A is worth two allowances in system B. In this way, entities in jurisdiction A may surrender either a domestic allowance or two allowances from partner system B, whereas entities in jurisdiction B may either surrender domestic allowances or give up half the number of allowances from partner system A. In an exchange ratio, the effective price collar is determined by adjusting and sorting all price thresholds in terms of the same allowance unit (either A or B, in the previous example). The price collar computed accounting for the exchange ratio may differ with respect to the one in the unrestricted linking. For instance, recalling the previous example in which each allowance from system A is worth two allowances from system B, consider the case in which ETS A has a floor triggered at $20 while ETS B has a floor triggered at $15. For firms in jurisdiction A, the effective price floors are $20 in system A (unvaried) and $30 in system B, as two B-allowances would need to be surrendered in stead of a domestic one. This can also lead to different PCMs being effective if the sorting of triggers changes with the exchange ratio. In the previous example, the price floor from system A would be ineffective if the floor from B enforces hard boundaries. Prospective partners should thus consider the effect of the exchange ratio on the effective price collar.

Import quotas

Prospective linking partners can also decide to set allowance quotas, which represent the maximum shares of external allowances that can be used for compliance. As import quotas allow firms to circumvent domestic floors and ceilings only up to the determined share of allowances, it does not affect the effectiveness of PCMs in either jurisdiction, given that each imposes an import quota.

[16] This is the case, for instance, with the Californian and of the New Zealand ETSs, which release extra allowances on top of the cap whenever a hard price ceiling is hit.

[17] See Borghesi and Zhu (2020) and the literature cited therein for a discussion of the economic and environmental implications of restricted as opposed to full linking

Considering the case of two soft price floors, with the a trigger that is lower in ETS B with respect to ETS A, firms in the latter jurisdiction could circumvent the domestic floor and purchase allowances from ETS B at a lower price. However, once each firm imported the maximum number of allowances set by the quota, they will be bound again by the domestic floor, which is thus still effective. The effectiveness of a hard price floor depends on the right of one jurisdiction to purchase and cancel allowances from firms in the other jurisdiction.

However, by reducing the extent and thus the effects of allowance trading between partner, import quotas may foster linking between ETSs whose PCMs are not readily harmonizable. In this perspective, quotas might be useful for testing the implication of the linkage for PCMs and for assessing any perceived risks (Quemin and De Perthuis, 2019).

4.7 Legal limitations

Beyond questions of technical compatibility between prospective linking partners, regulators need also to take care of the limitations to linking posed by the normative frameworks. For instance, the EU ETS currently restricts linking with any ETS which does not have an absolute cap with mandatory compliance. Such legal limitations might also apply to the PCMs of prospective partners. Indeed, as recalled in Section 3.1 on the EU ETS, a price-based PCM risks being equivalent to a fiscal measure, making unanimity among Member States mandatory in reaching a linkage agreement. This would pose a great obstacle to negotiations of a linking between the EU ETS and another system with a price-based PCM. Whenever there are legal limitations to the PCMs, the regulators should address whether they are necessary in the linked market or ask how they could be overcome.

Legal limitations of a different nature pertain to the possibility of jurisdictions to enforce PCMs in the partner jurisdiction. Two main issues deserve attention: 1) PCM coverage and 2) allowance cancellation by PCMs. As for the first issue, we note that both current linkages here examined, i.e. California-Quebec and EU-Switzerland, allow firms from either jurisdiction to purchase allowances sold by the other jurisdiction. In the first case, California and Quebec hold joint auctions in which all allowances are offered for sale, whereas in the second separate auctions are held, but firms from either Switzerland or the EEA can participate. However, while in the first case each ETS maintains its own (price-triggered) PCMs, it is still unclear whether the MSR will apply also to Switzerland, besides the EU. In case of quantity-triggered PCMs, it is particularly important to negotiate such details in advance, as they affect the activation of the mechanism[18]. As for the second issue, a relevant detail of a linkage concerns whether a jurisdiction whose PCM may reduce the effective cap is allowed to buy back or subtract allowances from the other jurisdiction, too. For instance, consider an ETS with a hard price floor that mandates buybacks of allowances sold below a certain price threshold. Following a linkage, could the regulator buy (and cancel) allowances also from firms in the partner jurisdiction? In this case, the regulator of such jurisdiction could need to improve its budgetary commitment in order to enforce the price floor also in the other jurisdiction. Similar considerations apply for the EU MSR and the RGGI ECR.

[18] In the EU-Switzerland linkage, agreement on this detail could likely be postponed due to the slight effect that the small Swiss ETS will have in the MSR indicator.

4.8 Final considerations

In this technical report, we provided a conceptual toolkit for analysing the interactions between Price Control Mechanisms (PCMs) and linking. On the one hand, PCMs may constitute an obstacle to linking (as in the EU-Australia case) or may provide some degree of market stability in which prospective partners can build mutual trust in the other's system (as in the RGGI-California and EU-California cases). On the other hand, linking can affect the functioning of partners' PCMs, making, for instance, some of them ineffective or making adjustments to their parameters necessary. For our analysis, we considered the potential implications deriving from linking between two non-specified ETSs, whose PCMs differ, along one or more dimensions. However, the characteristics of the specific partners in the negotiations can strongly affect the resulting linked carbon market. For instance, we recalled that much smaller partners could find that the adoption of the larger partner's PCMs is the only viable alternative, as in the Switzerland-EU linkage (compare to California-Quebec).

We did not address the question of what makes for the best partner, though this is likely to be the first issue that needs to be tackled. In this regard, there are two different strategies. The first strategy would be to pursue the linking that would yield the highest gains. A few studies have provided assessments on the gains from linking for different partners combinations (Doda et al., 2019; Li et al., 2019). The second strategy would be to increase cooperation with the ETSs with whom linking would be easier. In this regard, a comprehensive assessment of pairwise barriers is missing, although it appears most useful to the discussion. The choice between these strategies becomes particularly urgent when they point to different linkages. In general, the choice of a partner deserves further investigation, though the extant literature has shed some light on geographical proximity (Ranson and Stavin, 2016) and strategic reasons (Borghesi and Zhu, 2020) as relevant predictors of future linkages.

Another decision is how to conduct the harmonisation process. Here, the first alternative is represented by convergence on the most urgent ETS design differences, including several PCM dimensions, such as trigger type and bounds of intervention (Evans et al., 2020; Burtraw et al., 2013) or the effective price collar (Kachi et al., 2015). The second alternative would be to initiate cooperation along the easiest dimensions. Exchanging information on each other's carbon market and achieving harmonisation between PCMs, where it is easier, can be a useful foundation for further cooperation on the features that are hardest to amend (Green et al., 2014; Burtraw et al., 2013). Here coordination over the bounds of intervention might be better addressed at a later stage in the negotiations (Green et al., 2014), as they would represent one of the thorniest aspects of linking. Indeed, hard PCMs would carry their effects across the border, potentially affecting the partner's fiscal budget and environmental integrity. Nonetheless, hard PCMs might be difficult to retract or amend, in political terms, as they represent a strong commitment to sustain or to contain carbon prices. This tension between the priority of harmonising on hard vs. soft PCMs and the difficulty in doing so is a key political hurdle. The political debate would greatly benefit from additional research addressing specific ETS linking scenarios and identifying possible pathways to 'link by degrees', as an intermediate step towards full linkages, whose gains remain largest (Borghesi and Zhu, 2020). There are a few scholarly investigations into gradual linking between specific partners (Burtraw et al., 2013), but a more comprehensive analysis including several more ETSs would provide a needed starting point for discussing other prospective linkages.

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