POLICY BRIEF

Linking emissions trading systems with different measures for carbon leakage prevention

Highlights:

- Different measures for carbon leakage prevention across Emissions Trading Systems (ETSs) may distort economic competition between firms. The same is true of competition between jurisdictions if decisions on the location of production plants are concerned.
- Free allocation of emission allowances responds to a logic of carbon costs compensation. Border carbon adjustments aim at levelling the playing field between domestic firms and their foreign competitors. Direct support to low-carbon innovation aims at enhancing the competitiveness of domestic firms.
- Any instrument for carbon leakage prevention could produce, depending on its own specific design, competitive distortions that are illegitimate under WTO law or other applicable trade regime.
- By inducing convergence of allowance prices, ETS linking reduces any internal competitive distortion due to differences in carbon prices. However, given pre-link differences in anti-leakage measures, price convergence can highlight or even exacerbate potential competitive distortions.
- In a linking context, output-based allocation may amplify or attenuate competitive distortions by interacting with post-link changes in allowance prices.
- Differences in anti-leakage measures do not preclude linking in a technical sense. However, with time, some harmonization may prove necessary for the political sustainability of the linkage.
- The actual significance of any competitive distortion always depends on the extent to which firms compete in a market.

Issue 2022/18
March 2022

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1. Introduction

In the context of the LIFE DICET project[1], the second session of the second Carbon Market Policy Dialogue (CMPD) on "*Emissions Trading with different provisions to prevent carbon leakage*: *implications for linking*" took place on 9 June 2021. The CMPD sees the participation of the regulators of six major emissions trading systems (ETSs), namely those of the EU, California, China, Québec, New Zealand and Switzerland, and a number of international stakeholders, including policymakers, researchers as well as representatives of industry and civil society. In view of the meeting, a background report (Verde et al., 2021) was produced. This policy brief offers an abridged version of the report and, in addition, it provides a selection of insights from the policy dialogue.

Climate policies that regulate energy-intensive industries are normally accompanied by measures for limiting the risk of carbon leakage; specifically, the risk that increased production costs result in market share losses and, therefore, in increased emissions abroad. In an emissions trading system (ETS), the free allocation of emission allowances is a built-in lever that is typically used for preventing carbon leakage due to competitiveness deterioration. There are also other, external levers that can be used for the same purpose, notably border carbon adjustments and policies promoting low-carbon innovation. Free allowance allocation alone offers several options that differ from one another in the rules governing allocation and in related incentives for allowance recipients. Similarly, border carbon adjustments and policies for low-carbon innovation can come in many forms. All in all, there are multiple tools that can be used for preventing carbon leakage and many variants of these tools that policymakers can choose from. This abundance of options is reflected in the different anti-leakage approaches observed in existing ETSs.

Different measures for carbon leakage prevention across ETSs, regardless of whether the same ETSs are linked or not, may potentially distort economic competition. This is true of competition between firms, but also of competition between jurisdictions if decisions on the location of production plants are directly concerned. If two or more ETSs are linked together, the differences in question – if any such difference persists after linking – generally become more significant and visible. This is because a convergence in allowance prices, upon linkage, reduces or eliminates the risk of carbon leakage between linked ETSs (while price differentials remain *vis-à-vis* third jurisdictions). The harmonisation of free allocation rules, and possibly of other anti-leakage measures, is indeed a particularly relevant topic in the context of linking. More generally, however, the need to raise ambition in climate change mitigation has meant that carbon leakage prevention *per se*, independent of linking, is becoming increasingly important. The recent initiative of the EU regarding the proposed introduction of a border carbon adjustment – an unprecedented measure – is emblematic in this sense.

2. Conceptual framework

2.1 Carbon leakage: definitions, channels, and risk assessment

Definitions

In this publication, 'carbon leakage' is intended as the phenomenon whereby emissions reductions achieved in a jurisdiction are to some extent offset (potentially, even more than offset) by an increase in emissions abroad.[2] This version of carbon leakage, which refers to emissions effectively shifting across jurisdictions, is the most commonly considered.[3] In an opposite way, 'negative' carbon leakage arises whenever emission reductions attained in a jurisdiction lead to further emission reductions elsewhere. Furthermore, a leakage 'rate' measures the portion (percentage) of a given cut in emissions that corresponds to a consequent change in emissions abroad, with a positive number indicating leakage and a negative one indicating negative leakage.

Channels

Carbon leakage across jurisdictions may take place via three main channels[4]:

1 FSR Climate is managing an EU funded project titled LIFE DICET (Deepening International Cooperation for Emissions Trading) which supports European Union and Member States policymakers in deepening international cooperation for the development and possible integration of carbon markets – website: lifedicetproject.eui.eu

2 For our purposes, a distinction between national and sub- or supra-national jurisdictions is not relevant.

3 Carbon leakage could also refer to emissions shifting across economic sectors or across time, as with intertemporal leakage.

4 The three channels are not mutually exclusive: in principle, they could all be active at the same time.

- **Firm competition**, a.k.a. competitiveness channel. It hinges on the mechanism whereby more stringent climate policies than in other jurisdictions affect the competitiveness of domestic firms. The simple logic is that higher production costs reduce competitiveness, thus resulting in both increased production and increased emissions of competing firms subject to less stringent policies. Within the competitiveness channel, a key distinction is that between operational and investment leakage. Operational leakage relates to negative effects on short-term competitiveness and, as such, it is reflected in reduced output and immediate loss of market share; investment leakage, by contrast, relates to negative effects on long-term competitiveness, resulting in the shutdown of existing plants or in the investment in new production capacity abroad. Importantly, there are also arguments which diminish the competitiveness channel's relevance. According to the Porter Hypothesis (Porter and van der Linde, 1995), more stringent market-based climate policies may induce regulated firms to be, in fact, more competitive. Another argument is that carbon costs are only one of many variables determining investment decisions.
- **Global energy markets**: competitiveness deterioration is not the sole channel through which carbon leakage can occur. If a jurisdiction, or a set of jurisdictions, adopting more stringent climate policies makes up a significant share of global demand for fossil fuels, carbon leakage may materialise in other parts of the world as a result of reduced fossil fuel prices. An important aspect of this mechanism is that, absent international policy coordination, governments do not readily dispose of instruments to intervene on global energy markets and limit carbon leakage. In other words, there are no obvious unilateral measures to prevent carbon leakage occurring via global energy markets.
- **Technology spillovers**, which are specifically relevant to negative leakage. Emissions reductions achieved in a given jurisdiction could result – unlike in the two previous cases – in additional reductions elsewhere, i.e. negative leakage. Transboundary spillovers from development and use of low-carbon technologies explain the mechanism in play here. In brief, more ambitious climate policies, while reducing domestic emissions, may also induce lower emissions in other jurisdictions via learning, reduced abatement costs, and related spillovers.

Risk assessment

Assessing the risk of carbon leakage, as a consequence of possible adverse competitiveness effects, is important for preserving the environmental effectiveness of unilateral climate policies while not giving regulated firms unjustified compensations. A proper assessment of leakage risk is particularly important in the context of a fixed-cap ETS if the free allocation of emission allowances is a key anti-leakage measure. This is because the total volume of free allowances decreases with the cap over time and, therefore, allowance allocation needs to be well-targeted. In theory, leakage risk is determined by the extent to which climate policy drives up domestic production costs and the consequent change in emissions outside that jurisdiction. In practice, it has become standard to assess leakage risk on the basis of two criteria, namely a sector's emission intensity and trade intensity. Emission intensity metrics capture the potential significance of carbon costs meaning the maximum impact that carbon pricing could have on a sector; trade intensity metrics proxy for the (in)ability to pass-through additional costs without loss in global market share. Sectors at risk of carbon leakage are usually identified based on a combination of these metrics and corresponding threshold values. Sometimes (as with, for instance, California's and Quebec's ETSs), multiple thresholds are considered to distinguish between different levels of risk. In general, this approach strikes a compromise between accuracy in assessing leakage risk and administrative complexity. The growing scarcity of free allowances induces ETS regulators to seek greater accuracy in allocating those. However, while marginal improvements may, here, be imagined and achieved, simple 'definitive' solutions do not seem to exist.

2.2 Approaches to carbon leakage prevention

In an ETS, the free allocation of emission allowances is the canonical approach for preventing carbon leakage. However, free allocation is not the only approach for leakage prevention. Nor is it even necessarily the best one, especially when thinking of future, deep emission reduction targets like those already set by several ETSs around the world. Free allocation responds to a logic of carbon costs compensation imposed on regulated firms, insomuch as those would otherwise result in market share losses and, therefore, in carbon leakage. Other anti-leakage approaches, which may or may not accompany an ETS, aim at: a) levelling the playing field between domestic firms and their competitors in other jurisdictions; or b) fostering low-carbon innovation as a way of enhancing the competitiveness of domestic firms.

Compensatory measures: free allocation[5]

In an ETS, different rules can govern the free allocation of emission allowances to regulated firms. There are three 'archetypal' methods of free allocation (variants of which may co-exist and evolve over time in a given ETS): grandfathering; fixed base-period benchmarking; and output-based allocation. Under grandfathering, firms receive free allowances according to their historical emissions multiplied by an emission factor. Allocations are, thus, lump-sum transfers proportional to historical emissions. The application of product-specific benchmarks (expressed in terms of emissions per unit of output) in the calculation of allocations, characterises both fixed base-period benchmarking and output-based allocation. The purpose of benchmarks is to strengthen incentives for increasing emission efficiency, as well as to reward early action. Under fixed base-period benchmarking, however, allocations are proportional to activity levels in the given base period. With output-based allocation – this is the key difference between the two methods – allocations are proportional to current activity levels. Crucially, adjusting (or 'updating') allocations to current output means that, in effect, firms receive an output subsidy. This implicit subsidy entails that product prices increase by smaller amounts and that, therefore, the prevention of market losses and carbon leakage is more effective. The size of the subsidy depends on the stringency of the benchmark, as well as on other ETS parameters, such as the assistance factor and (in a fixed-cap ETS) the cap decline factor.

Levelling the playing field: border carbon adjustment[6]

Border carbon adjustment (BCA) is another instrument that can be used to prevent carbon leakage via the competitiveness channel. To date experience with BCA is very limited. However, the serious consideration of BCA recently, both in the EU and the US, means that the future diffusion of this approach has become a real possibility. BCA is supposed to level the playing field between domestic and foreign producers by equalising carbon prices faced by domestic firms and lower or higher carbon prices abroad. In theory, price adjustments would make up for any such differences in carbon prices. In practice, different BCA designs can be considered and evaluated according to multiple criteria. These include technical feasibility, environmental effectiveness, administrative costs and, most importantly, compatibility with international trade law.

When combined with an ETS (rather than a carbon tax), a BCA could require that importers pay a fee based on the market price of emission allowances: alternatively, it could require that importers buy allowances equivalent to what the ETS requires of domestic producers. In both cases, just as free allocation in the importing jurisdiction should be accounted for, carbon prices and free allocation in the exporting jurisdiction should be accounted for too. Further, one may consider a BCA that also offers relief to exports by rebating the associated domestic carbon payments. This would ensure that domestic exporters are not disadvantaged in international markets. However, scholars have warned that – at least in the case of a BCA-ETS combination – export rebates would "very likely be considered prohibited export subsidies" under World Trade Organisation (WTO) rules (Cosbey *et al.*, 2019). In general, a *de-facto* requisite for the compatibility of any BCA with WTO rules is a strong and provable environmental rationale, i.e. emissions reduction.[7] Also, it must be equally clear that the implementation of a BCA is neither arbitrary nor carried out in a way that is aimed at protecting domestic interests. Last but not least, a BCA needs to reconcile compliance with the principles of non-discrimination, under the GATT, and that

5 For a comprehensive analysis of different free allocation methods, see Acworth et al. (2020). For a direct comparison of free allocation rules in force in different ETSs, see Dobson and Winter (2018). For a detailed illustration of output-based allocation, see Fischer (2019).

6 For an in-depth analysis of border carbon adjustments, see Cosbey et al. (2019).

7 The "conservation of exhaustible natural resources" is one of the exceptions that allow a nation to violate the non-discrimination principles of the General Agreement on Tariffs and Trade (GATT), namely National Treatment and Most Favoured Nation.

of Common but Differentiated Responsibilities and Respective Capabilities, under the United Nations Framework Convention on Climate Change (UNFCCC).

Fostering innovation[8]

Instruments that complement an ETS by directly promoting low-carbon innovation in energy intensive industries may also play a key role in preventing carbon leakage. Increasingly, various forms of public subsidies are considered or are already used for just this purpose. In the EU, the EU ETS Innovation Fund, which provides financing to the commercial demonstration of innovative low-carbon technologies, is a case in point. Moreover, a number of new proposed instruments have been gaining traction. Carbon contracts for differences (CCfDs) are probably the novelty that has generated greatest interest. Essentially, CCfDs promote investment in innovative low-carbon projects by guaranteeing a fixed price for emissions reductions below the best available technology. Depending on the contract price level and thanks to reduced revenue uncertainty (and hence reduced financing cost), CCfDs can spur deep-decarbonisation projects that would not be viable otherwise under current market conditions and expectations.

Beyond CCfDs, other instruments that have been proposed to promote low-carbon innovation in industrial sectors include product carbon requirements and consumption charges. Product carbon requirements are emission-intensity standards for industrial products. Proponents of this instrument often suggest that the standards could be voluntary in a first phase, and subsequently become mandatory once there is enough capacity to produce low-carbon materials. The logic of consumption charges is different. Consumption charges are intended to complement output-based allocation by providing demand-side incentives for low-carbon innovation. The idea is that the sum of the two forces, namely output-based allocation for producers and stronger carbon price signals to consumers, would give producers greater incentives for investing in low-carbon innovation.

2.3 Carbon leakage prevention, competitive distortions, and linking

Any instrument for carbon leakage prevention could produce, depending on its own specific design, competitive distortions that are illegitimate under WTO law or under other applicable trade regimes (e.g. the European Single Market in the case of the EU ETS). Specific designs of free allocation, BCA, and any instrument promoting low-carbon innovation could all qualify, for example, as prohibited or actionable subsidies under WTO law.[9] Any anti-leakage instrument or measure that a jurisdiction may wish to use needs to be compatible with the broader relevant trade regimes. This is always true: whether an ETS is linked to another ETS or not.

Now, consider linking. On the one hand, by inducing partial or full convergence of allowance prices, ETS linking reduces (under partial linking) or removes (under full linking) any internal competitive distortion due to differences in carbon prices. On the other hand, given pre-existing (i.e. pre-link) differences in carbon leakage prevention between linked ETSs, price convergence can highlight or even exacerbate potential competitive distortions. This eventuality is most clear in the case of differences in free allocation. Imagine more generous free allocation in one ETS than in another linked ETS as reflected, for example, in laxer parameters for eligibility to free allocation or in less stringent benchmarks. This would entail different production costs for competing businesses in different jurisdictions. While there can be such distortions regardless of linking, they can also arise with linking if differences in carbon leakage prevention are not adjusted after price convergence. Moreover, linking could exacerbate competitive distortions if output-based allocation is used in one ETS but not in the other(s). For example, there could be a case in which bilateral linking determines a large price increase in the ETS that uses output-based allocation and only a small price decrease in the ETS that uses fixed base-period benchmarking. Firms in the output-based allocation ETS will then benefit from a significant increase in the implicit output subsidy that they receive. By contrast, competing firms in the fixed base-period benchmarking ETS will only see a modest reduction in the carbon price they face.

8 For a detailed analysis of the instruments for deep decarbonisation, see Chiappinelli et al. (2020).

9 Under WTO's Agreement on Subsidies and Countervailing Measures two types of subsidies are prohibited: subsidies that require recipients to meet certain export targets, or to use domestic goods instead of imported goods. Even where a subsidy is not prohibited, it can be actionable if it causes injury to other countries.

An increased focus on competitive distortions and, possibly, on the expectation of exacerbated competitive distortions may generate resistance to ETS linkages whose anti-leakage measures are not harmonized. A linkage may still take place, as the differences in question do not preclude linking in a technical sense. However, with time, some harmonization may prove necessary for the political sustainability of the linkage.

3. Literature review

The literature specifically relevant to the topic is not huge. Relevant contributions are scattered in studies – more often reports or book chapters rather than journal articles – that cover several aspects of ETS integration in the context of the existing international climate change regime or in the context of a hypothetical one. A second feature of this literature is that it focuses on potential competitive distortions due to differences in allowance allocation between ETSs. Differences in other anti-leakage measures, again as causes of potential competitive distortions, are largely ignored. The focus on heterogeneous allocation approaches is explained, in part, by the allocation method itself being a necessary element of any ETS. But there is also the fact that certain allocation rules may determine competitive distortions by interacting with linking.

3.1 Potential competitive distortions caused by different allocation rules, regardless of linking

Baron and Bygrave (2002) is one of the first studies to consider the possibility that differences in allocation method between ETSs produce competitive distortions; that is, the possibility that differences in the way emission allowances are distributed distort competition between firms in different ETSs, thus affecting market shares. An example: in one ETS emission allowances are distributed through auctions, while, in another, they are given for free, based on historic activity (i.e. grandfathered). Firms under the first ETS face real carbon costs. Firms, instead, under the second face opportunity costs – these being equal to the revenue that would be earned if emissions were reduced and the allowances sold. On the one hand, the assumption whereby rational, profit-maximising firms fully value the opportunity cost of using free allowances for compliance, in the same exact way as if it was a real cost, suggests that competitive outcomes are not affected by whether some firms have to buy allowances while their competitors get them for free; or, more generally, by whether some firms receive fewer free allowances than their competitors. On the other hand, the (presumed) irrelevance of the allocation method with respect to operational decisions does not negate obvious asymmetric effects on short-term profits, namely greater production costs for firms that have to buy relatively more allowances than their competitors. For this reason, Baron and Bygrave (2002) state that differences in (real) compliance costs raise competitiveness concerns. Similarly, Haites (2003) acknowledges that free allocation may have wealth effects which influence competitiveness. Jaffe and Stavins (2007) further specify that "if a firm faces constraints on its ability to raise capital at typical market rates, differences in allocation approaches can competitively disadvantage a firm that must purchase more allowances than its competitors".

A more specific, but no less important example of how differences in allowance allocation may cause competitive distortions arises with ETSs in which allowances are distributed for free based on current output. In an ETS that uses output-based allocation, regulated firms receive an implicit output subsidy, which, by definition, may distort competition in a given market (Haites, 2003; Jaffe and Stavins, 2007). Santikarn et al. (2018) also comment on possible competitive distortions related to how fixed base-period benchmarking and output-based allocation respond to the economic cycle. That is, during economic downturns, firms with predetermined allocations receive excess allowances, while firms whose allocation is based on output see a reduction in allocations; during economic booms, the opposite is true.

Differences in certain allocation rules may also directly affect decisions regarding the shut-down of production plants and – what is more relevant from a competition perspective – the location of new plants. Specifically, this is the case of differences in the rules for new entrants and closures within the scope of an ETS. As Blynth and Bosi (2004) explain, a firm will have an incentive to shut down production in jurisdictions that continue to allocate to closed plants (in other terms, pre-allocated allowances are not withdrawn upon closure), and start up or expand new production capacity in jurisdictions that will allocate allowances free of charge to new entrants. One may say that differences in new-entrant and closure provisions can distort competition between jurisdictions (competition for investments), rather than competition between firms.[10]

3.2 Potential competitive distortions caused jointly by linking and different allocation rules

When two (or more) ETSs are linked together, the respective allowance prices should converge as a consequence of trading. Under full linking, prices should, in fact, fully converge at some intermediate level.[11] In principle, by inducing price convergence, a linkage on its own reduces or, with full linking, eliminates any potential competitive distortion due to carbon price differentials within the linked ETSs (Baron and Bygrave, 2002). Of course, in levelling the playing field through price convergence, linking does initially produce competitiveness effects: negative effects for the firms facing a price increase relative to the pre-link situation, and positive effects for those facing a price decrease. The impacts of these price changes on the competitiveness of firms, in the different ETSs, will ultimately depend on, *inter alia*, a firm's ability to pass on allowance costs and on the recycling of auction revenues, if such mechanisms are in place (Flachsland et al., 2008).

While linking reduces or eliminates competitive distortions due specifically to carbon price differentials between ETSs, it does not address other potential distortions due to differences in allocation rules, i.e. those described in the previous paragraph. As a matter of fact, it is possible to think of cases where changes in allowance prices caused by linking accentuate or attenuate competitive distortions due to different allocation methods. Haites (2003) illustrates how these interactions may come about. One first needs to recall that output-based allocation gives firms an implicit output subsidy. Consider two ETSs, 'A' and 'B', which are linked together: the pre-link allowance price in 'A' is lower than the pre-link price in 'B'; plus, 'A' uses output-based allocation. After linking, the allowance price will rise in 'A' and, hence, the implicit output subsidy with it. Now, if output-based allocation was already a cause of competitive distortions before linkage, the price increase after linkage would amplify those distortions. Conversely, if the pre-link price in 'A' were higher than that in 'B', then the price decrease in 'A' after linkage would attenuate any pre-existing distortion due to output-based allocation. However, even in this kind of situation a linkage may encounter resistance. Jaffe and Stavins (2007) consider precisely this scenario: firms in the lower-price ETS ('B') may object to a link because, for them, that would entail facing the same allowance price as competitors in the other ETS ('A'), without receiving the benefit of output-based allocation that their competitors enjoy.

As these examples show, output-based allocation stands out as being potentially problematic when it comes to linking. However, in general, the actual significance of any competitive distortion always depends on the extent to which firms compete in a market. And the extent to which firms compete with each other can only be established empirically, on a case-by-case basis. Furthermore, as Jaffe and Stavins (2007) observe, it is possible that, in some cases, the opportunity to establish a linkage could eliminate the need for the use of output-based allocation.

3.3 The harmonisation of allocation rules

Given two or more ETSs, differences in their approaches to carbon leakage prevention, notably differences in allocation rules, do not represent an impediment to linking in a technical sense, i.e. to the exchangeability of allowances (Tuerk et al., 2009). Yet, as noted above, such differences can potentially distort competition between firms across jurisdictions, whether independent of linking or, if output-based allocation is used, in combination with linking via price convergence. What is more, differences in anti-leakage measures that are not adjusted after a linkage and price convergence can become (more) significant and, if so, potentially controversial. All these considerations lead to the same general conclusion: harmonisation or 'alignment' of anti-leakage measures and especially allocation rules should be pursued, so that a level playing field is achieved, not only in terms of carbon prices, but also in terms of actual carbon costs. In the real world, however, the extent to which harmonisation is needed to facilitate linkage will depend – experience demonstrates – on circumstances specific to each ETS and to each linkage (Jaffe and Stavins, 2007). Also, some differences between ETSs may remain without undermining

10 In the first two EU ETS trading periods, heterogeneous new-entrant and closure provisions across Member States were questioned as illegitimate sources of competitive distortions by EU State aid rules..

11 This level depends, in the first place, on the relative size of the ETSs and the respective abatement costs.

the case for linking. Another aspect of harmonisation which is worth mentioning is that the risk of leakage, while is normally reduced between harmonised ETSs, could potentially increase *vis-à-vis* third jurisdictions (Kachi et al., 2015).

In their innovative study on linking processes, Burtraw et al. (2013) analyse the harmonisation of numerous design elements of ETSs that consider linking, including those pertaining to allowance allocation and carbon leakage prevention more generally. Table 1 is the relevant section of a much more extensive table which, for any given design element (here: allowance allocation), summarises the authors' evaluation of harmonisation along three criteria: a) importance of harmonisation for the proper functioning of the linked ETSs (*'Important for functioning of markets?'*); b) the administrative difficulty of harmonisation (*'Difficulty to align?'*); and c) the importance of harmonisation for political-economy reasons (*'Important for political economy?'*), which mainly relates to the minimisation of distributional effects.

three out of four design elements are deemed to be hard to align, the exception being the allocation treatment of entrants and exits. However, alignment may be important for political-economy reasons, mainly related to distributional effects and equity considerations. Specifically, alignment is more convincingly considered important in terms of the allocation method – as stressed by many authors (Sterk and Schule, 2009, Hausotter et al., 2011, among others) – and it is potentially important for the other design elements. On the use, for example, of auction revenues, Mace et al. (2008) note that the acceptability of linking may be called into question if industrial sectors perceive that their competitors in a partner ETS receive additional support.

Table 1: Evaluation of allocation alignment (Burtraw et al., 2013).

	Important for functioning of markets?	*Difficulty to align?*	*Important for political economy?*
Allocation method	Maybe	Hard	Yes
Treatment of entrants and exits	No	Easy	Maybe
Measures to address leakage	No	Hard	Maybe
Use of auction revenues	No	Hard	Maybe

The argument put forward by the authors whereby differences in allocation method may affect the very performance of linking relates, again, to a scenario in which output-based allocation is used in one of the ETSs. In such a case, it is explained that "one might expect to see allowances and emissions flow to the program using output-based allocation even if the two programs are in every other way identical". We interpret this sentence as to mean that costs savings from linking may not be maximised. Beyond 'allocation method', other design elements that are contemplated include: a) the allocation treatment of entrants and exits; b) measures to address carbon leakage (to third jurisdictions); and c) the use of auction revenues. Harmonisation seems not to be important for the functioning of linked markets (first column) with any of these elements. As regards the ease of harmonisation,

4. Insights from the Carbon Market Policy Dialogue

On 9 June 2021, the first session of the second CMPD meeting on differences in provisions to prevent carbon leakage between ETSs and their implications for linking brought together over 40 international experts. These were policymakers, including the regulators of the six ETSs represented in the CMPD, researchers and representatives of regulated industries and civil society. A selection of the most relevant insights from the interventions and discussion is reported below.

- Lessons or insights can be learnt from past experience of energy prices about the economic consequences of higher future carbon prices, over the next ten years or so, as required by 'net-zero' scenarios. For many countries, with a few exceptions such as the

US, the required carbon price increases are smaller than the energy price increases observed in the last two decades.

- Experience of relevant energy price increases shows that aggregate economic effects are very small. Irrespective of the outcome variable that is considered – whether it relates to productivity, trade, investment, FDI, or employment –, if you look at the economy as a whole, or at least at the manufacturing sector as a whole, aggregate effects are very small.

- Experience of relevant energy price increases also shows that, behind negligible aggregate effects, narrower effects can vary significantly both between and within sectors. Energy-intensive sectors are the most affected, as one would expect. More interestingly, firms in the same sector can be affected very differently: high-productivity firms win, low-productivity firms lose, the former managing to get some of the market share of the latter.

- Some recent policy developments might reduce concerns about international competitiveness deterioration due to differentials in climate ambition. One such development is the adoption of climate neutrality targets by a large and increasing share of the world's economy: a convergence in long-term objectives that is reassuring to some extent. The green recovery packages discussed by national governments represent a second relevant development. These packages often include subsidies to technology adoption and innovation, which arguably diminish the need for border carbon adjustments.

- By international trade law, the justification for BCAs, such as the EU's Carbon Border Adjustment Mechanism (CBAM), must be the safeguard of climate protection, not the safeguard of international competitiveness. Export rebates as part of a BCA run a risk to be regarded as actionable or even prohibited subsidies under WTO law. Carbon leakage should be minimised, including through BCAs, merely because carbon leakage undermines climate protection, which is a global public good.

- Least Developed Countries (LDCs) should be exempt from the CBAM by virtue of their special status both under the Paris Agreement and WTO law.

- With a view to the UNFCCC COP26, in Glasgow (November 2021), China, Russia, India and other emerging economies clearly communicated that they will not accept the EU's CBAM. It is a top issue in Russia, as data on EU's steel and electricity imports suggest that Russia would have to pay a lot at the border, having little or nothing to be credited for. The European Bank for Reconstruction and Development has offered Turkey to help with the introduction of carbon pricing, and other EU neighbouring countries already have plans for carbon pricing in their drawers. However, those carbon prices will likely be much lower than European carbon prices, so the issue of substantial adjustments at the border, if they deliver to EU markets, remain.

- The US administration has expressed its intention of introducing some version of a BCA even though no carbon pricing currently exists (nor in the foreseeable future) at the federal level. This raises the question of how the EU and the US could effectively cooperate on BCAs.

- The first year of operation of China's national ETS really is a trial period. This is reflected, for example, in the fact that regulated power companies will only have to surrender allowances up to 20% of their short position, which is a very light obligation. Also, gas-fired power plants are not subject to any compliance obligation, meaning allowances need not to be surrendered if they are in shortage. If all goes well, it is possible to imagine China's ETS being extended to other sectors in four or five years' time.

- With reference to the EU ETS, there is an increasingly pressing case for the benchmarks used for allocating free allowances to be redefined so that differences in production processes are accounted for. Take hydrogen, for example. As it stands, there is a clear reference to the conventional way of producing hydrogen, but if you made hydrogen by another, cleaner process, you would not benefit from the benchmark. The same consideration suggests that harmonisation of benchmarks across ETSs – to be achieved through cooperation – is highly desirable for facilitating linkages between ETSs.

5. Discussion and conclusions

In June 2021, the six ETSs represented in the CMPD continue evolving in significant ways. Particularly striking is the price rally observed in the EU ETS, which has seen EUA prices increase from around €20/tCO_2 to well over €50 in the space of one year. Regarding the drivers of this escalation, it seems safe to assume that a change in expectations played a key role following political agreement over the EU's climate neutrality goal and a more ambitious emissions reduction target for 2030.[12] Major developments have taken place in China, as the national ETS officially started on 1 February 2021 – the day the regulations creating the ETS entered into force – and actual trading of emission allowances is expected to commence by the summer. 2021 is also the first year of operations for New Zealand's radically reformed ETS. At a more general level, an increasing number of governments have committed to achieving net-zero GHG emissions by around mid-century.[13] What is more, the impact of the Covid-19 pandemic on the economy has led many governments to gear their expansionary interventions toward an acceleration of the ecological transition.

Within this dynamic context, the question of how to deep-decarbonise the economy while avoiding carbon leakage has become more important than ever in a practical, concrete sense. The fact that the EU is currently working on the introduction of a WTO-compatible border carbon adjustment (BCA) – an unprecedented measure at the international level – reflects the perceived urgency of this issue. Considering the implications of a BCA for the linking of ETSs, a well-designed mechanism could facilitate the establishment of linkages, as no (or reduced) price adjustments would apply upon price convergence between the ETSs that are linked together. However, any BCA would firstly need to be recognised by the trading partners as a genuine environmental measure, and not as a protectionist one. Secondly, avoidance of carbon price adjustments as the sole additional incentive to link may not suffice. In this regard, casting linking agreements into broader preferential trade agreements could give the parties involved further incentives to establish a linkage. Arguably, the history of the EU ETS, which currently covers the 30 States of the European Economic Area (the 27 EU Members States plus Iceland, Liechtenstein and Norway), lends support to this hypothesis (Ellerman, 2010).[14] However, facilitating linkages is not normally the ultimate purpose of a BCA. Also, given the many complexities and implications of linking, it is possible that a BCA would induce carbon prices to converge across ETSs without a linkage. Clearly, this would still be a desirable outcome from an economic efficiency perspective.

Back to the six ETSs reviewed in the report, a difference that emerges from their comparison concerns the method of allocation of free allowances to the industries at risk of carbon leakage. In California's, Quebec's, New Zealand's and China's ETSs, output-based allocation is employed. In the EU's and Switzerland's, fixed base-period benchmarking is used, or primarily used, instead. The fact that output-based allocation was chosen for China's brand-new ETS, for New Zealand's recently reformed ETS and, to some extent, also for the current trading period of the EU ETS[15], suggests that this type of allocation – more effective in preserving market shares given its implicit output subsidy – has gained popularity in the last few years. Interestingly, the literature stresses how output-based allocation alone can distort business competition, as well as how, in a linking context, it may amplify or attenuate competitive distortions by interacting with post-link changes in allowance prices. These conclusions are the results of thought experiments, however, meaning that they derive from pure theoretical reasoning. In the real-world, the significance of these distortions will depend on the circumstances of a specific linking situation. The degree to which firms under different ETSs compete with each

12 The EU has committed to reducing its overall net GHG emissions by 55% below 1990 levels, by 2030. A proposed revision of the EU ETS is expected in July 2021 which (among other things) will reduce the cap accordingly.

13 Colleagues at the International Carbon Action Partnership have calculated that net-zero targets are currently enshrined in law or proposed in legislation in jurisdictions accounting for about 12% of global emissions. Besides, net-zero targets appear in policy documents and pronouncements in jurisdictions covering another 40% of global emissions.

14 In the lead-up to the 2009 UNFCCC conference, in Copenhagen, Ellerman (2010) addressed the question of whether the EU ETS could be considered a proto-type global system. Today, in the Paris Agreement era, Ellerman's question has partly lost relevance for its reference to a new potential Kyoto-type regime. The analysis remains relevant, however, as its insights can be transferred to bottom-up processes of ETS linking.

15 As of Phase IV of the EU ETS, maximum State aid addressing the risk of indirect emissions leakage is based on current output. Moreover, allocations are adjusted in both cases: output increases exceeding +15% and output decreases exceeding -15% relative to historical levels.

other in markets, is critical in this sense. The EU ETS experience again suggests that differences in allocation rules more likely become problematic from a competition perspective if the linked ETSs are part of a deeply-integrated economic area.

In the first two EU ETS trading periods, differences in allocation rules across Member States, especially those for the treatment of new entrants, produced some controversies. These frictions were subsequently overcome through the tight harmonisation of allocation rules implemented as of Phase III. The linking arrangements between the ETSs of California and Quebec provide another relevant piece of experience. After over six years, the linkage continues to work successfully despite differences in free allocation between the two ETSs. Both California and Quebec use output-based allocation, but their allocation rules are not identical. Taken together, these two experiences suggest that the harmonisation of allocation rules is not strictly necessary for a linkage to take place. However, they also suggest that, first, the importance of harmonisation is directly related to the intensity of competition between firms under different ETSs; and that, second, harmonisation is likely to be increasingly asked for with the increasing scarcity of emission allowances. In the case of the EU ETS, the whole harmonisation process was led by the European Commission as a central coordinating authority: something quite natural, given the many parties involved. In the case of the California-Quebec link, partial harmonisation has been managed bilaterally, within the framework of the Western Climate Initiative.

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Published by
European University Institute (EUI)
Via dei Roccettini 9, I-50014
San Domenico di Fiesole (FI)
Italy

The LIFE DICET project (lifedicetproject.eui.eu) is co-financed by the LIFE Programme of the European Union (EU). The policy brief reflects the authors' views and the European Commission is not responsible for any use that may be made of the information this policy brief contains

doi:10.2870/651097
ISBN:978-92-9466-157-9
ISSN:2467-4540
QM-AX-22-018-EN-N