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1. Introduction

The persistently low allowance prices in the EU emissions trading scheme (EU ETS) – oscillating between €5/tCO_2 and €17/tCO_2 since 2008/9 – has reignited debates about the dynamic efficiency of cap-and-trade schemes. Within the context of the EU ETS, the debate has largely focused on the causes of the price slump (for instance Koch *et al*. 2014; European Commission 2014a), policy options to address the problem in the short- and long-run (Grosjean 2014; de Perthuis and Trotignon 2014), and the efficiency, environmental effectiveness, and political feasibility of the various options (Weishaar 2014a; Knopf *et al*. 2014). Despite the potentially significant risk that linking poses to market stability by facilitating contagion of localised price shocks and consequently eroding political support for domestic ETSs (McKibbin *et al*. 2008), studies analysing the linking implications of the proposed market stabilisation measures are largely absent. We aim to fill this gap.

Linking establishes inter-system trading in emissions rights between the linking-partner ETSs. By connecting fragmented carbon markets, it expands market size and increases market liquidity. Not only does it lead to a cost-efficient achievement of a given environmental target by equalising marginal abatement costs across the linking-partner ETSs, it also eliminates competitive distortions that might arise from differences in pre-link allowance prices (Jaffe and Stavins 2007; Tuerk *et al*. 2009). Politically, linking creates a bottom-up climate policy architecture that could *substitute* or *complement* the top-down climate policy process of the United Nations Framework Convention on Climate Change (Flachsland *et al*. 2009; Jaffe *et al*. 2009;

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Ranson and Stavins 2013). Linking could also serve as a commitment device by embedding a domestic climate policy in a bottom-up international climate policy architecture (Tiche *et al*. 2014a).

The linking literature has long identified significant differences as potential obstacles for the linking of ETSs (Haites 2003; Jaffe and Stavins 2007; Tuerk *et al*. 2009). For one, some differences could raise efficiency, environmental integrity, and equity issues (Tuerk *et al*. 2009; Tiche *et al*. 2014b). For another, as Flachsland *et al*. (2009: 365) argue, a mix of different design features may undermine the policy priority rankings of one or more of the linking-partner jurisdictions. Additionally, linking creates regulatory challenges by creating a form of pooled sovereignty whereby the climate policies of the linking-partner jurisdictions become interdependent (Granaut 2011). This is by no means to suggest that complete harmonisation of different design features is a prerequisite for linking. To the contrary, a mutually beneficial link can be established between ETSs with different design features (Flachsland *et al*. 2009; Tuerk *et al*. 2009).

The aim of the paper is to answer the question: if and how different market stabilisation measures affect linking of ETSs. Following a law and economics approach, we analyse the linking implications along the three criteria of efficiency, environmental effectiveness, and regulatory autonomy by using the market stabilisation measures of the EU ETS and the South Korean ETS (hereinafter: Korean ETS) as case studies. The market stabilisation measures of these ETSs provide an interesting case study because they represent different spectra of the debate on market stabilisation measures. While the EU ETS is proposing a quantitative scheme of scarcity management, most of the Korean ETS market stabilisation measures are price-based.

The remainder of the paper is organised as follows. In section 2, we discuss the why and how of carbon market stabilisation. Subsequently, in section 3, we summarise proposed market stabilisation measures of the EU and Korean ETSs.

Section 4 analyses the efficiency, environmental integrity, and regulatory implications of a mix of the different market stabilisation measures for an EU-Korean carbon market. Section 5 concludes the paper.

2. Stabilising carbon markets: Why and how?

Standard economic theory holds that a cap-and-trade scheme achieves a given emissions target at the lowest possible cost. The 'cap', if backed by a credible compliance and enforcement system, puts a limit to the quantity of greenhouse gas that regulated entities emit over a compliance period. The 'trade' allows regulated entities to shift abatement activities to entities with the lowest marginal cost of abatement. In equilibrium, this equalises regulated entities' marginal abatement costs, a *sine qua non* for a cost-efficient realisation of an environmental target. If all that matters is achievement of a given emissions target at the lowest possible cost, a cap-and-trade scheme ensures just that. Yet, the success of a cap-and-trade scheme arguably depends also on the extent to which it provides dynamic incentives for the invention, innovation and diffusion of low-carbon technologies (Magat 1979; Jaffe and Stavins 1995).

Compared to command-and-control climate policy instruments, market-based instruments provide greater dynamic incentives (Jaffe *et al.* 2002; Allan *et al.* 2014). Among market-based instruments, however, a carbon tax seems to provide better dynamic incentives than a cap-and-trade (Requate 2005). This is primarily because a (pure) cap-and-trade scheme leaves prices uncertain, and at times, volatile. When setting caps, regulators rely on several assumptions including expected economic growth, business-as-usual emissions, and technologic progress. These assumptions may later go astray, resulting in higher or lower prices than the predicted carbon price path that incentivises an optimal rate of abatement, innovation and investment to reduce costs in the long-run (Knopf 2014).

Additionally, that supply is inelastic in a cap-and-trade system means that demand-side shocks may lead to volatile prices.[1] When demand for allowances suddenly increases due to, for instance, extreme weather conditions or an energy crisis, supply from abatement effects by regulated entities cannot respond quickly (Weishaar 2014a). Similarly, when demand for allowances slump due to, for instance, an economic recession, a successful diffusion of a new abatement technology, or a regulatory change, the supply of allowances cannot contract in response (Weishaar 2014a). For instance, in the summer of 2000 the Regional Clean Air Incentives Market program in California saw a sudden spike in the price of NOx emissions allowances from an average of $400/t to an average of over $40,000 due to an energy crisis (Goulder and Schein 2013). In April 2006, allowance prices in the EU ETS crashed from nearly €30/tCO_2 to less than €13.31/tCO_2 after it became apparent that verified emissions were less than the number of allowances allocated to regulated entities (Ellerman and Buchner 2008).

Without predictable, sufficiently high, and politically credible carbon prices, private entities will defer low-carbon investments. This may lock-in emissions-intensive investments and exacerbate the costs of transitioning into a low-carbon future (Hepburn 2006; Fankhauser and Hepburn 2010; Weishaar 2014a). There are several policy instruments that can be used to address price uncertainty and price volatility in cap-and-trade schemes. We discuss them in three categories.

A first category concerns instruments that address the problem of price volatility by targeting the very design feature that makes a cap-and-trade scheme prone to demand-side shocks – the cap. These include banking, borrowing, and offset provisions (Fankhauser and Hepburn 2010) and allowance reserve schemes (Murray *et al*. 2009). Banking and borrowing provisions, and offsets expand a cap-and-trade

[1] Price volatility, which generally refers to a change in prices over time, is not necessarily bad. A change in prices over time is expected in markets and carbon markets are no exception. In so far as the change in prices reflect market fundamentals and are predictable, they may not be problematic. They become problematic when they are large and cannot be anticipated, creating uncertainties for market participants and leading to suboptimal decisions. By price volatility, we mean the latter type.

scheme, respectively, across time and across space, and offer flexibility by making supply less inelastic (Fankhauser and Hepburn 2010: 4363-65). Similarly, an allowance reserve scheme creates a limited (or unlimited) pool of allowances to tap into during price spikes (Murray *et al*. 2009).

A second category is a dynamic management of supply by an independent authority (Grosjean *et al*. 2014; de Perthuis and Trotignon 2014). An independent regulatory agency decides the supply of allowances taking into account the supply-demand dynamics in the carbon market. Authors often seek to draw parallels to how the an independent central bank manages monetary policy. This option aims to address two sources of price uncertainty and volatility: regulatory uncertainty stemming from political uncertainty and time-inconsistency, and an inflexible and inelastic supply.

The third category refers to direct price management schemes such as price floors, price ceilings, and price collars. These mechanisms combine features of price (taxes) and quantitative instruments (cap-and-trade) and create hybrid schemes (McKibbin and Wilcoxen 1997, 2002a, 2002b; Hepburn 2006: 230).[2] Price floors establish a minimum carbon price. A price ceiling, in contrast, sets a maximum carbon price. A price corridor combines a price floor and a price ceiling and allows the carbon price to freely float between the corridors set by the floor and ceiling prices.

A few of these mechanisms, or variations thereof, have already gotten their way into most of current and past ETSs. An unlimited banking, a limited borrowing, and a limited use of offsets are common features of current and past cap-and-trade schemes (Weishaar 2014b: 66-96). The Australian Carbon Pricing Mechanism, abolished in July 2014, was originally designed with price collars (Tiche *et al*. 2014a).

[2] Since Weitzman (1974) it has been established that when abatement costs are uncertain and the marginal damage function is relatively flat, which has been understood to apply to climate change (Wood and Jotzo 2011), a price instrument that sets the marginal costs of abatement is more efficient than a quantitative scheme. Roberts and Spencer (1976) further showed that a hybrid scheme delivers higher net benefits than a pure quantitative or a price scheme when the costs of pollution reduction are uncertain, but the benefits are known.

The Regional Greenhouse Gas Initiative enforces price floors through auction reserve prices (Weishaar 2014b: 76). The Californian cap-and-trade scheme has an allowance reserve scheme that would be deployed to contain high carbon prices (Weishaar 2014b: 79). The EU ETS' Market Stability Reserve (MSR) is also a form of quantitative instrument of scarcity management. The Korean ETS incorporates several measures including price floors, price ceilings and an allowance reserve scheme (Park and Hong 2014).

The next section elaborates on the market stabilisation measures of the EU and Korean ETSs.

3. Carbon market stabilisation measures of the EU and Korean ETSs

3.1. The EU ETS approach to market stabilisation

The EU ETS faced volatile prices at several junctures (see generally Ellerman and Buchner 2008; Ellerman et al. 2014; Ferdinand 2015). It commenced in 2005 with a modest carbon price of below €10/tCO_2 which continued until mid-2005. Allowance prices peaked to above €30/tCO_2 in April 2006 to later fall sharply after the publication of the first verified emissions which showed the market was over-allocated (Ellerman et al. 2014: 11). Prohibition of banking of Phase I allowances drove prices to near zero in September 2007 (Ellerman and Buchner 2008).

At the beginning of Phase II, prices picked up and reached near €30/tCO_2 to yet again start declining in late 2008 (Ferdinand 2015). The price decline has since continued and the beginning of the third trading phase in 2013 saw one of the lowest carbon prices since 2007 with prices reaching below €5/tCO_2. Allowance prices have since not broken the €10/tCO_2 mark. The carbon market now runs a surplus of over 2 billion allowances and, without additional reforms, the surplus is predicted to last beyond 2020 (European Commission 2014c).

Three major factors are widely believed to have caused the allowance oversupply. The first concerns the economic crisis since 2009 which led to a decline in industrial output and emissions (European Commission 2012; de Perthuis and Trotignon 2014: 3-4; Weishaar 2014a). The second relates to a combination of increased inflow of offset credits during phase II, the early auctioning of Phase III allowances in the final years of the second phase, and the release of allowances in the New Entrants Reserve (Weishaar 2014a). The third factor is an effect of an interaction between the EU ETS and other climate policies, notably renewable and energy efficiency policies (European Commission 2012; de Perthuis and Trotignon 2014: 3-4).[3]

Since 2010/11 the Commission has been consulting on several short- and long-run policy options to address the problem of oversupply and increase the resilience of the EU ETS to demand-side shocks. For the short-run, the Commission is deferring the auctioning of 900 million allowances (known as 'back-loading') withheld from 2014 to 2016 auction volumes to the end of the third phase (Commission Regulation (EU) No 1210/2011). This is aimed at temporarily relieving the carbon market from the oversupply and help prices pick-up. Although the backloaded allowanced were initially expected to return to the market by the end of the current trading phase, it is now proposed that they would instead return to the MSR (European Commission 2015).

The MSR, scheduled to commence in 2019, is expected to address the problem supply-demand imbalance in the long-run (European Commission 2014a; European Commission 2015).[4] It manages allowance surplus in the market by adjusting annual auction volumes when the overall allowance surplus is outside a predefined range.[5]

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[3] In an *ex post* empirical analysis covering Phase II and the first year of Phase III, Koch *et al*. (2014), on the other hand, argue that only 10 percent of the EU ETS price dynamics can be explained by these three factors.

[4] In addition to the MSR, the Commission has proposed to increase the EU's emission reduction target for 2030 from 30 percent to 40 percent below 1990 levels. To proportionately increase the contribution of capped sectors towards meeting the emissions target, it is proposed that the annual linear reduction factor at which the EU ETS cap has been declining since 2013 from 1.7 percent to 2.2 percent (European Commission 2014a). The Council adopted the 40 percent emissions reduction target on 23 October 2014 (European Council 2014).

[5] The allowance surplus is defined as the difference between the total number of allowances issued and international credits submitted from 1 January 2008 to the end of a given year, and verified

If the surplus exceeds 833 million, it absorbs 12 percent of the surplus by withholding them from future auction volumes (European Commission 2014b). If the allowance surplus falls below 400 million, the MSR releases 100 million allowances from the reserve and adds them to future auction volumes (European Commission 2014b). If the reserve has less than 100 million allowances, all allowances in the reserve will be released. Whenever the allowance surplus remains between the 400 million and 833 million thresholds, the MSR plays no role.[6]

The Commission argues that the MSR provides a "rule-based, non-discretionary and predictable" mechanism of addressing supply-demand imbalances in the long-run (European Commission 2014c). It also indicates that several stakeholders support the idea of a quantitative mechanism of supply management. Alternative proposals, especially direct price-management schemes, could not garner as much support because they are against the "central principles" of the EU ETS "as an instrument based on volume not on price" (European Commission 2014c: 14). The Commission also noted that "agreeing on the "right" price thresholds would be very contentious, if not impossible" (European Commission 2014c: 14).

3.2. The Korean ETS approach to market stabilisation

The Korean ETS, which commenced on 1 January 2015, is a cap-and-trade scheme covering 66 per cent of South Korea's annual emissions (ICAP 2014). It is structured into several phases, each running for 5 years, except that the first two phases run for 3 years each (Park and Hong 2014: 3). Each period operates under a separate set of rules outlined in a National Allocation Plan (NAP). The NAP specifies, *inter alia,* the cap for a given phase, the total number of allowances for each compliance year, the

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emissions recorded since 2008 and the number of allowances in the MSR in the relevant year (European Commission 2014c: 3).

[6] There is an exception to this. The MSR will release 100 million allowances annually if a measure is adopted according to Article 29a of Directive 2003/87/EC, which specifies the conditions under which measures to control sudden allowance price spikes could be taken.

types of sectors and businesses to be covered by the ETS, and the distribution criteria of emissions allowances.

The Korean ETS incorporates several instruments that authorities may deploy to address too high or too low allowance prices. The Emission Allowance Allocation Committee (EAAC) – a committee chaired by the Minister of Strategy and Finance – may decide to implement market stabilisation measures if: (i) the average allowance price in the preceding six consecutive months increases by more than threefold of the average allowance price in the past two years; (ii) the average allowance price in the preceding six consecutive months is more than twofold the average allowance price in the past two years and the average trading volume of one month is at least twice the volume of the same month in the past two years; or (iii) the average price of allowances in the preceding month falls below 60 percent of the average price for the two preceding years.

If any of the above conditions is met, the EAAC *may* decide to: (i) release additional allowances not exceeding 25 percent of the total allowance reserve;[7] (ii) set temporary price-floor or price-ceiling; (iii) increase or decrease the quota on the use of offset credits;[8] (iv) increase or decrease allowance borrowing between compliance years;[9] or (v) require compliance entities to hold a maximum or minimum number of allowances (). Unlike the EU ETS' MSR, the market stabilisation measures of Korean ETS are neither rule-based nor non-discretionary. Even if the price-based triggers are met, the measures will not automatically deploy unless a decision, upon a request by the Ministry of Environment, to that effect is taken by the EAAC.

There are several unknowns about the market stabilisation measures of the Korean ETS. First, it is unclear whether multiple instruments will be deployed

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[7] During the first phase (2015-2017), about 5 percent of the total allowances are retained in the reserve (ICAP 2014).
[8] Currently, covered entities may cover up to 10 percent of their emissions in a compliance year using domestic – CDM or otherwise – offset credits (ICAP 2014).
[9] The minimum and maximum allowance retention limits will be 70 percent and 150 percent, respectively (ICAP 2014).

simultaneously should either of the conditions be met. Second, no parameters are defined for withdrawing either of the instruments once activated. Third, it is also unclear how the different measures will be implemented. Will the price floor, for instance, be implemented through a government buyback scheme, a fee payable by covered entities, or something else? The answers to these questions have efficiency, environmental integrity and regulatory implications for the ETS and its prospects for linking as we will show in the next section.

As the discussion in this section shows, the EU and Korean ETSs apply different types of market stabilisation measures. The differences can be summarised into three. First, while the EU ETS uses a system of scarcity management, the Korean ETS predominantly uses direct price control mechanisms. Second, the Korean ETS' market stabilisation measures are less immune from political influence than those of the EU ETS'. While the EU ETS' MSR is rule-based, non-discretionary, and automatic, the market stabilisation measures of the Korean ETS are deployed only after a decision to that effect is taken by a political body – the EAAC. Third, the EU ETS sets quantity-based triggers for the MSR while, on the other hand, the Korean market stabilisation measures use price-based triggers.

4. Market stabilisation measures and linking

In this section, we analyse the efficiency, environmental integrity, and regulatory implications of allowing a mix of the EU and Korean market stabilisation measures operate side-by-side in a linked EU-Korean carbon market.

4.1. Efficiency implications

The EU and Korean ETSs use different types of triggers to activate their respective market stabilisation measures. The MSR of the EU ETS is activated by quantity-based triggers that are defined *ex ante*. By contrast, the market stabilisation measures of the Korean ETS are activated by price-based triggers. In this section, we analyse whether these differences affect the efficiency of an EU-Korean carbon market, i.e. the ability of the carbon market in achieving the EU-Korean aggregate emissions reduction targets at the least possible abatement cost. We also examine the efficiency implications of Korea's price floor.

Unlike the triggers of the EU ETS' MSR, the price-based triggers of the Korean ETS are not fixed. The trigger prices will move in accordance with the average price of allowances over the preceding two years. The triggers do not thus afford as much price certainty as fixed price triggers. Two additional factors compound the uncertainty. First, the deployment of the market stabilisation measures in Korea is not automatic. Measures can be deployed only after a decision to that effect is taken by the EAAC. Second, it remains unclear which and how many of the several instruments will be deployed if the price-based triggers are met.

The absence of fixed price triggers, the lack of clarity about the type and number of instruments that will be deployed to address too low or too high prices, and the room for political manoeuvre through the EAAC sow uncertainty. Because linking creates interdependence between the climate policies of the linking jurisdictions and a regulatory intervention in one jurisdiction affects the other (see the discussion in section 4.3 below), the uncertainty pervading the Korean carbon market would also impact the EU ETS by obstructing price discovery.

The differences in the nature of the respective schemes' triggers may also invite incoherent regulatory interventions. The MSR is designed to absorb or release allowances based on a relative surplus in the market irrespective of the level of the carbon price. If the MSR absorbs allowances, prices will increase. The price increase may in turn activate the Korean price ceiling or other similar measures, increasing allowance supply in the market that may in turn again activate the quantity-based triggers of the MSR to absorb allowances. The mix of the EU and Korean market stabilisation measures may thus set off a cycle of regulatory intervention that sows uncertainty, distorts price discovery, and erodes credibility in the market. Ironically, the measures designed to bring stability and predictability to the market might create instability and erode confidence in the carbon market.

Another source of inefficiency will be Korea's price floor. As discussed above, a price floor could be implemented through three mechanisms: an auction reserve price, a government buyback scheme, or a fixed or flexible fee/tax approach. Of these, an auction reserve price and a government buyback scheme are implausible in the context of the Korean ETS for the former would be ineffective and the latter financially burdensome (see section 4.3 below). The third option is to require that covered entities pay a fee per a ton of CO_2 in addition to surrendering an allowance covering the relevant emission (Wood and Jotzo 2011). This will increase the cost of abatement in an EU-Korean carbon market.

Let us first analyse the effect of the fee on the domestic market without any linking. By imposing a fee, the government could ensure that the effective carbon price remains at or above the level of the fee (Fankhauser *et al*. 2011; Wood and Jotzo 2011: 1750). After the fee is introduced, the marginal abatement cost curve – comprising the fee and the price of allowances – would remain unaffected because allowance prices would decrease "by an amount exactly the same as the fee" (Wood and Jotzo 2011: 1750). The fee leads neither to a higher effective carbon price nor to more emissions reduction than a situation without the fee. Because the purpose of introducing the fee is supporting a slumping allowance price, the fee does not achieve that. It may actually lead to a further slump in allowance prices without changing the effective carbon price.

In the context of a bilateral link between the EU and Korean ETSs, the fee would be asymmetric as the EU ETS lacks (or does not envisage) a similar system. The pre-linking symmetry between an increase in the level of the fee and the corresponding decrease in allowance prices will be lost after the Korean ETS links with the EU ETS. In this asymmetric setting, the unilateral fee will be added on top of the international carbon price that the Korean ETS – given its relatively small size compared to the EU

ETS – hardly influences. This would increase the effective carbon price (marginal cost of abatement) in the Korean ETS above the international carbon price by the level of the fee or a little less than that.

The increase in the marginal cost of abatement shifts more abatement to the Korean ETS than would happen in a linking scenario without the fee/tax. Given equalisation of marginal abatement costs across the linking-partner ETSs is a *sine qua non* for the efficiency of a linked carbon market, the unilateral fee leads to inefficiencies as it prevents equalisation of marginal abatement costs of Korean and EU entities. This means that abatement will not be shifted to wherever it may be achieved at the least cost, increasing the overall cost of mitigation and reversing, at least in part, the gains from trade (Fankhauser *et al*. 2011).

4.2. Environmental integrity

The environmental effectiveness/integrity of a cap-and-trade scheme depends on its cap, a robust system of monitoring, reporting and verification, and a credible compliance and enforcement system. Provided that the cap is set at a socially desirable level and it is backed by a robust and credible monitoring and compliance system, a cap-and-trade scheme is environmentally effective. Linking does not affect this because it simply shifts abatement within the participating cap-and-trade schemes without affecting the aggregate level of emissions. The post-linking cap would be a sum of the individual linking-partner schemes' caps.

Seen in the light of the foregoing, the Korean ETS lacks an effective cap. It contemplates relaxing the cap by implementing a price ceiling or relaxing the offset provisions. It remains unclear how the price ceiling will be implemented. Generally, it could be implemented in any of the following three ways: issuing unlimited number of allowances when the price ceiling is triggered, requiring regulated entities to pay the ceiling price in lieu of surrendering allowances, or setting up a limited pool of allowances that will be released to the market when prices reach the ceiling level. The last option is unlikely in the context of the Korean ETS as a separate allowance reserve is put in place to address price spikes.

If the price ceiling is triggered and it is implemented through either the payment of a ceiling price or by issuing an unlimited number of allowances, linking will lead to more emissions than in a pre-linking scenario. As a significant price increase in an EU-Korea carbon market is likely to largely reflect changing market fundamentals in the EU ETS, any measure that aims to address the price increase should address those market fundamentals. This would mean that Korean authorities must address a surge in demand not only from their own covered entities but also from entities covered under the EU ETS, leading to issuance of more emissions allowances than in a pre-linking scenario.

4.3. Regulatory implications

An inevitable consequence of linking is an intersystem trading in emissions rights between entities covered under the linking-partner ETSs. In this section, we first examine if this interdependence increases/decreases price volatility in linking-partner ETSs in comparison to a pre-linking scenario. Next, we discuss the implications of the interdependence for the regulatory autonomy of the linking-partner jurisdictions and the effectiveness of unilateral market stabilisation measures.

Compared to a pre-linking scenario, does linking increase/decrease price volatility in the linking-partner ETSs? This is likely to be affected by the relative size of the linking-partner ETSs and whether the price volatility is global or local. In the case of a global price shock affecting relevant linking-partner ETSs equally, linking is likely to help them absorb the price shock by increasing liquidity and flexibility. This is vital especially to small ETSs that inevitably face limited flexibility and liquidity by virtue of their size. In the context of the EU and Korean ETSs, the liquidity benefits of linking would be greater to the Korean ETS – an ETS about a fourth of the size of the EU ETS.

Where the price shock is local, the intersystem trading in allowances increases the risks of contagion of the shock from one ETS to others (McKibbin *et al*. 2008).[10] The disrupting impacts of such price shocks crucially depend on the relative size of the linking-partner ETSs. In a bilateral link between ETSs with significant variation in size, price shocks originating from the larger ETS may lead to more instability in the smaller ETS than the other way round. This is likely to be the case in a full bilateral linking between the EU and Korean ETSs because the demand-supply dynamics in the EU ETS will largely determine the post-linking carbon price and the Korean ETS will become a price-taker.

Linking also creates interdependence in the linking-partners' climate policies. Each jurisdiction's climate policies will become less immune to regulatory interventions in other jurisdictions. The cross-border impacts of the regulatory interventions depend again on the relative size of the linking-partner ETSs. In a linking between ETSs with significant variation in size, regulatory measures taken in the bigger market largely shape the supply-demand dynamics in the linked carbon market. The smaller market becomes a price-taker and its regulatory measures only marginally influence the overall carbon market.[11]

While the smaller market suffers from localised price shocks originating from the bigger market, its regulatory measures become ineffective in addressing the ensuing market instability. Let us see how difficult enforcing a Korean price floor would be in a linked EU-Korean carbon market. Trying to set the price floor through an auction reserve price would be ineffective because almost all allowances are allocated free of

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[10] A fitting example is what ensued after the EU and Australia announced in August 2012 a proposed link between their respective ETSs commencing in July 2015. The expected price of Australian Carbon Units – Australia's primary carbon currency – for 2015 slumped from near A$30/tCO2 to just A$12.1 (Point Carbon 2013). It is natural and to be expected that linking would cause prices to increase in one scheme and to decrease in another. Yet, the price slump also reflected a regulatory uncertainty in the EU with respect to addressing allowance oversupply pervading the EU ETS. The linking brought "the EU ETS' policy uncertainties … to the shores of the Australian carbon market" (Tiche *et al*. 2014b).

[11] It has to be noted that regulatory measures of a small ETS could, in some circumstances, have significant implications for the interconnected carbon market. This is, for instance, the case when a small ETS enforces a price ceiling through an unlimited issuance of allowances (see section 4.2 above).

charge. Even if the Korean ETS were to auction all its allowances, an auction reserve price would not guarantee a price floor without a similar scheme in the EU ETS. By contrast, a government scheme that buys back allowances at a threshold price could guarantee a price floor. However, this requires buying allowances flowing also from the EU ETS. Because of linking, the financial burden of buying back allowances balloons.

As Flachsland *et al*. (2009: 366) argue, localised price shocks will be unavoidable in so far as the economies of the linking-partners remain idiosyncratic, and each linking-partner jurisdiction might be better placed to respond to such shocks independently. Yet, linking reduces the effectiveness of unilateral regulatory measures, especially by smaller ETSs. Faced with ineffective unilateral measures, linking-partner jurisdictions could be driven to agreeing on a harmonised set of market stabilisation measures or put in place other governance structures that dynamically address instability of the interconnected carbon market (for discussions about institutional arrangements of linking, see Mehling and Haites 2009; Görlach 2015).

However, neither agreeing on a harmonised set of measures nor ceding regulatory autonomy to, for instance, an independent agency is easy especially if the linking-partner jurisdictions pursue different climate policy priorities. In the case of the EU and Korean ETSs, their policy priorities with respect to market stabilisation seem incompatible. In terms of instrument choice, the EU has clearly shown an aversion to price-based market stabilisation instruments (see for instance, Weishaar 2014a: 141). The Commission argued that price-based measures "would fundamentally modify the EU ETS, as the system would no longer be a quantity-based [instrument]" (European Commission 2014c: 21). By contrast, Korea includes both quantity-based and price-based instruments in its policy arsenal.

With respect to the overall functioning of their market stabilisation measures, the Commission has been advocating for a rule-based and predictable system of addressing supply-demand imbalances in the EU ETS (European Commission 2014b). Once established, the MSR foresees no significant role for the Commission or Member States. It is designed as an automatic scheme with *ex ante* defined triggers. The Commission ruled out price-based instruments because, inter alia, they would leave the decision on prices to policymakers (European Commission 2014c: 21). In contrast, market stabilisation instruments of the Korean ETS envisage the active involvement of the government, not least because they are activated only after an approval by the EAAC.

With regard to the level of carbon prices, the EU seems to (implicitly) favour high and predictable carbon prices that will drive investment and innovation in low carbon technologies.[12] By contrast, Korea seems to be concerned about the economic consequences of high allowance prices especially during the early years of the ETS. After years of intense industry lobbying for a softer target, the government watered down the ETS cap that it announced earlier. It may also be no coincidence that EAAC is housed within the Ministry of Strategy and Finance, and that is plays crucial functions in shaping the level of carbon prices. Given these divergent policy priorities and preferences, addressing the regulatory challenges of linking by, for instance, pooling sovereignty or putting in place other forms of coordination is likely to be difficult.

5. Concluding remarks

In this paper, we analysed if and how different market stabilisation measures affect the linking of ETSs by taking the EU and Korean ETSs as examples. The two jurisdictions differ not only in their policy arsenal targeting market instability but

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[12] This is not, however, to deny that too high carbon prices are not a concern in the EU ETS. After all, the MSR is aimed at addressing both too high and too low allowance prices. Also, Article 29a of Directive 2003/87/EC stipulates the institutional mechanisms of addressing too high allowance prices. Yet since the first phase, there has been a growing concern that the EU ETS has not been able to deliver a predictable and sufficiently high carbon price to incentivise research and development and long-term investments in low-carbon technologies. The recent discussion about structural reforms was also started largely due to concerns about the dynamic efficiency of the ETS.

also in the policy priorities they would like to achieve through their respective measures. In terms of instrument choice, the EU excludes price-based instruments from it policy arsenal. By contrast, Korea liberally cobbles together both quantity-based and price-based instruments. That the two jurisdictions use different policy instruments will have profound implications for the efficiency and environmental integrity of an EU-Korean carbon market.

From the perspective of safeguarding efficiency and environmental integrity, a linked EU-Korean carbon market will be better served by a harmonised set of market stabilisation measures or other governance structures such as dynamic supply management by a supranational independent agency. Neither is easy given the currently incompatible policy priorities that the jurisdictions seem to pursue. This may partly be explained by the different stages of development of the respective carbon markets.

During the initial phase of the EU ETS, delivering high and predictable prices heeded little, if any, attention from policymakers. The emphasis was on garnering stakeholders' support for an "alien" climate policy instrument. Despite the Commission's implicit plea for a centralised scheme with a bigger share of auctioning in the allocation of allowances, the ETS commenced as a decentralised scheme and almost all allowances were allocated for free. These were the "prices" paid to garner industry support. Over the years, the ETS has undergone several changes, culminating in the current centralised scheme that aspires to phase out free allocation gradually and to deliver high and predictable prices that incentivise investments in low-carbon technologies.

By contrast, as a newcomer to the global landscape of emissions trading, Korea seems to be concerned about carbon prices spiralling out of control. This might explain the diversity of its policy arsenal targeting market instability and the active government involvement in their operation. In time, the respective jurisdictions' climate policy priorities may align to one another. Without this, a convergence in the types and design of their respective market stabilisation measures is unlikely, and linking the two ETSs may remain a distant dream.

6. References

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