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Michael Mehling and Benjamin Görlach

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Abstract

All things being equal, integration of emissions trading systems though linking increases their economic efficiency. With several greenhouse gas emissions trading systems already in operation and additional markets emerging at the subnational, national and regional level, their linkage has attracted considerable attention among researchers and decision makers. A provision in the recently adopted Paris Agreement facilitates voluntary cooperation between parties, including linking of emissions trading systems. To date, however, research has largely focused on bilateral links and linking between aligned trading systems. As linking expands beyond such default scenarios, it gives rise to numerous challenges that differ from those encountered at more limited scale and lower levels or complexity. This paper seeks to identify such challenges and describe different options for their successful management.

Key words: Emissions Trading, Carbon Pricing, Linking, Carbon Clubs, Paris Agreement

JEL classification: Q54

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1 Introduction

Many of the benefits of a link between emissions trading systems (ETS) are directly related to the scope and size of the resulting market (Green et al., 2014: 1065). Linking will result in greater heterogeneity of abatement cost across market participants, thereby allowing greater aggregate efficiency gains through trading, which in turn may facilitate political agreement on more ambitious reduction targets (Lazarowicz, 2009); by increasing the number of market participants, a link also results in improved liquidity in the market. Likewise, the larger the sectoral and geographic scope of the linked market, the greater its ability to mitigate leakage and competitiveness concerns as prices and marginal abatement costs converge. All things being equal, thus, a greater number of linked ETS should also yield greater benefits.[1]

Unsurprisingly, extending the rationale of linking beyond the natural starting point of a link between two ETS has exerted significant appeal to decision makers in the public and the private sector. As the number of jurisdictions with some form of carbon trading in place continues to expand, the anticipated benefits of linking have recently prompted several high-level appeals to work towards a global carbon market by way of multilateral integration of local, regional and national ETS (BG Group et al., 2015; Carbon Pricing Leadership Coalition, 2014; Haug et al., 2015; ICAP, 2014: 4; House of Commons, 2015: 11-12; Merkel and Hollande, 2015; New Zealand et al., 2015). Despite some controversy over the role of markets in international climate cooperation, moreover, the Paris Agreement adopted in December 2015 contains language that allows accounting for transfers of mitigation effort between sovereign nations, effectively creating a negotiated basis for future links between domestic ETS (Paris Agreement, 2015: Art. 6). Notwithstanding limited progress with actual linking, it can therefore be assumed that multilateral linkage will remain on the political agenda going forward.

As linking extends beyond bilateral relationships, however, it will be accompanied by new governance challenges, some of which are additional and distinct to those already faced in a bilateral link. While bilateral linking requires coordination between two parties, a multilateral link will necessitate a process that facilitates agreement among several parties, with a potentially changing composition of linked jurisdictions over time. Critical design features introduced by one party – such as price caps or price floors – can affect all other linked systems, requiring that minimum conditions for linking be met by the entire group of participating jurisdictions. Restrictions and conditions imposed by each individual party may thereby narrow the range of viable linking options to a lowest common denominator. Procedures that require the active involvement of each party will become more complex to manage and may require longer timelines than are possible in a purely bilateral relationship. As a rule, thus, the greater the number of participants in a linked carbon market, the greater the governance complexity.

Simply extending the coordination mechanisms that work in a bilateral linking context may therefore prove inadequate for the governance needs in a multilateral context. Much will depend on how the multilateral link evolves, and whether it originates around a common governance framework or organically through incremental expansion of bilateral linkages without central coordination.

Additionally, bi- and multilateral linkages evolving at the domestic or regional level are likely to overlap with existing multilateral governance structures, notably the international climate regime under the UNFCCC. Ideally, as the broad provisions on cooperative approaches in the Paris Agreement are fleshed out and operationalized during future negotiating rounds, multilateral

[1] In theory, a globally uniform carbon price set at a level that internalizes the social cost of greenhouse gas emissions would maximize the aforesaid benefits, and therefore offer the most cost-effective policy option for climate change mitigation. Because it is not likely to garner political support in the near or medium term, however, expanding links between ETS offer a more flexible and therefore more viable pathway towards leveraging these advantages.

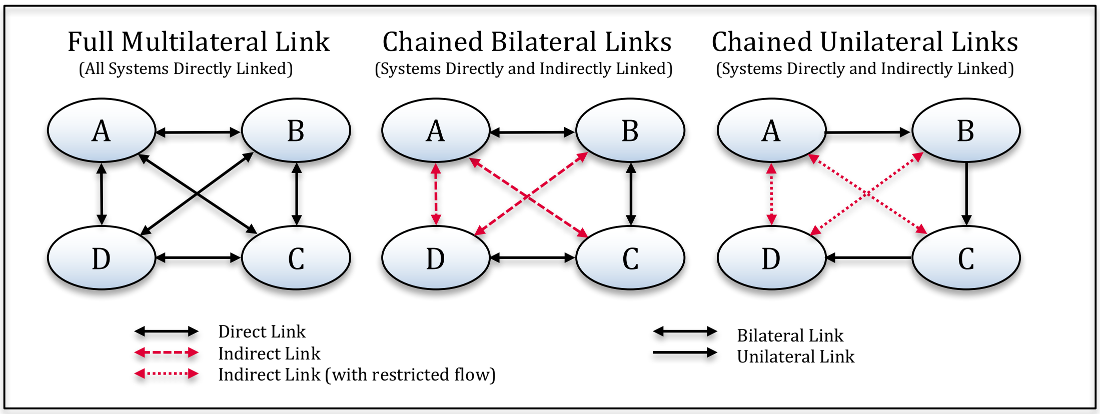
rules and infrastructures will serve a facilitating role, for instance by providing common definitions, methodologies or institutions that can promote linkages and address some of the attendant governance challenges. Importantly, any shifts in greenhouse gas abatement efforts following from a bi- or multilateral link need to be reflected under the UNFCCC regime, ensuring that net flows in the carbon market are accounted for when determining achievement of the Nationally Determined Contributions (NDCs) containing pledged mitigation efforts (Bodansky et al., 2015).

Related governance questions will be addressed in greater detail in the next subsections, starting with an overview of the specific governance challenges arising from an extension of linking arrangements beyond bilateral arrangements, categorizing different forms of such an extension, summarizing the state of discussions around their implementation, and briefly addressing their respective benefits and disadvantages. Further subsections address the question of compatibility with existing and emerging elements of the international climate regime, as well as, finally, possible compatibility issues with other multilateral regimes such as the international trade regime. A concluding subsection reviews the main takeaways from this analysis, inferring recommendations for policy makers looking to facilitate linkages between ETS in a manner that is consistent with other international regimes and supportive of eventual extension towards a growing and, ultimately, global carbon market.

2 Alternative Frameworks for Multilateral Linking

Generally speaking, a multilateral link is any link between three or more trading or crediting systems. Multilateral links with a limited number of parties may also be termed plurilateral, to distinguish them from those with large regional or global participation (Aust, 2007: 139). There is no upper limit to the number of parties: a multilateral link can, in theory, reach universal participation, and thus become a *de facto* global carbon market (Jaffe et al., 2009: 806), although political dynamics currently suggest that multilateral links will at best evolve gradually and remain limited in scope for considerable time.

Although unidirectional links between three or more parties may satisfy the formal definition of a multilateral link set out above, with changes in any one system affecting all other linked systems, the focus in this section will rest on linking in which trading flows are possible between all linked systems. Direct trading between all linked systems (multidirectional trading) is not a necessary



condition, as a single chain of direct links between systems will allow units to flow across all systems, including those that are not directly linked (see Figure 1 below). Still, a full multidirectional link allowing direct trading between all participating systems will certainly reduce transaction costs and improve market efficiency.

Figure 1: Full Multilateral, Chained Bilateral and Chained Unilateral Linking

Two separate pathways to a multilateral link are thus conceivable: absent some form of central coordination and planning, a link can become multilateral when partners in a bilateral link jointly or individually enter a new link to a third system, with further expansion of the market occurring over time whenever one or more of these systems links to additional systems. Each new link would typically become a matter of independent negotiation,[2] without a harmonized procedure ensuring consistency with previous links. Unless parties jointly engage in an effort towards greater centralization, the governance of such a multilateral link is likely to be heterogeneous, with governance functions exercised through various layers of bilateral arrangements that ensure only minimum ad-hoc coordination across the entire linked market.

Alternatively, where three or more parties decide to proceed with a greater degree of coordination, they may link through a common governance framework and potentially even align the design of their domestic ETS with a harmonized design ("model rule" or design template). Over time, additional parties can join this multilateral link to form clusters, or "clubs", of carbon markets, each in turn ensuring that its system is aligned with the common design and governance framework. Conditionality of accession based on minimum design and governance standards will serve to safeguard the compatibility of systems in the linked market, and ideally obviates the need for lengthy negotiations experienced in a less coordinated linking scenario. But compatibility of systems need not be the principal criterion for multilateral linking: where system heterogeneity is such that it precludes a traditional link, parties interested in carbon market integration can also explore restrictions or quotas to mitigate the potential impacts of problematic design differences, or altogether depart from reliance on compatibility and instead focus on comparability, using tiered adjustment mechanisms to establish the fungibility of units.

It should be noted, however, that there is no static dividing line between any of these pathways towards multilateral linking: a multilateral link that has evolved in an ad-hoc, organic fashion may eventually see political support for greater coordination and harmonization emerge in participating jurisdictions, ultimately resulting in the adoption of central rules and institutions. Conversely, a multilateral link that has grown out of a concerted effort with centralized governance structures may experience renegotiation of linking terms with

[2] In the course of such negotiations, parties will typically commit to revise or harmonize design elements of their ETS in order to reduce frictions in the operation of the link, and commit to consult or inform each other about any intended or expected changes in their respective systems, pledging cooperation in the joint governance of the link. An example for such a negotiated outcome is the "Agreement between the California Air Resources Board and the Gouvernement du Québec concerning the harmonization and integration of cap-and-trade programs for reducing greenhouse gas emissions" of 1 October 2013,

individual parties or accession of new parties that are unwilling to adhere to all elements of the harmonized framework, yet whose participation in the linked market is considered politically or economically so advantageous that individual divergences are considered tolerable; or finally, a multilateral link may initially be based on comparability adjustments and heavily discount units from less robust participants, yet in doing so incentivize systems to converge in levels of ambition and thus ramp up towards full equivalence over time. In all cases, both the participating systems and their cooperation through a multilateral link are dynamic processes rather than static endpoints.

In sum, like emissions trading itself, the practical implementation of multilateral linking will rarely evolve along the lines of pure conceptual ideas, more typically manifesting itself as a shifting equilibrium on a sliding scale between different theoretical extremes. For the purposes of this paper, however, the analysis of governance implications of different pathways to multilateral linking will focus on conceptually straightforward starting points, recognizing that insights from these theoretical ideals will nonetheless be relevant for hybrid approaches combining elements of different approaches.

2.1 Ad-hoc Multilateral Linking

In its simplest form, the extension from a bilateral to a multilateral link occurs when one or both parties to the existing link choose to enter into a link with a third system. If only one party decides to link with the third system, it will create a chain of bilateral links, resulting in both direct and indirect linkage between systems; if, by contrast, both parties to the bilateral link agree to link to the third system, the resulting link will be fully multilateral, with direct links between all parties (see below, Figure 2). Under either option, the new link will result in some degree of fungibility of carbon units, allowing the sale of allowances or credits from the third system into either of the two systems forming the original link, and vice versa. Consequently, it will also have implications for the original link by affecting the availability and quality of carbon units throughout all linked systems.

Such ad-hoc emergence of a multilateral link without prior harmonization or centralized coordination can yield some of the benefits of an expanded market, but will likely be accompanied by transaction costs that can impede unrestricted trading across all systems. At the same time, it introduces new risks and additional complexity into the governance of the linked systems. Each of the two pathways towards ad-hoc multilateral linking – chained bilateral and full multilateral linking – are discussed in greater detail in the following subsections. Additionally, a separate subsection will address the implications of extending the multilateral link beyond the initial constellation of three parties.

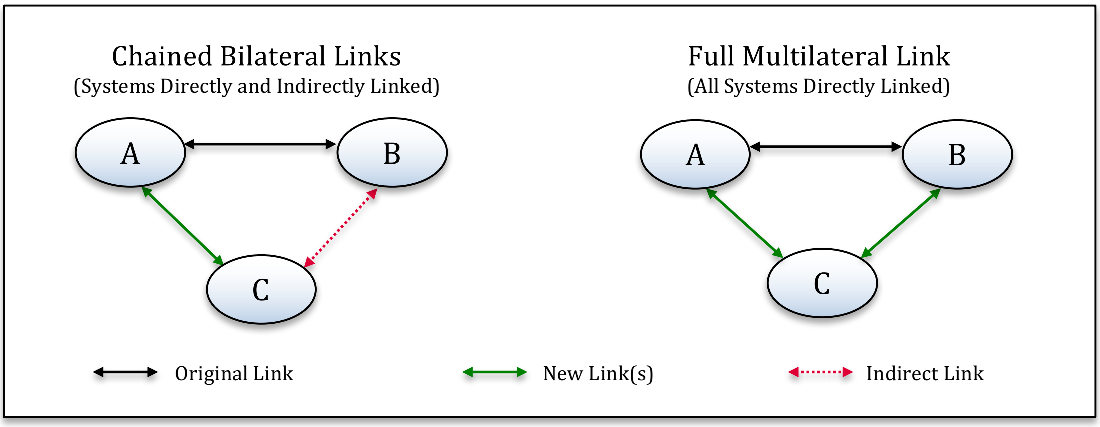


Figure 2: Chained Bilateral and Full Multilateral Linking

2.2 Multilateral Linking through Chained Bilateral Links

The unilateral decision by any one partner in an existing link to enter a new link with a third system – creating a chain of bilateral links – can have multiple ramifications for the original linking partner, both regarding the routine operation of the market and the management of changes to system compatibility. If the original link is conditional on the adoption or maintenance of specific design features (e.g. specified MRV standards or offset protocols), for instance, the party entering a new link may intentionally or unintentionally undermine this feature of the original linking arrangement without altering its own design.

An example can illustrate this risk of chained bilateral links: if the original linking partners – A and B in Figure 2 above – have agreed that neither system will introduce a price cap or safety valve, one party could still benefit from capped allowance prices by linking to a third system with such a feature in place. Because a price cap is a contagious feature (see, e.g., Tuerk et al., 2009; Hawkins et al., 2014; ICAP, 2015), it would *de facto* extend to all three systems: if A links to a third system, C, that has introduced a price cap, market participants in the original linking partner, B, will have access to a new and potentially unlimited supply of allowances at the capped price via A. Even if units are not fully fungible across all systems, the flow of units at capped prices from C to B can still occur through displacement of units from A, as its market participants meet demand by purchasing units from C or engage in arbitrage activities to profit from the price differential. In such a scenario of limited fungibility, unit flows through the indirect link would be limited by the relative size of systems (with the size of A being the limiting factor), and transaction costs may potentially be higher. Qualitative or quantitative restrictions in place between any of the systems will further limit the flow of units. Still, the unilateral decision to enter a link between A and C will result in an indirect link between B and C, and invariably have impacts on the original linked market.

In order to prevent subsequent links from undermining the integrity and operation of the original link, linking partners should from the outset seek to include provisions in their linking arrangements stipulating the conditions under which either party may unilaterally enter links with third systems, or at least setting out a consultation procedure and timeline so the original linking partner is left with sufficient time to consider the impacts of the new link, discuss conditions or changes that may need to be applied to maintain the viability of the original link, or – as a last resort – terminate the original link, potentially with an accelerated timeline. Such provisions are of particular relevance where the links are formal and based on a legally binding agreement; but even where the links are based on reciprocal unilateral linking (Mehling et al., 2009) and each partner can, in theory, withdraw from the link at any time, some type of understanding on the process for additional linkages will be critical to ensure the transparency and predictability needed to avoid disruptions.

2.2.1 Full Multilateral Linking

Alternatively, the second partner in the original linking arrangement (B in the example above) may decide to join the new link, creating a full multilateral link in which all three systems (A, B and C in the example above) are directly linked. If this occurs on an ad-hoc basis, that is: evolving individually (between A and C and between B and C) rather than through a coordinated decision of all parties, the links between each system will typically still be independent bilateral links, meaning that their existence is not mutually conditional, nor will conditions or governance elements set out therein necessarily be harmonized with the other links. For the same reasons that coordination is beneficial in bilateral relationships, some degree of coordination across parties will also be helpful in the newly formed multilateral relationship.

Given the convergence of political will facilitating links between all parties, such coordination should generally prove easier than in the foregoing scenario of chained bilateral links, where one of the original linking partners opts against a direct link to the new party (for instance because it does not consider the new party's ETS sufficiently robust). Where some form of coordination is politically viable, different governance functions can be employed to sustain the compatibility of systems, avoid disruptions to the market, reduce transaction costs, and generally foster transparency and mutual trust. Such governance functions range from information exchange, consultations, and external or peer review over co-decisions to a joint institutional platform (more generally: Görlach et al., 2015: 23 et sqq.). As in the case of links between only two parties, the greater the desired level of market integration, the more robust their common governance structures will need to be.

2.2.2 Extending the Ad-hoc Multilateral Link

What has been outlined above for the governance of a multilateral link based on the ad-hoc extension of a bilateral link applies to any further links expanding the multilateral link, be it by lengthening a chain of bilateral links or by increasing the number of parties to a full multilateral link. On the margin, however, the addition of each new system will increase the number of links between systems, adding to the complexities faced when seeking to govern the growing linked market. In practice, a multilateral link that emerges in an ad-hoc process will likely unfold organically, with parties linking jointly or individually to third systems over time. As the linked market expands, it will therefore combine features of both a chain of bilateral links and a full multilateral link. What all expansion pathways have in common, though, is a non-linear increase in direct and – as the case may be – indirect links between systems (see below,

Figure 3). Regardless of how systems link, the sum of direct and indirect links will always increase disproportionately along a series of triangular numbers (1, 3, 6, 10, 15, 21, and so on).

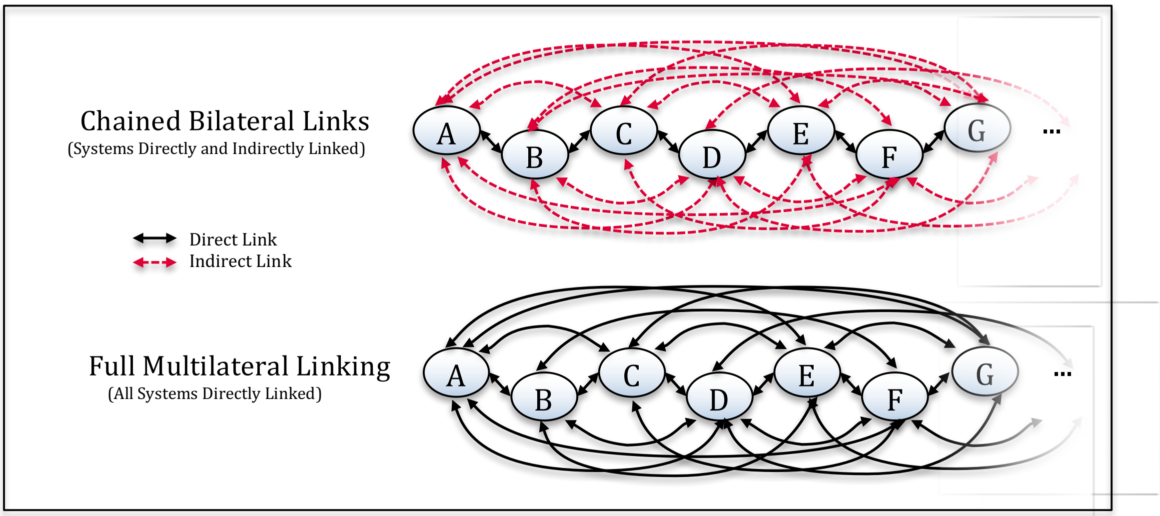


Figure 3: Rising Complexity with Ad-hoc Multilateral Linking

Because of the complexity accompanying a rapidly growing number of direct and indirect links, parties will have an interest in specifying minimum conditions and procedures for any future links entered by their respective linking partners. Where no such arrangement is agreed from the outset, parties may opt to reach an understanding retroactively as additional links are negotiated. In all cases, absent some form of centralized coordination, the growth in individual ad-hoc arrangements will quickly result in an unwieldy patchwork of parallel procedures and material stipulations. This dynamic should eventually create pressure towards greater coordination and some degree of harmonization under a shared governance framework. At the same time, as the market expands – and especially if it affords growing evidence of the benefits of linking – it is likely to exert a gravity pull vis-à-vis other systems through its size and the political weight of participating jurisdictions, potentially turning it into a hub or docking point for accelerated expansion (Haug, 2015: 11; for the EU ETS: Wettestad, 2014). At that point, however, the multilateral link progresses from evolving on an ad-hoc, case-by-case basis to a more centrally coordinated approach, which is described in greater detail in the next section.

2.3 Coordinated Multilateral Linking

As mentioned above, the rapidly growing complexity of ad-hoc linking arrangements, including potential spillover effects across indirect links, is likely to prompt consideration of the degree of coordination among parties aimed at governing, or at least guiding, the multilateral linking process. The same approaches that have been used to govern bilateral linking can also be harnessed for multilateral carbon market integration, ranging from soft coordination through mutual information procedures and the exchange of best practices to common design standards and formal institutions. Both varieties of governance deserve further elaboration with a view to the multilateral context.

Aside from the increased number of participants, soft coordination across three or more links will not be substantially different from coordination in a bilateral link, with the exception of a potential increase in the complexity of interactions and the resulting expedience of streamlining and centralization. Where, for instance, notification procedures in a bilateral relationship may function adequately without any central coordination, the proportional increase in procedural steps and data with a growing number of participants may favor the creation of centralized institutions, such as a central repository to facilitate the systematic collection of notified information, or a central administrative entity to support various procedures. Because of the cost advantages of economies of scale, a larger number of participants can lower the administrative burden and increase the value of joint institutions, thereby helping justify their cost. Still, while such streamlining can yield significant efficiency benefits, it also marks a partial departure from the tailored, individually agreed linking arrangements witnessed to date. Safeguards therefore need to be in place to prevent efficiency from undermining environmental integrity and a robust market. In particular, where coordinated governance facilitates participation, for instance by replacing lengthy negotiations with a more straightforward "opting-in" or accession process, adequate transparency standards and practices need to be in place to sustain confidence in the resulting market. Credibility of each individual system and the overall market is critical, especially if the multilateral link is to expand further by attracting newly adopted or emerging trading systems.

If parties decide to move beyond soft coordination, the differences between bilateral and multilateral linking will become more pronounced. For one, hard coordination – whether in a bilateral or multilateral setting – will also have fundamental implications for the sovereignty of participating jurisdictions, and their flexibility to tailor their ETS and each linking relationship to their specific and evolving circumstances. Exploration of more centralized coordination will hence depend on whether its benefits outweigh the loss of sovereign control, and thus require a similar balancing decision to that preceding a bilateral linking arrangement (Haites, 2014: 11) or, in effect, any other international commitment. Multiple factors will play a role, including not only the direct trade-off between reduced domestic flexibility and improved governance of multilateral linking (thereby improving transparency, liquidity and the overall efficiency of the market, and potentially facilitating further expansion), but also other aspects such as preexisting cooperation in trade or regional integration, desire to bolster multilateral cooperation on climate change, diplomatic pressure from linking partners, reputational benefits, and so forth (Green et al., 2014: 1066; Ranson et al., 2016: 285 et sqq.) In the end, the functional benefits of improved coordination will not necessarily be in question.

But many of the more extensive options outlined below have a bearing on contentious questions about moral responsibility and capacity that have also burdened international negotiations within the UNFCCC, for instance when it comes to centralized mechanisms for verification and oversight, or for evaluation of mitigation effort. Shifting such debates from the UN climate negotiations to a multilateral linking process, even one with more limited participation, is not going to eliminate the underlying political and distributional disagreements, and may thus prove equally difficult to negotiate.

Where parties can nonetheless muster the political will for more extensive governance cooperation, they can leverage a variety of approaches that may help improve the efficiency of the joint market and reduce the risk of unintended effects. Two options for centralized coordination of multilateral linking processes that have either already been applied in practice or have been proposed in the recent policy debate are harmonization of design and governance frameworks, and creation of common trading hubs. Each is set out in further detail in the following subsections.

2.3.1 Harmonized Design and Governance Frameworks

A particularly robust approach to coordination involves the alignment of ETS prior to linkage through a harmonized design and governance framework, limiting or eliminating differences between ETS. Because this ensures the greatest possible degree of compatibility (and will typically be part of a political process that is geared towards market integration), it can promote a favorable linking dynamic with a high degree of participation and coordination (Flachsland et al., 2009; Haites, 2014; Ranson et al., 2013). As they harmonize system design, parties can also agree on a common set of design and governance standards, procedures, and institutions, allowing for substantial consolidation and hence efficiency gains. Any third parties subsequently interested in joining the multilateral link under such a harmonized approach would first have to align their system design with the common template,[3] motivated by the benefits they would enjoy, such as aggregate cost savings and greater liquidity.[4] Different options exist to formalize each new accession to the link, with the most likely being either approval of a linking arrangement between all parties (see below, Figure 4), or a more streamlined procedure in which only a common institution, such as a centralized committee or secretariat, has the power to enter an arrangement with new linking partners on behalf of all existing parties.

At the subnational level, a harmonized design and governance framework has already been successfully implemented within the WCI, which issued a common design template in 2010 guiding participating states and provinces in the establishment of their ETS ("Design for the WCI Regional Program").[5] As a result,

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[3] Not all design features need to be harmonized to leverage the benefits of consolidation, however, and parties may even resort to quantitative and qualitative restrictions on units to address concerns arising from such differences (for further detail, see also Sec. 5.2.2.2). But while such variances may not fundamentally affect the governance of the multilateral link, they will lessen its overall efficiency (Jaffe et al., 2007).

[4] Additionally, a benefit from such cooperation could consist in mutual guarantees that members will not impose border carbon adjustments on each other (Keohane et al., 2015), although this latent sanctioning option has yet to be implemented in practice and is controversial in terms of its legality under international law.

[5] RGGI has chosen a similar approach, with the only difference that participating jurisdictions have not had to enter separate linking arrangements, but rather have been linked by virtue of implementing the RGGI MoU and Model Rule (see Sec. 2.1). Similarly, the EU ETS – by virtue of its

linking the two WCI jurisdictions that have set up an ETS – California and Québec – proved to be relatively straightforward process, with only minor currency-related differences requiring attention in the linking arrangement. So far, the link is only bilateral, but once the province of Ontario has set up an ETS pursuant to the WCI design rules, it should be able to enter a direct link to the ETS in California and Québec without any major design adjustments.

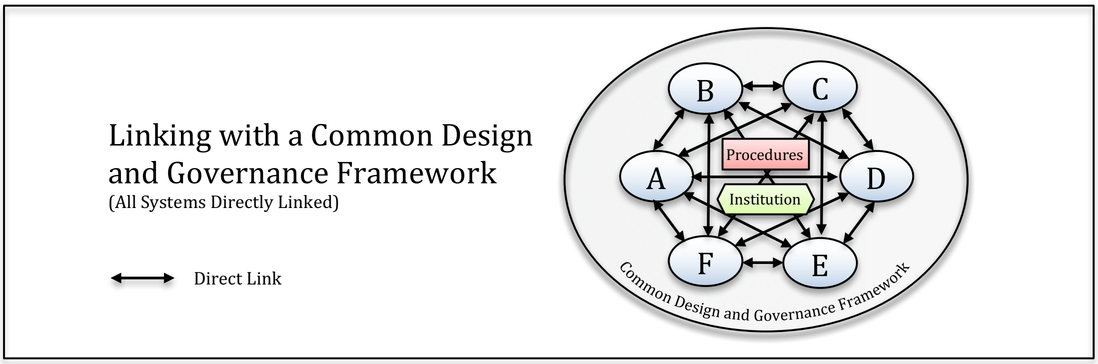

Figure 4: Linking with a Common Design and Governance Framework

Not only the ETS design as such, but also the linking arrangements should ideally be harmonized across the multilateral link in order to reduce inconsistencies and streamline their operationalization. Once the linking arrangements set out identical notification and consultation procedures, for instance, their implementation can be merged into one materially and temporally coherent process rather than a rapidly growing number of heterogeneous acts distributed across time. Because of the requisite level of coordination preceding development of a harmonized framework, this approach is also more amenable to the establishment of common institutions, such as a common registry or auctioning platform, which will further help consolidate individual governance elements and thus reduce overall complexity. As can be observed in cases such as the WCI, common institutions to administer the joint market can become an intrinsic feature of the harmonized design and governance framework: there, parties agreed to create a central institution – WCI, Inc. – to carry out a number of oversight, support, and management functions.

Just as a robust bilateral link should set out transparent procedures to manage systemic change and external shocks, the harmonized linking framework should also anticipate further evolution of the market and its broader economic and political context to ensure compatibility over time (Haites et al., 2009). If system designs begin to diverge in ways affecting the viability of the multilateral link, the properties that render a harmonized design framework beneficial for multilateral linking – namely its ability to consolidate procedures and institutions

size and political weight – has served as a template for several ETS that have been established around the time of or after its entry into force, for instance in Norway or Switzerland, as well as in the accession candidate countries. In these cases, however, implementation of EU ETS legislation is mandatory as part of implementing the *acquis communautaire*, be it by virtue of EEA membership or the accession agreements.

at a central level – can become compromised. As with bilateral links, a strong case can be made for requiring that any design or governance changes be agreed jointly and implemented across all linked systems in order to safeguard the coherence and consistency of the overall framework.

Still, while increased harmonization between systems would offer a number of clear benefits, it is not reflected in the current trend towards greater heterogeneity in carbon pricing instruments and differences in ETS design (Marcu, 2015). Each trading system is the outcome of a complex and highly contingent policy process with numerous stakeholders and affected interests, whose accommodation will usually take precedence over attempts to align design features with other jurisdictions or a common design template. Where political support can be mustered nonetheless, harmonization will be easiest if it can occur at the time the trading system is first established. Subsequent adjustments – at least those affecting fundamental design elements – will be more difficult, both because of path dependencies in the design and implementation of any ETS, and the need to honor political compromises entered with domestic constituencies in the initial establishment process. Experience suggests that only smaller systems with a dominant interest in linkage are willing to cede proprietary design features in order to facilitate a link; it is doubtful that large established systems will have a similar inclination to implement far-reaching changes. The increased difficulty of aligning vastly different systems once they have been made operational underscores the usefulness and importance of early cooperation on capacity building and best practices in emissions trading (Burtraw et al., 2013), such as the efforts promoted by the International Carbon Action Partnership (ICAP) and the World Bank Partnership for Market Readiness (PMR). Directly or indirectly, these initiatives will also promote some degree of harmonization and standardization of trading features.

Existing cases in which parties have opted for a common design and governance framework show that the required level of coordination is most likely to emerge under conditions of geographic proximity and a history of economic and political cooperation (Tuerk et al., 2009; Ranson et al., 2016). Membership in regional organizations of economic integration or environmental cooperation would thus be favorable predictors of future openness to multilateral linking with design and governance harmonization, given the already developed channels for negotiation and familiarity with joint institutions. And indeed, current markets integrating multiple jurisdictions have either emerged within a sovereign state or supranational organization, such as the EU ETS and RGGI, or in the context of prior regional cooperation, such as the trading system created under the WCI. What this suggests is that future clusters of linked markets could emerge in the vicinity of influential policy leaders such as the EU and China, or in cooperative forums such as North American Free Trade Agreement (NAFTA) or Northeast States for Coordinated Air Use Management (NESCAUM), the Association of Southeast Asian Nations (ASEAN) or Mercosur and the Andean Community (see below, Figure 5).

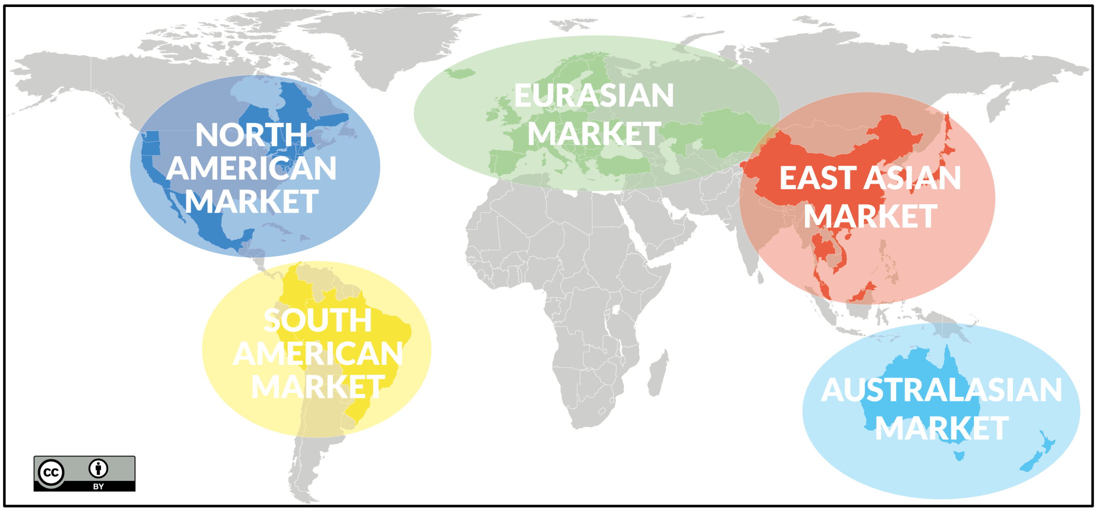

Figure 5: Possible Emergence of Carbon Market Clusters, or "Clubs"

Because the harmonized terms and conditions would be largely set by the initial parties in the linked market, subsequent participation, while voluntary, would require embracing the common design and governance features, or at least those features which have been designated mandatory for the integrity and operation of the multilateral link. Accordingly, jurisdictions joining over time would become "takers" of the common ETS design as a condition of membership in the "club"[6] (Marcu, 2015; Keohane et al., 2016). As the joint market expands, along with the aggregate political and economic weight of its participating jurisdictions, the cluster of trading systems may set in motion a "snowball" dynamic where new and emerging systems have a significant political and economic incentive to join. Yet while such a proliferation of carbon trading clusters or clubs would be favorable in terms of improving market efficiency within the regional coverage of linked systems and also potentially fostering competition among systems on system design and governance, it may also result in the unintentional creation of a path dependency of its own, with each cluster becoming increasingly locked into its proprietary system design and governance approach as it expands. Harmonization within clusters may thus unintentionally impede harmonization between clusters. As the next subsection shows, however, another approach to multilateral linking may help bridge entrenched differences between individual markets, and potentially even clusters of linked trading systems.

2.3.2 Emissions Trading Hubs

Where ETS development is not coordinated from the outset, the political economy will usually be such that systems evolve from very different starting points and along varying timelines, reflecting diverse socioeconomic circumstances. Heterogeneity of system design is therefore an intrinsic tendency of any carbon market, and is expected to increase – rather than diminish – going forward (Marcu,

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[6] The economic concept of a club as a "voluntary group deriving mutual benefits from sharing the costs of producing an activity that has public-good characteristics" and with sufficiently large gains from participation "that members will pay dues and adhere to club rules in order to gain the benefits of membership" (Nordhaus, 2015: 1340; similar: Victor, 2015) can be applied both to a harmonized design and governance framework with membership conditional on adoption, as well as the idea of emissions trading hubs outlined in the next subsection.

2015; Metcalf et al., 2012: 110). In such a scenario, jurisdictions will rarely be ready to explore linkage at exactly the same time, calling for greater flexibility than a fully harmonized approach would generally allow. Parties may also be unwilling to surrender sovereign control over the design and governance of their ETS to a centralized decision making process despite the benefits greater harmonization would allow. In such cases, and where design choices and governing institutions are already too deeply entrenched to permit ready harmonization (see e.g. the example of ETS clusters, or "clubs above), an alternative approach to facilitate multilateral linking can involve the creation of a common hub. One or more centralized hubs could be established at regional or global level by a group of jurisdictions, such as the EU and its linking partners, or by an existing international forum such as the Major Emitters Forum (MEF) or the International Carbon Action Partnership (ICAP).

Unlike a harmonized design, which would guide and possibly constrain jurisdictions in the design of their ETS and – as just outlined – ideally do so from the outset, a hub could emerge at any point in time and create a bridge between systems with potentially very different designs. An essential advantage of such a hub, therefore, would be that it allows jurisdictions to retain greater control over their own ETS, especially if it only sets out minimum definitions, standards and procedures (although if parties are willing, they could also adopt a more sophisticated system of rules and institutions, potentially as a further step as the hub matures). When different ETS are ready to link with other systems, they can "dock" into this hub, provided they meet all the conditions specified for accession. As a result of opting in, they would become linked to all other ETS that have already joined the hub, as well as any future systems that meet the entry requirements and decide to join.

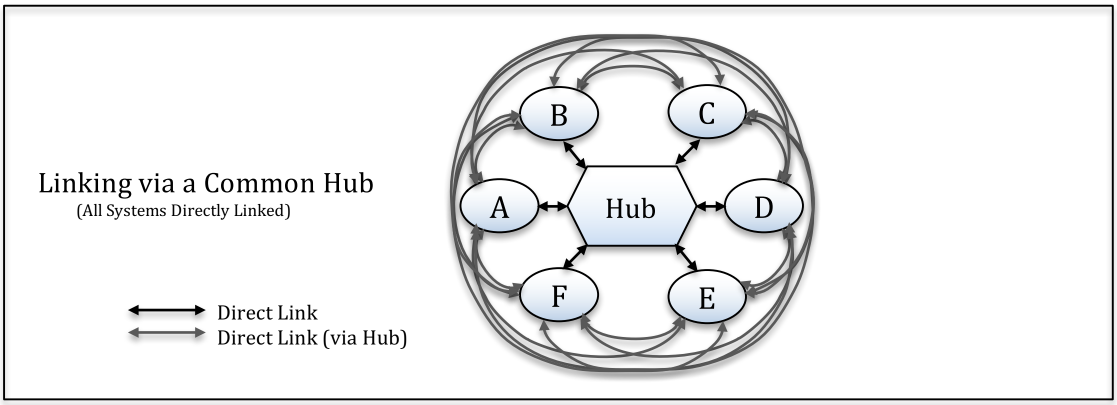

Figure 6: Linking via a Common Hub

Rather than addressing the conditions of a link on a case-by-case basis, with its attendant complexity, transaction cost, and heterogeneous outcomes, they could be set out in a blanket list of participation criteria, which, when met, either results in automatic membership or sets in motion a process of accession. Conditions for accession to the hub could consist of minimum requirements regarding the stringency and ambition of participating ETS, as well as minimum design specifications. Conceivably, these could include a "minimum list" of design requirements, such as transparency and MRV standards; a "negative list" precluding certain problematic design features, such as an intensity target; or a "positive list" of acceptable or recommended design features (Keohane et al., 2016). Beyond such joint definitions and standards, a hub could also offer specific services to facilitate trading with other participating ETS, such as a mechanism to track allowance transfers through the hub and provide relevant information to the domestic registries of each acceding jurisdiction.

Entry barriers to accession could be reduced by simplifying the process of joining the hub, for instance by rendering it automatic upon adherence to the membership criteria and a simple application procedure, possibly involving a vote by a central decision-making body with delegated powers.[7] A specified waiting period would allow other parties, a central institution or third-party verifiers to ascertain whether the accession conditions have been met, or – both in the case of accession and withdrawal – would give market participants an opportunity to prepare for potential price and revenue impacts. More formal accession procedures could be modelled after those in use for regional organizations of economic integration, requiring either formal ratification by all parties, as is the case with EU enlargement, or formal ratification by the acceding party and a formal approval process by a central entity with legal personality and conferred powers, as is the case in WTO accession procedures.[8] While the latter options will offer greater legal certainty, they also entail a more onerous process, are less easily modified if circumstances require, and may even limit the scope of eligible participants.[9] As with bilateral linking, interest in simplicity and flexibility tends to therefore compete with the objectives of predictability and robustness.

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[7] An example is the International Monetary Fund (IMF), which requires a vote by its Board of Governors to decide on an application for membership by a third country, without case-by-case negotiations or parliamentary ratification procedures, see Art. II Sec. 2 of the Articles of Agreement of the International Monetary Fund, Bretton Woods, New Hampshire, 22 July 1944, in force 27 December 1945, in conjunction with Sec. D-1 of the Rules and Regulations of the International Monetary Fund, 62nd Issue, May 2011. As a condition for membership, countries are required to share information on financial, fiscal, economic, and currency exchange policies, adhere to a code of conduct found in the Articles of Agreement, pay a quota subscription, and refrain from restrictions on exchange of foreign currency. See also IMF, 2015.

[8] Article XII of the Agreement Establishing the World Trade Organization (WTO Agreement), Marrakesh, 15 April 1994, in force 1 January 1995, affords "[a]ny state or customs territory having full autonomy in the conduct of its trade policies" eligibility to accede to the WTO "on terms agreed between it and WTO Members"; these terms are negotiated with a Working Party established by the General Council and open to all existing Members, and through bilateral negotiations with any interested Members, resulting in an "accession package" with schedules of market access commitments. Once both the Working Party's Draft Report and Protocol of Accession and the market access commitments in goods and services are completed to the satisfaction of members of the Working Party, the "accession package" is adopted at a final formal meeting of the Working Party. If either the General Council or the Ministerial Conference approves the package, a is enshrined in a Protocol of Accession which the applicant can sign and ratify. Following a period of 30 days after notification of ratification, the applicant becomes a full Member of the WTO. See also WTO, 2015.

[9] Limitations can arise with regard to subnational jurisdictions, for instance, because international and domestic constitutional law generally deny them international legal personality and thus the ability to enter formal international commitments. In other cases, such as the United States, political divisions tend to prevent the 2/3rd majority vote in the Senate required to ratify an international treaty, thus becoming a *de facto* barrier to a multilateral link based on formal international treaty-making.

Even ETS with substantial differences in design and level of ambition could be accommodated in a common hub if the latter includes mechanisms to manage and account for such divergence. Contagious design features or deficiencies in the environmental integrity of a system might normally raise doubts about the compatibility of systems and therefore preclude a link. Their undesirable effects on the linked market – including the possibility of large asymmetrical allowance flows in the event of unforeseen developments or even moral hazard for systems to weaken their environmental integrity in order to increase net revenue from trading – could be partially curtailed or addressed with quantitative restrictions that limit the allowance flow, for instance by setting a quota on net allowance transfers.[10] Once a volume of allowances equal to the specified quota has been transferred from one ETS to any other ETS linked to the common hub, no more allowances could be purchased from the originating system, at least until its entities have purchased allowances from other systems and thereby reduced the balance of net allowance outflows. In such a framework, the quota could apply in perpetuity, or be reset in specified intervals, for instance annually or at the outset of multi-year trading periods, allowing new net transfers. Critically, while such a quantitative restriction would contain any distributional impacts resulting from the accession of differently robust ETS to the common hub, thereby making the likely effects more predictable and potentially helping assuage political concerns (Roßnagel 2008: 397), it also comes at a price, namely limiting the ability of the joint market to allocate mitigation efforts and thus diminishing the benefits of linking (Jaffe et al., 2007; Lazarus et al., 2015). Moreover, while these mechanisms allow for linkage between systems with some heterogeneity – where compatibility has been considered insufficient to warrant a full and unrestricted link – they still presuppose a minimum degree of compatibility, which in turn is based on the assumption that fungibility of units derives from their equal, or largely identical, mitigation value. If the current trend towards greater ETS heterogeneity continues to increase, such assumptions may become increasingly difficult to support.

An alternative mechanism to facilitate linking between ETS with different system designs and ambition levels departs from this assumption of fungibility of mitigation effort, and instead is based on a comparison of effort and corresponding adjustments. It involves the use of discount factors, ratios or exchange rates, which can be applied in a way that favors robust systems and penalizes systems with weak integrity, be it insufficient environmental ambition, lacking credibility of enforcement, or other problematic design features (Burtraw et al., 2013: 6). Units from systems that are considered insufficiently robust might thus be subject to a discount or disadvantageous exchange rate, reducing their value for compliance in other systems without altogether sacrificing fungibility.

[10] Such a quota system would be similar to a gateway mechanism proposed to facilitate links between jurisdictions that are parties to the Kyoto Protocol and have entered quantitative emission limitation and reduction objectives in its Annex B, and jurisdictions that have adopted no such international commitments. In that context, the mechanism would have created a repository for Assigned Amount Units (AAUs) from the Annex B party, with any allowance transfers to non-Annex B jurisdictions resulting in AAUs being stripped and held in the repository, whereas any incoming allowances would be assigned an AAU from this repository. In net terms, such a clearinghouse would have to ensure that net allowance flows can only take place from Annex B parties to non-Annex B parties; see e.g. Sterk et al., 2006: 63 et sqq.

Not only would such a ratio or exchange rate reduce the attractiveness of what might be considered "subprime carbon units" (Chan, 2009) and thereby limit unit flows across systems, capping distributional impacts in a way similar to quantitative or qualitative restrictions, but they would also create an incentive for systems to improve their environmental integrity so that their units may be traded without penalty. Also, proponents argue that establishing such an approach that provides fungibility of units through comparability of effort rather than equalization of units would make it politically more viable and quicker to implement (Widge, 2015).

Although each ETS could theoretically introduce its own set of ratios or exchange rates and apply these independently to units from other systems, the ensuing patchwork of unilateral approaches would result in similar complexity as uncoordinated multilateral linking. It would also create substantial opportunities for arbitrage, which – while potentially useful to secure liquidity in narrowly traded markets – would afford profits at a scale that may not represent the best allocation of resources. Reflecting the practice in modern currency markets, therefore, a harmonized framework of ratios or exchange rates would significantly increase transparency and lower transaction costs. Also, the process of defining exchange rates is complex, and its outcome will have significant impacts on the direction and volume of unit flows, and therefore on the distribution of abatement in different jurisdictions, and of course on the economic efficiency of this distribution. If they are set wrong, they can thus undermine the economic benefits of linking and even weaken the overall environmental outcome (Lazarus et al., 2015).

Probably the most comprehensive exploration to date of a hub-based architecture for carbon trading systems employing exchange rates is the concept of "Networked Carbon Markets" (NCM) advanced by the World Bank Task Force to Catalyze Climate Action (see below, Figure 7). It would introduce a multi-tiered, risk-based carbon asset rating process to guide the central definition of exchange rates and provide a frame of reference for carbon value (World Bank, 2013). Jurisdictions that have introduced carbon markets could voluntarily "opt in" if they agree to having their carbon units (or "carbon asset classes") rated by independent private rating agencies on the basis of a standardized process and formula.[11] At the heart of this proposal, thus, lies the independent risk-based evaluation of different carbon trading initiatives to determine their "mitigation value" (MV), a value distinct from the "compliance value" (CV) assigned by a national or international regulator, or the financial value (FV) established through supply and demand, liquidity and other factors in the market (Macinante, 2015). This assessment of mitigation value would be dynamic and updated periodically to reflect changes in the underlying circumstances. As proposed, it would not only take into account risks relating to the actual policy in question and its characteristics, but also risk relating to the characteristics of the broader climate policy framework in the jurisdiction and its contribution to global climate change (World Bank, 2014b).

[11] The proposed formula reads as follows: Rating = f {program rating, credibility rating, ambition adjustment} (Hughes, 2014); its components are explained in greater detail in the following paragraph.

Underlying this approach is the notion that linked carbon markets can only expand beyond individual clusters if they can draw on a common metric such as the relative mitigation value of carbon units, taking into account both the quality of the program generating those units as well as the jurisdiction-level target and progress towards global climate change mitigation (World Bank Group, 2014a). Specifically, it breaks these three factors down as follows:

- *Program Level Rating*: Carbon integrity risk, based on the risk that the policy or program will not achieve its stated carbon emission reduction target;
- *Jurisdiction Level Rating*: Policy and regulatory risk, based on the credibility of the jurisdiction's own stated climate change mitigation target or pledge, and the risk that it will not meet that target;
- *Global Level Rating:* Adjustment for ambition, or relative climate mitigation contribution.

Part of this rating exercise would thus involve a probabilistic *ex ante* assessment of the likelihood that a specified greenhouse gas mitigation objective is achieved. For the ambition adjustment, in turn, some observers have suggested measuring the mitigation effort embodied in a tradable unit against an empirical benchmark, such as its contribution to achievement of an Intended Nationally Determined Contribution (INDC), and the extent to which that INDC represents an equitable share of the collective effort needed to meet an agreed target such as limiting anthropogenic warming below 2°C (Kartha, 2014; Keohane et al., 2015). Different approaches to the rating process are under discussion, although observers seem to broadly agree that it should be based on an approved, transparent and consistent methodology, applied by independent rating agencies that are themselves accredited based on uniform criteria, and remunerated in a way that avoids conflicts of interest.

A set of designated institutions would provide the common hub, and render the foregoing rating system operational. In particular, an International Carbon Asset Reserve (ICAR) would convert ratings into exchange rates, and serve as a market maker to improve liquidity. Additionally, by being issued a specified share of units from each participating jurisdiction as a condition of membership,[12] ICAR could also help pool risk-mitigation efforts by its participants, for instance helping address price extremes by absorbing or releasing unit supplies in the event of market shocks.[13] Smaller markets, in particular, would benefit from the increased liquidity and buffering effect afforded by such an institution, while

[12] On options for the capitalization of the reserve, see Füssler et al., 2015: 16.

[13] In the event that a defined surplus of units is exceeded in any participating jurisdiction, indicated by a price or volume trigger, ICAR would be required to buy units from that jurisdiction if the local regulator makes a corresponding request. The acquisition of units would occur through an ascending auction, where the price at which permits are purchased is the lower the market price or the rating-based price, whichever is lower; conversely, if a jurisdiction experiences a demand shock and prices exceed a specified threshold, ICAR would be required to lend units back to the regulator, provided certain eligibility criteria for borrowing have been satisfied. In order to safeguard the environmental integrity of the affected system, its regulator must commit to returning the borrowed if it does not wish to endanger its rating.

larger markets would likely value the strategic benefit of a backup source for unit reserves in case domestic price and risk management mechanisms prove insufficient. But by having access to a reserve of pooled units, ICAR could also be empowered to address risks such as non-permanence of carbon units, underperformance of mitigation activities, or invalidity of traded units (Füssler et al., 2015: 11). In addition to ICAR, the concept of Networked Carbon Markets also proposes establishing an International Settlement Platform to track cross-border trading, manage information and increase market transparency, help manage counterparty risk, and exercise certain supervisory functions to prevent fraud.

Importantly, the rating approach would allow continuous adjustments to the mitigation value of participating jurisdictions, allowing changes in the underlying circumstances to be reflected in the linked market without necessitating complicated changes to the entire framework. Where needed, adjustments could occur in periodic intervals, or triggered by external developments, such as changes in macroeconomic indicators. Theoretically, the ability to adjust mitigation value on the basis of a rating would even allow linkage to policies other than an ETS, such as carbon pricing through taxes, or even regulation through performance standards. Although this gives rise to its own set of challenges, for instance the need to translate a fixed price or carbon-intensity rate standard into absolute emissions, it does offer new avenues for cooperation in an increasingly heterogeneous landscape of domestic climate policies, and could therefore deliver even greater efficiency gains than a multilateral link purely between ETS (Metcalfe et al., 2012).

Yet while the departure from an approach premised on the compatibility of systems and stipulating the equivalence of units could offer interesting perspectives such as those described in the previous paragraph, the need to compare mitigation efforts of participating jurisdictions will also give rise to unavoidable debate, and may limit willingness to join the hub. Comparison of efforts raises significant political and methodological challenges, and these same challenges have also contributed to acrimony and slow progress in the UNFCCC negotiations. Unsurprisingly, the originators of this proposal have themselves conceded that the idea of a rating process, especially one that scrutinizes the ambition of domestic climate change mitigation efforts, will be "very controversial" (World Bank, 2013).

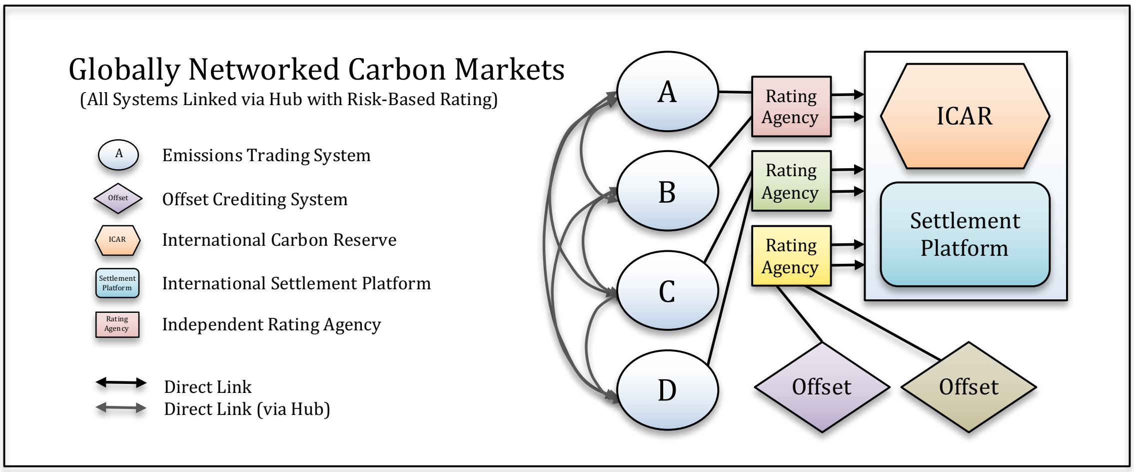

Figure 7: Globally Networked Carbon Markets (based on Hughes, 2014)

2.4 *Hybrid Approaches*

Finally, as mentioned earlier in this section, the observed trend towards heterogeneity of domestic and regional mitigation efforts will also carry over into multilateral linking and diminish the likelihood that any such linking can proceed within pure conceptual categories. Rather, different pathways to multilateral linking are likely to evolve in parallel, giving rise to potential overlap. In a multilateral link between geographically adjacent jurisdictions which have all implemented a common design and governance framework, for instance, one participant may nonetheless decide to enter into a bilateral link with a third jurisdiction. A number of factors could motivate such individual action, for example close historical ties or an overriding strategic interest. As with the examples of ad-hoc linking described above, such individual links emerging out of a context of multilateral linking will result in a number of indirect links and therefore contribute to uncertainty and complexity in the overall market (see below, Figure 8). This underscores the overriding importance for any linking arrangement, whether bilateral or multilateral, to anticipate future linkages entered by its parties, and to set out conditions or guidelines to promote transparency and limit negative impacts. Other than that, however, the governance needs will not differ materially from those already described in the context of bilateral linking as well as the various pathways to multilateral linking above.

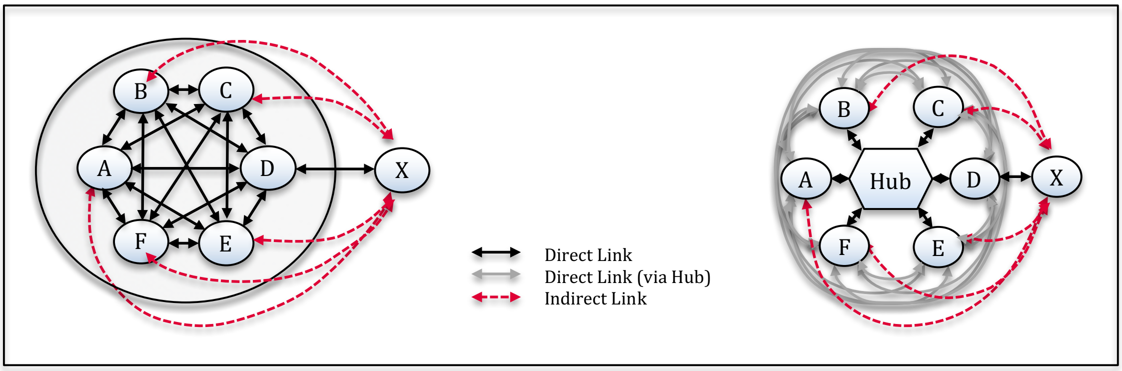

Figure 8: Asymmetric Expansion of a Carbon Market "Cluster" or "Hub"

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