NOTA DI LAVORO

64.2014

The Politics of Market Linkage: Linking Domestic Climate Policies with International Political Economy

By **Jessica F. Green**, Case Western Reserve University, USA
Thomas Sterner, Environmental Defense Fund and University of Gothenburg, Sweden
Gernot Wagner, Environmental Defense Fund and Columbia University's School of International and Public Affairs, USA

Climate Change and Sustainable Development
Series Editor: Carlo Carraro

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Summary

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Keywords: Climate Change, Global Warming, Cap and Trade, Carbon Tax, Linkage, Climate Finance, Political Economy, Kyoto, Copenhagen, Paris

JEL Classification: Q5, Q54, Q58

For helpful comments and discussions, we thank Richie Ahuja, Dan Bodansky, Dallas Burtraw, Dan Dudek, Tom Hale, Alex Hanafi, Jennifer Haverkamp, Nathaniel Keohane, Robert Keohane, Josh Margolis, Gib Metcalf, Erica Morehouse, Michael Oppenheimer, and Bryce Rudyk, as well as participants in the Global Institutions for Climate Finance seminar at New York University Abu Dhabi and the Applied Environmental Economics seminar at the Environmental Defense Fund. We thank Katherine Rittenhouse for excellent research assistance. All remaining errors are our own.

Address for correspondence:
Gernot Wagner
Environmental Defense Fund
18 Tremont St, Ste 850
Boston, MA 02108
United States of America
Phone: (617) 723-2996
Fax: (617) 723-2999
E-mail: gwagner@edf.org

The politics of market linkage:
Linking domestic climate policies with international political economy

Jessica F. Green, Thomas Sterner, and Gernot Wagner [1]
3 April 2014

Abstract

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[1] The authors are, respectively, an assistant professor of political science at Case Western Reserve University, an acting chief economist at the Environmental Defense Fund and professor of economics at the University of Gothenburg, and a senior economist at the Environmental Defense Fund and adjunct associate professor at Columbia University's School of International and Public Affairs.

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Corresponding author: gwagner@edf.org.

"There is...no doubt in my mind that we will progressively realize that the most cost effective way to implement that global regulation is through linking these individual [emissions trading] schemes, via common standards and rules that provide enhanced liquidity and fungibility while avoiding double counting."

—Christiana Figueres, Executive Secretary, UN Framework Convention on Climate Change

1. Introduction

Although the rate of climate change seems to be accelerating and the human role and eventual impacts are becoming ever clearer (IPCC 2013), the international political processes for addressing it appear to have slowed down. The 'top-down' approach to climate change—where states jointly agree to a schedule of emissions reductions through an international treaty—has fallen out of favor. The Kyoto Protocol is flagging. Its recent extension through 2020 was largely *pro forma*. The number of parties is shrinking, and major emitters, including Canada, Japan and Russia, have indicated that they will not sign on for another round of commitments. In theory, states should collectively commit to reducing emissions in order to avoid free riders (Olson 1965). However, despite the Durban Platform decision to negotiate a new agreement by 2015 "applicable to all", the climate negotiations demonstrate that such a goal is difficult to realize in practice.

The purpose of an international agreement is to provide incentives for collective action by curbing free-riding. It may therefore appear paradoxical, that nations are so averse to a climate treaty but have begun to adopt policies to address climate change unilaterally. These include cap-and-trade systems, carbon taxes, commitments to reducing energy intensity, forest codes to combat deforestation, and a host of policies aimed at improving energy efficiency, and developing and deploying renewable energy sources. Cap-and-trade systems, in particular, are becoming increasingly prevalent. The European Union's Emissions Trading Scheme (EU-ETS) is the largest such market, but other markets include Australia, New Zealand, California, Canadian provinces, and the Regional Greenhouse Gas Initiative (RGGI) in the Northeast of the United States. Soon South Korea will launch a national trading system, and others—most significantly, some Chinese cities and provinces—are poised to follow (GLOBE International, 2014; IETA 2012; Grubb 2013). All told, 10% of the world's population and 35% of the world's GDP is regulated by some form of domestic or regional cap-and-trade system today.[2]

This emergence of a patchwork of national and sub-national carbon markets has prompted calls for a "bottom-up" climate architecture (Rayner 2010; Falkner, Stephan & Vogler, 2010; Victor 2011). Since countries cannot be compelled to reduce through an international treaty, some observers argue that a more feasible approach, at least in the short-term, is to let countries or sub-national governments set the pace. This has also been the recent *de facto* negotiating position of the U.S. delegation to UN climate talks.

[2] This calculation includes the EU, Australia, New Zealand, California as well as ten northern U.S. states covered under the Regional Greenhouse Gas Initiative (RGGI) and is based on 2010 World Bank population and GDP statistics. The World Bank (2013) estimates that 7% of global emissions are governed by a carbon price.

Linkage plays a prominent role in such a bottom-up architecture. Cap-and-trade systems lend themselves particularly well to linkage (Burtraw *et al.*, 2013; Jaffe, Ranson & Stavins, 2010; Jaffe & Stavins, 2008; Metcalf and Weisbach, 2012; Ranson & Stavins, 2012; Stewart *et al.*, 2013). Proponents argue that linking individual cap-and-trade systems would allow a global carbon market to emerge organically: no top-down cap would be necessary. Chinese carbon allowances could be bought and sold on European markets, or vice versa. Linkage would produce both economic benefits—more reductions at a cheaper cost—as well as political ones—providing an end run around "global warming gridlock" that has all but stalled the intergovernmental process (Victor 2011). Indeed, some linkage arrangements are beginning to emerge or are already in place, such as between California and Quebec as well as between the EU and Norway, Iceland, Liechtenstein and Switzerland. There are also links created by the flexible mechanisms such as the Clean Development Mechanism (CDM), Joint Implementation (JI), and Reducing Emissions form Deforestation and Forest Degradation (REDD). Additional links both among existing developed-country and even between developed and developing countries are being explored, in particular with China.

The logic of linkage is based on the simple premise that the marginal cost of emissions abatement is lower in some jurisdictions than in others. Since climate change is a global problem, the location of emissions reductions is irrelevant. Linking markets leverages this cost differential to provide cheaper ways for reducing emissions. Cost differentials are greatest between developed and developing countries; in these linkage arrangements, developed countries, in effect, pay for reductions in the developing world. In theory then, linking carbon markets should go a long way toward tackling climate change. Such an approach would increase the total amount of reductions, lower their total cost and increase financial flows from developed to developing countries that are often associated with such levels of reductions.

However, we argue that as the potential benefits of linkage grow—by leveraging differences in marginal abatement costs across linked jurisdictions—so do the political obstacles. The advantages to linking rest on the age-old principles behind the benefits of trade: comparative advantage. There is however one fundamental difference, the "goods" to be traded are the absence of emissions, as measured by emissions credits. The number of credits each country "needs" is a subjective and political question. Moreover, the linkage between countries must be established through political agreement, through which parties agree to the baselines against which abatement is to be counted. In the end, these political challenges may undermine the economic and environmental advantages of linkage. Specifically, we identify four political obstacles faced by bottom-up approach to climate policy: potential for gaming of overall targets; objections to large-scale transfers to developing countries; the need for high levels of regulatory coordination; and potential incompatibility with related domestic policy objectives.

In the final analysis, these obstacles will reproduce many of the same problems that have stymied intergovernmental negotiations.[3] The result may be a lower level of emissions reduction, as countries may have to compromise on environmental efficiency in order to achieve political feasibility. Helm (2003) suggests the effect on trading on emissions levels is ambiguous, since less environmentally-concerned countries would elect to have less ambitious targets, given the option to trade their allowances.[4] We demonstrate that the four obstacles might lead toward a compromise on emissions reductions, in favor of political expediency.

Our argument proceeds as follows. First, we briefly explain how linkage works. Second, we present the standard economic argument for linkage, emphasizing the key element: differential marginal costs of abatement. We show that a world of linked carbon markets can, in theory, produce the same level of abatement at lower costs than a world of separate domestic markets. (Conversely, linked carbon markets could achieve more abatement at equal cost.) Third, we lay out four political obstacles that work against the economic logic for linkage. Finally, we argue for a gradual approach to linkage, emphasizing the need for building strong institutions and framework for subsequent strengthening of carbon markets.

2. The mechanics of linkage

In a cap-and-trade system, each domestic market distributes allowances to regulated entities within the jurisdiction. Total allowances are capped at a certain level, which is decided by the government. If a given entity emits more than its allowances, it will need to purchase additional allowances from other entities that have a surplus.

Linked jurisdictions can trade in credits or allowances, or both.[5] Allowances are the emissions certificates apportioned under a particular cap. Direct linkage of two cap-and-trade systems would enable allowances from one system to be used in the other. Credits differ from allowances in that they are usually generated through project-level activities and are often outside the geographic scope of the cap-and-trade system. They come from third party suppliers, and are also often voluntary. The Clean Development Mechanism (CDM) of the Kyoto Protocol is an example of a source of credits. It allows developed countries to meet their reductions requirements under Kyoto through the purchase of credits generated by emissions reductions activities undertaken in developing countries, which are not obligated to reduce their own emissions. Offset credits can also be generated domestically, though they often fall outside the purview of the cap-and-trade system. Importantly, there is no theoretical ceiling on offset credits—they could be generated in virtually endless supply—unless each jurisdiction chooses to limit the amount of allowable credits.

[3] Weitzman (2013) develops this argument in the context of negotiating quantitative limits versus a uniform global carbon tax. He concludes that negotiating a globally coordinated cap-and-trade system requires agreement on caps for each country, whereas negotiating a uniform tax only requires negotiating one price.

[4] See also Flachsland et al. (2009) and McKibbin et al (2008) for earlier caveats to linkage.

[5] See Lubowski (2012) for a detailed description of the linkage mechanism, with the application to Chile.

Linkage increases liquidity among linked jurisdictions. Links may be one-way or two-way, direct or indirect, and they may include both allowances and offset credits, or just one or the other (Jaffe & Stavins, 2008). In a one-way linked market, jurisdiction A accepts allowances and credits, if it so chooses, from jurisdiction B, not *vice versa*. In a two-way linked market, allowances are freely accepted by both A and B. These two markets are thus *directly* linked. If a third jurisdiction, C, chooses to trade with B, then it is *indirectly* linked to A. As we discuss in section 4, indirect linkages are important from a political perspective; a market that is indirectly linked to another becomes subject to its rules without being involved in their creation.

Linkage presents theoretical and practical challenges. Some are mundane: for example, most markets use metric tons as the basic nomination; the Regional Greenhouse Gas Initiative (RGGI) in the Northeast U.S. uses short tons. Other questions of interoperability, such as the type and amount of third-party offset credits allowed, can be more fundamental. We explore those in the following sections.

3. The economic case for linking trading systems: Leveraging differential marginal costs of abatement

Bigger markets are better. That, in a nutshell, is the economic logic for linking separate carbon markets. Global trade in goods and services maximizes comparative advantage and increases output. Global trade in emissions allowances would fulfill a similar promise. Open and linked markets are more liquid and also more efficient, allowing money to flow where the marginal cost of abatement is lowest. Countries that can produce reductions more cheaply will do so and sell them to those nations where emissions reductions are more expensive to generate.

The differential global costs of abatement are key to making linkage work: they lower total costs and raise overall reductions. In particular, marginal costs of abatement are typically lower in the developing world (Dellink *et al* 2010). This assumption hinges not just on the technical abatement potential but also on emissions reductions baselines and growth rates. Baselines matter because they are the point of reference for evaluating reductions. Since levels of abatement are fundamentally unobservable, baselines are critical for measuring success. But success varies dramatically with different economic growth rates. Fast-growing developing countries will have to work harder to meet (or exceed) the baseline than slow-growing developed ones.

CDM exemplifies the logic of leveraging differences in marginal abatement costs. It has catalyzed the transfer of billions of dollars to the developing world. Reducing the marginal ton of carbon dioxide equivalent (CO_2e) emissions is more expensive in Germany, say, than in China. In fact, China's large source of potential emissions reductions and domestic institutional capabilities has catapulted the country into the dominant source of CDM offset credits. China is now developing seven regional cap-and-trade trial systems, and some observers are already eyeing potential future linkage opportunities. At least in the short-term, a linkage between China and Europe would

lower reduction costs in Europe, since the marginal costs of reducing emissions are significantly lower in China. (As we argue in Section 5, eventual linkage may indeed serve a vital role as a catalyst for developed countries to commit to emissions caps.)

To formalize the standard economic argument for linkage, consider two countries, one developed and one developing. Assume the developed country faces a high marginal abatement cost curve, MC_H, whereas the developing country's curve is much lower, MC_L.

We posit that the developed country faces a high initial emissions reduction target, X_H^0 whereas the developing country faces a lower target of X_L^0. Total abatement across both countries will equal $\Sigma X^0 = X_H^0 + X_L^0$ (Figure 1).

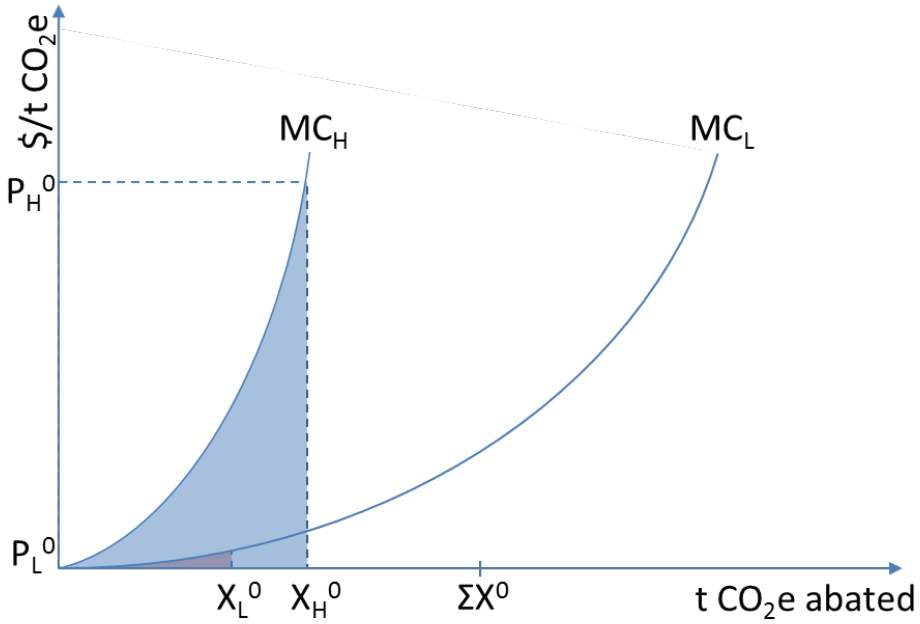

Figure 1— Initial allocation of abatement commitments and costs for high and low-abatement cost countries.

Figure 1 shows a world without trading, where the large shaded area under MC_H represents the total cost of emissions for a given level of emissions reduction in the developed country, and the small shaded area under MC_L represents the total abatement cost in the developing country.

The high-abatement cost country faces significantly higher costs than the low-abatement cost country. In particular,

$$P_H^0 >> P_L^0,$$

and, thus, given $X_H^0 > X_L^0$ assumed above,

$$\int_0^{X_{H^0}} MC_H \gg \int_0^{X_{L^0}} MC_L.$$

Linkage across the two countries, then, could potentially decrease overall costs significantly while keeping the initial abatement target intact (Figure 2).

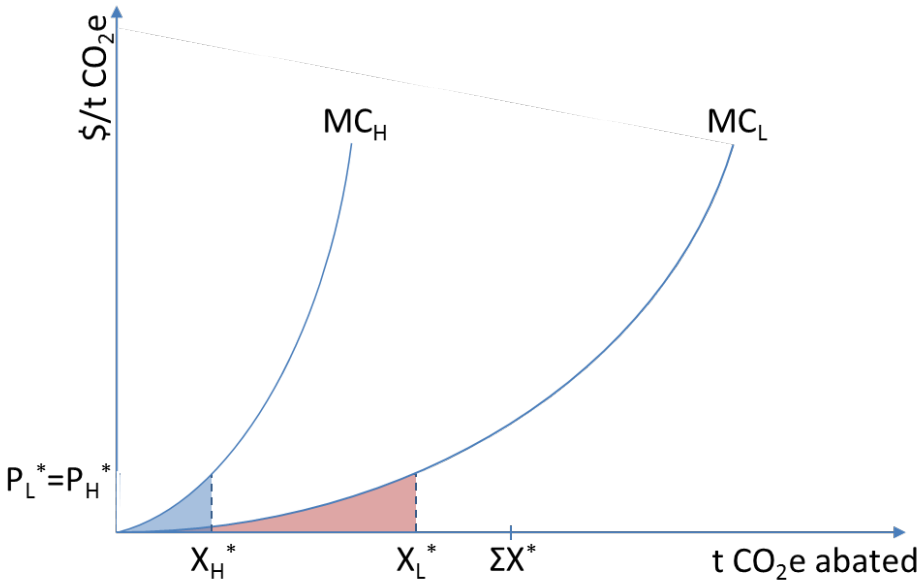

Figure 2—Efficient allocation of abatement commitments with trading.

Overall abatement across both countries, ΣX^*, equals the initial position from Figure 1, ΣX^0. Yet total costs are much lower. Trading allows for the same level of emissions reduction at lower cost, as represented by the significantly smaller combined shaded areas in Figure 2. (Alternatively, much more abatement could have been achieved for the same total cost, if only most of the money were spent in the lower-cost abatement country.)

Figure 3 takes the precise areas from Figure 1 and Figure 2 and shows their relationship more directly. The top line comes from Figure 1, showing the initial abatement commitment and costs. The bottom comes from Figure 2, showing the final abatement commitments and costs for developed and developing countries, respectively.

Total abatement remains the same,

$$X_H{}^0 + X_L{}^0 = X_H{}^* + X_L{}^*,$$

but there are potentially large gains from trade:

$$\int_0^{X_{H^0}} MC_H + \int_0^{X_{L^0}} MC_L \gg \int_0^{X_{H^*}} MC_H + \int_0^{X_{L^*}} MC_L.$$

The total abatement costs without trading are much larger than the total costs with trading, despite equal overall abatement efforts across both regions.

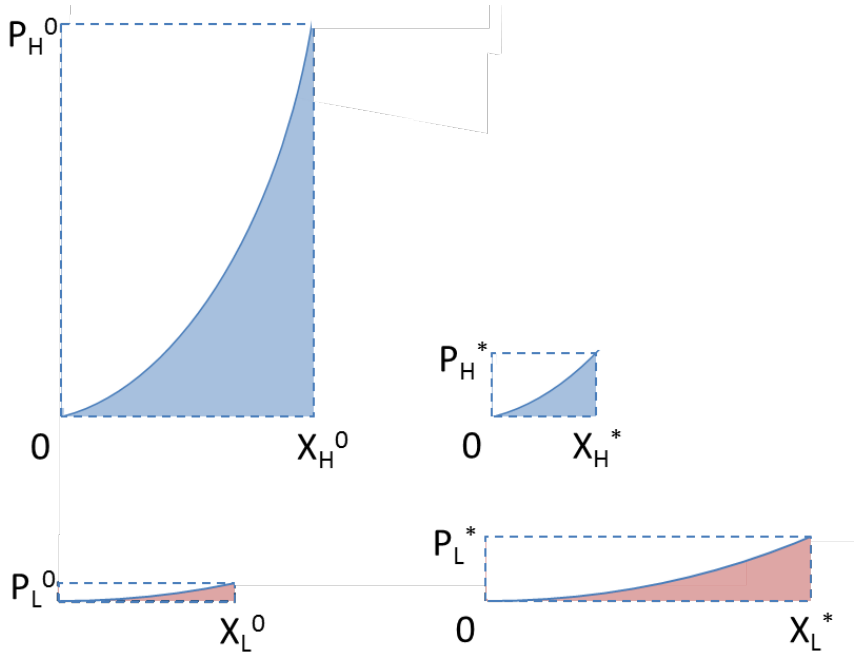

Figure 3— Abatement and costs by high and low-cost countries (top and bottom, respectively), before and after trading (left and right), taking the precise areas from Figures 1 and 2.

Important for our analysis is that linking across jurisdictions will create winners and losers within and across cap-and-trade systems. Within a particular cap-and-trade system, net buyers will stand to gain if the post-linkage market price is lower than prior to linkage. Similarly, net sellers will stand to gain if the post-linkage market price is higher. This creates natural constituents for linkage as well as natural opponents within any cap-and-trade system.

Linkage also generates winners and losers across cap-and-trade systems. In economic terms, this implies a *potential* Pareto improvement from trading. While total abatement costs across both countries are significantly smaller after trading, costs to the developing country will rise.

To turn this potential Pareto improvement into an actual one requires monetary transfers from the developed country to the developing one that are greater than the additional cost to the developing country, yet smaller than the cost savings from the developed country:

$$\int_0^{X_{L^*}} MC_L - \int_0^{X_{L^0}} MC_L \leq wealth\ transfer \leq \int_0^{X_{H^0}} MC_H - \int_0^{X_{H^*}} MC_H \ .$$

These wealth transfers are potentially large and could lead to significant overall cost savings, amounting to half of overall abatement costs (Dellink *et al.* 2010). The financial flows in linked cap-and-trade systems are the transactions between regulated entities. Some jurisdictions may elect not to link simply due to domestic political objections to

transferring wealth abroad; thus, political support for potentially large financial flows is a necessary condition for linkage.

This point is worth emphasizing: It is generally assumed that the low-income country has the opportunity to 'save' on overall costs by abating more. But the incentives for doing so depend on financial flows from high-income nations. Financial flows are also at the heart of the politics. It is not surprising that the developing world advocates for much bigger transfers than the developed world, a fundamental difference in negotiating positions that has made a global grand bargain extremely difficult.

We argue in the next section that a bottom-up approach appears to sidestep these contentious issues but in fact, only hides—or perhaps delays—them. Linking markets would ultimately face the same inherent obstacles as a 'top-down' agreement: all jurisdictions need to agree to the overall level of ambition and the resulting monetary transfers. This holds particularly true for linkage between jurisdictions with large differences in marginal abatement costs—i.e. precisely in those situations when linkage can yield its biggest economic dividends. By contrast, linkage among developed-country jurisdictions avoids many of these issues. That is why we have already seen such developed-developed country linkages, and why they should indeed proceed in many instances. Linkage among jurisdictions with large differences in marginal abatement cost structures will be much more difficult to pursue.

We also address a more fundamental question around policy objectives: Full linkage assumes a desire to drive down carbon prices, in particular in the high-cost abatement country. What if maintaining initially higher compliance costs is indeed in the country's long-term interest? Even then, linkage may still be desirable, largely as a way to encourage other countries to take up emissions reductions goals. But that, too, falls outside the strict market logic of minimizing costs. The most economically attractive linkages—between developed and developing countries—will be particularly challenging.

4. International and domestic political obstacles to linkage

The economic logic for linkage is sound: as long as there are differential marginal abatement costs across nations, linked markets can be both economically efficient and environmentally beneficial. Linking jurisdictions can jointly achieve greater reductions at less cost.

Insights from both political science and economic practice, however, suggest reasons to be less optimistic. The assumptions of this model ignore important political dynamics, which, if not addressed, could ultimately undermine the promised benefits of linked domestic carbon markets. These problems are especially likely among linking jurisdictions with wildly different marginal abatement costs, where environmental and economic gains from linkage could, in theory, be largest. Successful linkage, which we define as a net reduction in emissions among trading entities, must meet at least four conditions conditions.

First, success requires that participating jurisdictions do not game the system by setting baselines without trying to maximize short-term, domestic economic gain. Rather, they need to commit to allowance allocations over the medium and long term, in spite of uncertainty about costs. Second, it requires political support for potentially large financial flows from the developed to the developing world that result from leveraging differential marginal costs of abatement. Third, any successful market linkage demands close regulatory coordination, which becomes increasingly difficult as more jurisdictions—in particular those with unequal marginal abatement cost curves and differential regulatory capacity—join a linked market system. Fourth, successful linkage needs to be compatible with other domestic policy objectives, in particular the lowering of compliance costs.

In the following discussion, we show why it may be problematic to assume that all four of these conditions hold.

4.1 Lower levels of ambition

The political appeal of a bottom-up linkage approach is its flexibility. Each trading jurisdiction can choose its level of ambition, according to the political constraints and opportunities of the domestic context. Any top-down approach of 'targets and timetables' used in Kyoto limits the range of acceptable commitments at the international level, since each government is constrained by domestic preferences (Putnam 1988).

A bottom-up approach, proponents argue, bypasses these difficulties, by allowing each jurisdiction to choose their level of ambition without regard to other governments. However a bottom-up approach may afford *too much* flexibility in one of two ways. First, each jurisdiction could simply choose an unambitious cap. Second, a given jurisdiction could lower its level of ambition if compliance becomes too costly.

The trial phase of the EU Emissions Trading Scheme (ETS) provides a useful illustration of the first problem, the unambitious cap. From 2005 to 2007, individual member states set their own emissions reduction targets (Ellerman, Convery & De Perthuis, 2010). Only then did the individual caps get added to a whole. The result was a large over-allocation of allowances in Phase I, resulting in a significant drop in prices in April 2006, once that over-allocation became evident to market participants.

Importantly, while allowance prices for Phase I decreased significantly (eventually approaching zero, because Phase I allowances could not be used in future periods), futures prices for Phase II allowances held comparatively stable. In Phase II, the ETS became closer to a top-down arrangement. Though based on earlier domestic allocations, Phase II allocations no longer allowed member states to set their own caps. Instead, the European Commission was endowed with the authority to change member state's proposed caps. The allocation mechanism resembled something much closer to a top-down 'targets and timetable' approach.

A further problem is that too much flexibility after linkage occurs can also result in lowering levels of ambition. If allowances become sufficiently scarce, then linked jurisdictions can raise caps or increase the availability of credits from other markets. In the former, the trading entity essentially prints money by creating more allowances (Victor and House 2004).[6] In the latter, regulated entities can seek offset credits in other markets—presumably with lower prices—allowing them to meet reduction requirements without much change in behavior.

Enhancing supply through either raising caps or opening markets to offset credits has two effects: First, and most obviously, it reduces the level of ambition of climate change policy. A higher cap means less abatement. It is noteworthy, for example, that despite fairly extensive market infrastructure, we are not reducing our global emissions by nearly as much as is needed: Despite cap-and-trade systems covering 10% of the world's population and 35% of the world's GDP, the world is nowhere near meeting the 2°C target that negotiators aimed for in Copenhagen. Domestic cap-and-trade systems are setting up important frameworks and institutions for eventual reductions, but overall caps will need to be much more comprehensive and ambitious in subsequent trading periods to achieve the desired results.[7]

Another implication of lowering levels of ambition is that it undermines the efficiency gains of linking markets. Raising caps within a given cap-and-trade market means reducing its marginal cost of abatement; thus, that market has less to gain from purchasing credits from other linked markets. As marginal costs of abatement equalize across markets, gains from trade among linked jurisdictions approach zero. Jurisdictions that choose not to raise their caps will face higher costs. In turn, this may spark a race to the bottom. In this sense, the 'bottom-up' approach quickly creates interdependencies among linked markets where collective action is needed to avoid beggar-thy-neighbor policies—precisely the dynamic that has plagued the international process.

This 'race to the bottom' is most likely among trading jurisdictions with widely different marginal abatement cost curves. Two developed-world jurisdictions with similar levels of ambition, marginal abatement costs and overall system designs may find it relatively easy to overcome this obstacle. However, there is little economic gain in terms of lower overall abatement costs from such a link. Instead, the economic advantages are due to having a larger overall market and, thus, increasing the fungibility of allowances. This logic, for example, applies to the link between California and Quebec

[6] This can, of course, go either way; states could also decide to *lower* caps, making environmental targets more ambitious. The Regional Greenhouse Gas Initiative recently took such a step, announcing plans to tighten its caps by 45%. The EU is considering similar steps around "backloading" allowances and, thus, temporarily tightening its own cap.

[7] The EU does, in fact, have a long-term commitment of reducing emissions by 1.74% per year, every year. By 2050, that will result in emissions that are 70% below 2005 levels. Even that, though, is not yet in line with most commonly cited obligations for the EU of 80% by 2050, and the commitment only covers slightly less than half of all of the EU's carbon dioxide emissions.

where the dynamics described here are largely absent. They become more pronounced as the wealth gap between countries widens.

4.2 Need for supporting financial flows

The economic logic of linkage rests on differential marginal costs of abatement and the resulting international monetary transfers (section 3). As soon as it is cheaper to abate in one country over another, buying permits on the international market—whether an offset market, or a set of linked regional, national or sub-national markets—is tantamount to a financial transfer between trading entities.

Yet large scale financial flows of capital from developed to developing countries are likely to face the same obstacles as those that occur through a top-down agreement. The negotiations around mobilizing $100 billion per year from developed to developing countries by 2020 for mitigation and adaptation, from both public and private sources, provides one example of the difficulties embedded in such a negotiating process. Only a fraction of the $100 billion has been committed from public sources, and even less of that has been disbursed.[8] Setting up one of the funding vehicles, the Green Climate Fund, has been an extremely contentious process (Abbott and Gartner 2011).

CDM, too, exemplifies the complex politics of financial transfers. At its height in 2006 and 2007, annual transfers in the CDM approached $10 billion. Most of the money came from the European Union and was invested in China (World Bank, 2012). Very little went to other developing and least developed countries. This pattern raised concerns about the distribution of wealth transfers. To broaden the distribution of funds, many have called for CDM reform, especially in Europe (Report of the High Level Panel on the CDM Policy Dialogue, 2012). In fact, the EU has since restricted certain types of offsets, both by sector and region.

There is an alternative interpretation of the CDM critique: CDM has fulfilled its exact purpose, enabling China to move from a supplier of offset credits to a nation implementing its own emissions mitigation policies. It is now in the process of creating seven regional cap-and-trade trial systems. Limited linkage may play just such a role now in moving China further along to agreeing to firm national emissions reduction targets. However, such a shift might reproduce the same political problem: the need for potentially large financial flows from developed countries to, in this case, China.

In essence, full linkage among a broad swath of developed and developing countries and jurisdictions will effectuate the very same types of financial flows that have been controversial in CDM and the Copenhagen Accord. Assuming similar levels of ambition, the size of the eventual transfers will likely be similar in both top-down and bottom-up situations.

[8] See the UNFCCC Finance Portal for Climate Change for the most updated figures: http://www3.unfccc.int/pls/apex/f?p=116:8:5075510030800287. See also: Buchner *et al.* (2012).

4.3 Loss of regulatory autonomy

Linking markets also entails coordination on important design elements. Will links be one-way or two-way? Will they include offset credits or allowances? Will full banking and borrowing be permitted? Will there be limits on the number of allowances or credits permissible from other markets? Since design choices in one jurisdiction will affect policy in another, these decisions will require some level of consensus among linking jurisdictions. Such consensus may be easily achieved among two parties, but quickly becomes more complex when there are multiple jurisdictions involved.

Two key regulatory challenges emerge. First, linkage requires robust regulatory frameworks. Carbon markets create a unique commodity. The metric ton of CO_2e is entirely a policy creation which requires careful and sustained oversight. Measurement, monitoring reporting, verification, compliance, and enforcement issues are paramount. Linking jurisdictions need to agree on standards as well as on controls for quality and quantity of third-party offset credits. Jurisdictions with lax compliance will likely see the price of their allowances drop.

One proposal to address this issue is to require buyers to be liable for the quality of the allowances and offsets purchased (Keohane and Raustiala 2008; Victor 2011). Rather than trying to impose *post hoc* sanctions on sellers of sham offsets—a difficult task for low capacity governments and when powerful sellers are involved—one solution may be to require buyers to assume responsibility if the permits are invalid.

A second challenge that compromises regulatory autonomy is the increased interdependence among linked jurisdictions. Larger trading systems achieved through linkage would increase liquidity. However, they will also propagate any possible early mistakes in system design. At the extreme, the collapse of one system—either because of design flaws, regulatory uncertainties, or other economic or political circumstances—could result in serious impacts on linked markets. The recent financial crisis serves as a powerful example of the vulnerabilities of linked systems with decentralized regulatory oversight in an entirely different realm.

The need for regulatory coordination and the interdependence created by linkage both curtail each jurisdiction's autonomy. This issue becomes even more pronounced in cases of indirect linkage, where a linked jurisdiction may end up being subject to the effects of rules that it did not directly agree upon.

Threats of the loss of regulatory autonomy will prompt linking jurisdictions to negotiate for favorable designs. Some linking jurisdictions will push to lock-in favorable rules; others may want flexible rules that can be amended to ensure favorable circumstances in the future. Late-comers may lobby for changes in the rules, or be dissuaded from joining altogether.

The appeal of bottom-up markets is, in some way, to provide a testing ground for different design options. Linking markets prematurely would lock in these designs and

set *de facto* standards across large, international trading systems. One fear is that early linkage of markets will lock in design standards that have yet to withstand the test of time or, worse, create a race to the bottom when it comes to setting overall regulatory standards.

4.4 Competing domestic objectives

Lastly, there is an important caveat to the assumptions underlying any linkage argument. The economic logic for linkage assumes the desire to reduce costs of compliance, holding levels of ambition constant. Yet, linkage will produce winners and losers within a given jurisdiction. Those with high marginal costs of abatement will be pleased by lower compliance costs. However, potential permit sellers—that is, those with low costs of abatement—will lose out, since they may be undercut by allowances purchased abroad. Thus, although overall costs would be reduced by linkage between a developed and developing country, within each country, these costs will be unequally distributed.

Similarly, there will be winners and losers across jurisdictions. Consider countries that face a higher carbon price after linkage. The country as a whole benefits from exporting permits. The sellers of permits will benefit. Buyers, however, will face higher prices.

Then there is a potentially even more fundamental objection. Early movers, like the EU, who have shown a willingness to overcome global free-rider effects unilaterally have revealed to be driven by another rationale than that of making permits cheaper. In the EU, for example, climate policy is often seen to be about creating the preconditions for a long-term transformation to an economy free of fossil fuels. Cap and trade, thus, serves as one tool for this purpose, but it is only one. Others include direct support for renewable energy and energy efficiency that come at higher costs per ton of CO_2e abated in the short run but fulfill other goals (Aldy and Pizer, 2014).

As a result, some countries may be skeptical about linkage simply because they want to maintain a relatively high domestic carbon price in the short run. Jaeger *et al.* (2011), for example, shows an inherent time tradeoff: steeper emissions targets now may result in cheaper abatement costs in the future. Following this line of thought, lower short-term prices achieved through linkage may not be in the strategic interest of some member states of the EU. Countries that wish to spur innovation or that have strong renewable energy sectors may not wish to lower the price of carbon in the short-term.

Conversely, in some cases, linkage may be useful in promoting multiple policy objectives simultaneously. For example, discussions of incorporating credits from projects Reducing Emissions from Deforestation and Forest Degradation (REDD) into carbon markets is not only a way to reduce emissions, but will also slow deforestation and preserve biological diversity. In cases where multiple policy objectives can be achieved through linkage, we expect its likelihood to increase.

Importantly, linkage may serve as an incentive to motivate others to commit to binding emissions reduction targets on their own. For example, the EU had long held the position of global leader on climate change, and is using multiple tools to reduce its emissions and encourage others to do so. Linkage is part of this overall plan. The EU plainly says that an international carbon market will develop "through 'bottom-up' linking of compatible emissions trading systems."[9] It further states that "linking the EU ETS with other cap-and-trade systems offers several potential benefits, including...supporting global cooperation on climate change."

The EU example shows the mechanism through which linkage could potentially be very useful: as a political incentive and interim step toward stronger global climate commitments. The drive toward linkage may serve domestic political objectives, even without the pure economic argument for linkage. Politically, linking one's domestic trading system may serve to demonstrate commitment and a leadership role. Once linked, it may be more difficult to abandon or weaken one's cap-and-trade system, even if weakening may now be in one's short-term economic interest (4.1). These political reasons alone may provide sufficient justification for linkage, but we need to recognize that they are distinct from the traditional economic arguments for linkage outlined above. In the final analysis, even politically motivated linkage will face the same issues of potentially lower levels of ambition, the need for financial flows, and the potential loss of regulatory autonomy.

5. A path forward: An incremental approach to linkage

Linkage has been proposed by academics and policymakers alike as an alternative to the top-down intergovernmental approach of the Kyoto Protocol (Burtraw *et al.*, 2013; Jaffe, Ranson & Stavins, 2010; Jaffe & Stavins, 2008; Metcalf & Weisbach, 2012; Ranson & Stavins, 2012). Our analysis suggests that four potentially significant obstacles need to be overcome in order for linkage to build sustainable systems that achieve the twin long-run goals of reducing emissions and the cost of compliance.

Achieving these goals will require navigating complex tradeoffs between efficiency and political feasibility. In particular, there are several design implications of this analysis: First, linkages among developed countries are less politically problematic—in part also because they yield fewer economic gains. Second, bigger markets are typically better, but linking markets may also introduce political unpredictability associated with a loss of regulatory autonomy and the need for close coordination among jurisdictions with potentially competing objectives. Third, differential time horizons among linked jurisdictions will increase opportunities for gaming. Finally, banking and borrowing increases price stability and are clearly desirable features in any cap-and-trade system, but they may also accentuate any of these tradeoffs.

[9] See http://ec.europa.eu/clima/policies/ets/linking/index_en.htm

Confronting these tradeoffs necessitates an incremental approach to linkage.[10] In the short term, the goal of bottom-up policy should be to focus on building operational systems. As such, experimentation and learning are important (Sabel and Zeitlin, 2010), and those experiments may best proceed while focusing on domestic institutions. If states and sub-national jurisdictions do choose to link, they need to be prepared for the set of potential obstacles like potentially large financial transfers. This also implies the need to anticipate the full range of political implications related to the loss of any regulatory autonomy. After a certain point, bottom-up approaches will need to overcome political challenges similar to those created by a negotiated, top-down solution. In the meantime, though, bottom-up solutions may help states develop domestic carbon markets and catalyze more ambitious global action (Stewart *et al.*, 2013).

A number of jurisdictions in developed countries have already linked their markets. The EU has two-way linkages with Norway, Iceland, Liechtenstein and Switzerland. California has linked with Quebec. New Zealand and Australia have linked their markets (though the status of Australia's carbon market is in flux). Other linkages are sure to come, revealing apparent political advantages to linked systems in these cases.[11] Developed-country linkages often pursue objectives other than overall cost reduction—as, in fact, they should. Catalyzing others to change is an important overall policy goal.

6. Conclusions

As states develop their national climate policies, we will see a combination of bottom-up arrangements and top-down negotiations. As different domestic systems try to link, they will confront issues related to the level of ambition, oversight and policy design. Some of these coordinating challenges may be easier than others. The setting of the overall cap in each jurisdiction, for example, is likely the most visible process, which will raise different questions from other less visible design decisions such as the verification of third-party offsets.

This bottom-up process may create a renewed interest in and impetus for more globalized agreements. International climate architecture could do worse than mimic the EU's 'model.' Right now, we are in the global equivalent of something akin to the EU's Phase I, where each country sets its own level of ambition. The Durban Accord and mandate to negotiate a global set of ambitions by 2015, to become effective by 2020, already points the way toward Phase II, where there is some loose coordination of caps. Most importantly, everyone from climate negotiators to domestic politicians designing

[10] See Burtraw *et al.* (2013) for an alternative approach to gradual linkage, with a direct application to RGGI and California's AB 32 cap-and-trade system. Moreover, informal linkages, such as through MOUs, can help jurisdictions "align" their practices before formal arrangements are codified.
[11] Dellink *et al.* (2010) suggests that linkage among Annex I countries would only lead to "moderate aggregate cost savings."

their own domestic systems, should keep the global equivalent to EU-ETS's Phase III in mind—a hierarchical system with a firm, global cap on emissions.

Until then, linkage ought to be taken for what it is: a potentially important but also limited step toward a more globalized climate policy. Early linkages reveal the political if not the economic advantages of such arrangements. That said, bottom-up systems will not be able to avoid the very real issues that have haunted top-down negotiations for so long. The larger the economic advantages to linkage, the greater will be the visibility of issues such as overall levels of ambition, supporting financial flows, regulatory autonomy, and competing domestic objectives.

We are in the experimental phase of a potentially far-reaching undertaking: creating a global market for carbon. Given the complexity of this project, we advise proceeding with caution: the simpler the linkage arrangements, the better. That potentially implies quantitative and time limits for early linkages. These limits will provide sufficient transparency and certainty to begin the trading process, while minimizing the risks of unanticipated adverse consequences. Markets engaged in linkage should first focus on creating sound infrastructure for global carbon markets, a process that begins at home.

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