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Global trading versus linking: Architectures for international emissions trading

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ABSTRACT

International emissions trading is widely seen as an indispensable policy pillar of climate change mitigation [Stern, N., 2007. The Economics of Climate Change. The Stern Review. Cambridge University Press, New York]. This article analyzes five different types of trading architectures, classified into two top–down (UNFCCC driven) and three bottom–up (driven by individual countries or regions) approaches. The two types of approaches are characterized by a trade-off between environmental effectiveness and political feasibility, respectively, whereas their relative cost-effectiveness depends on implementation details. Bottom–up architectures constitute imperfect substitutes for top–down architectures in terms of environmental effectiveness, and thus remain mere fallback options. However, especially the 'formal linking' architecture can act as complement in terms of cost-effectiveness.

1. Introduction

The last years have witnessed a considerable amount of political activity geared towards the establishment of emissions trading systems. Amongst other things, this reflects the fact that emissions trading is generally seen as an indispensable pillar of climate change mitigation, and is expected to constitute a key building block of future international climate policy (e.g. Stern, 2007).

The Kyoto Protocol and the Marrakesh Accords established an inter-governmental trading system that is set to run for five years, from 2008 until the end of 2012. On this market, which covers the emissions of 37 states, representing 29% of the world's CO_2 emissions in 2004 (CAIT, 2008),[1] governments can trade emission permits—here called Assigned Amount Units (AAU)—which in principle allows to minimize the costs of compliance with their Kyoto reduction targets. They can also use credits generated under the Joint Implementation (JI) and Clean Development Mechanisms (CDM).

Even earlier, in 2005, the European Union launched its emission trading system (EU ETS), which regulates about 10,000 facilities that currently emit around 2 Gt of CO_2 per year (Skjaerseth and Wettestad, 2008). With a value of 50 bn US$ the EU ETS dominates the international carbon market, which totaled to 64 bn US$ in 2007 (Capoor and Ambrosi, 2008). EU policy-makers have emphasized that, irrespective of the outcome of the UNFCCC negotiations on a post-Kyoto climate policy package, the EU ETS will remain in place even after 2012 (EU Council, 2007).

Plans for the introduction of domestic emissions trading systems are also underway in several other Annex-I countries.[2] These regional activities are flanked by the recent establishment of the International Carbon Action Partnership (ICAP), a forum that was created with the explicit intention of exploring the "(…) potential linkage of regional carbon markets" (ICAP, 2007).

These developments can be understood as manifestations of two different approaches towards the establishment of emissions trading systems: first, there is the top-down approach, characterized by a centralized multilateral decision-making process and embodied in the UNFCCC negotiations. Second, there is the bottom-up approach, associated with decentralized decision-making of individual nations or sub-national entities that implement emissions trading systems uni-, bi- or plurilaterally (Zapfel and Vainio, 2002).

These processes yield two different types of institutional architectures for international emissions trading. The backbone of 'top-down' architectures is emissions trading between governments, while 'bottom-up' architectures rest upon the implementation and possible linkage of regional systems, based

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[1] Throughout our paper, data from CAIT (2008) refers to CO_2 emissions of the year 2004, excluding emissions from LULUCF.

[2] On the national level these include New Zealand, Australia, Switzerland, the United States, Canada, and Japan. Sub-national initiatives for emissions trading also exist in the US (the Regional Greenhouse Gas Initiative (RGGI), California, the Western Climate Initiative (WCI), and the Midwestern Greenhouse Gas Accord), Canada (some provinces are members to WCI), and Japan (Tokyo and Kyoto).

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on company-level emissions trading. This article aims to describe, analyze and compare these different institutional architectures.[3]

In the course of our analysis, we will argue that top-down and bottom-up architectures show characteristic differences in three key aspects. These are:

- environmental effectiveness
- cost-effectiveness
- political feasibility

Our main findings can be summarized as follows: because of their inclusiveness, top-down approaches tend to cover a larger share of global emissions and thus offer a higher degree of environmental effectiveness than bottom-up approaches. However, a significant share of global emissions could also be captured by means of a decentralized approach, in which a carbon market is created by linking existing domestic or regional ETS. The environmental effectiveness of both approaches can be enhanced by integrating baseline-and-credit schemes, e.g. the CDM of the Kyoto Protocol.

If emissions price equalization is the sole criterion, top-down approaches also fare better in terms of economic effectiveness. But if plausible market imperfections associated with emissions trade between governments (such as market power or information asymmetries) are taken into account, price equalization is unlikely to be a sufficient criterion for efficiency, which requires the equalization of marginal abatement costs. Bottom-up approaches, based on preexisting trading systems between companies, provide a more robust price signal, and can be very efficient once they are 'linked'.

High political feasibility emerges as the main strength of bottom-up approaches, and, at the same time, biggest hurdle for top-down architectures. For the latter, a full international agreement on burden-sharing constitutes a condition sine qua non, while the former lends itself to the formation of a coalition-of-the-willing with subsequent enlargements.

We conclude that the apparantly intuitive view of bottom-up and top-down approaches as (imperfect) substitutes needs to be amended. In as much as bottom-up trading architectures bring about not the optimal, but the feasible, they remain a second-best alternative to a top-down global cap-and-trade system in terms of environmental effectiveness. However, when viewed as building blocks that allow putting a cost-effective and expandable carbon market into place without further delay, their supportive role in the eventual establishment of a global carbon market becomes apparent.

The remainder of our contribution is organized as follows: we begin in Section 2 by addressing questions of terminology and definition. Top-down architectures are described and analyzed in Section 3, bottom-up architectures are dealt with in Section 4. A comparative analysis and discussion are given in Section 5. We summarize our findings and present our conclusion in Section 6.

2. Definitions

Discussions about emission trading systems use a distinct lingo, drawing on a number of terms and concepts (e.g. offset credits) that are relatively new, and sometimes lack a clear definition. Hence, before introducing the conceptual framework for the analysis and comparison of different ETS architectures, we want to briefly clarify the basic terminology, as employed in this article.

Cap-and-trade systems set a binding, absolute cap on total emissions, but allow for certificates—corresponding to the right to emit a specific volume of emissions—to be traded among the covered entities, which are either nations or companies. The Kyoto Protocol trading system for Annex-B countries is an example for cap-and-trade at the governmental level, while the EU ETS operates at the company level. In contrast, baseline-and-credit systems define a certain baseline such as a business-as-usual projection or a relative target, and only allow emission reductions that go beyond this baseline to be used as sellable credits (often referred to as 'offsets'). In this study, we understand baseline-and-credit systems as non-binding systems, meaning that there is no penalty if the baseline is exceeded. The CDM and JI mechanisms established under the Kyoto Protocol are examples of such non-binding baseline-and-credit systems.

We use the terms carbon market and emissions trading system interchangeably to refer to both cap-and-trade and baseline-and-credit systems. The more general term emissions trading architecture is used to denote the overarching structure of relations between emissions trading systems that are implemented all over the world. Different emissions trading architectures can be compared with regard to their degree of integration or fragmentation.[4] Fragmentation means that there are several trading systems with none or only few linkages and, correspondingly, different prices for permits. Integration occurs if there is either only one global trading system or there are sufficient linkages between different carbon markets to lead to an equalization of permit prices across these systems.

In what follows, we interpret the ongoing political efforts in terms of two systematically different approaches, namely the 'top-down' and the 'bottom-up' approach to international emissions trading. In our comparative analysis, we will argue that the associated emissions trading architectures differ particularly in three aspects, which we set out beforehand.

Environmental effectiveness refers to the capability of an emissions trading architecture to bring about significant reductions in global emissions. Its potential for doing so depends, first of all, on the share of global emissions that are actually covered by the emissions trading regime. But taking that as given and assuming a certain emissions target is, however, not sufficient for evaluating its environmental effectiveness, because the offsetting effect of leakage is neglected.[5] Formally, the *percentage* reduction of global emissions can be expressed by the following equation:

$$\text{Global Reduction} = \text{Regime Reduction}\ x\ (\text{Regime Emissions}/\text{Global Emissions})\ x\ (1-\text{Leakage Rate})$$

[3] 'Intermediate' architectures situated in between the basic cases of bottom-up and top-down are, of course, also conceivable, e.g. in the form of harmonized national policies (we thank the referee for pointing this out). However, since we focus on international emissions trading and the way it is implemented under different architectures, these cases are not treated here.

[4] In distinguishing integrated and fragmented architectures, we draw on Biermann et al. (2007) who define universalism–which corresponds to our notion of integration–as "(...) a situation in which all countries of relevance in a given issue area (a) are subject to the same regulatory framework; (b) participate in the same decision-making procedures (...); and (c) agree on a core set of common commitments." Fragmentation occurs if these conditions are violated.

[5] Leakage occurs if the regulation of emission intensive industries in one country leads to an expansion of those industries in other, less or unregulated countries, due to a shift in comparative advantage. The impact of this effect will depend on a number of factors, including the size of the carbon price differential, the trade exposure of affected sectors, and the relative importance of the expected persistence of the cost gap for investment decisions. International sectoral agreements, border tax adjustments and the free allocation of allowances (Neuhoff, 2008) have been proposed to address leakage concerns. In general, the available evidence suggests that this effect would not be a serious problem in most sectors, at least in the short- to mid-term (Stern, 2007; Neuhoff, 2008; The Economist, 2008).