MARKET MECHANISMS AND THE PARIS AGREEMENT

Harvard Project on Climate Agreements

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Market Mechanisms and the Paris Agreement

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INTRODUCTION

As attention to the threat of global climate change has increased in most parts of the world, national and sub-national governments have increasingly turned to market-based policies — principally emissions-trading and carbon-tax systems — to reduce emissions of greenhouse gases (ICAP 2017; World Bank 2017). It is broadly recognized that well-designed market-based policies can be cost-effective in achieving aggregate emissions-reduction targets, and this has been validated by considerable accumulated experience. Some jurisdictions are exploring opportunities for linking their emissions-trading systems (ETSs), because linkage between regional, national, and sub-national policy instruments has the potential to further reduce costs.

In parallel, the Paris Agreement — developed over a decade within the UNFCCC regime — represents a breakthrough in multilateral efforts to address climate change. For the first time, an international agreement to reduce greenhouse-gas emissions includes mitigation contributions from all of the major-emitting countries — and, indeed, a large majority of the countries of the world. Further, the Agreement includes a dynamic feature through which mitigation commitments can be strengthened over time.

The Paris Agreement includes provisions — in Article 6 — with the potential to support and leverage market-based emission-reduction systems implemented by regional, national, and sub-national jurisdictions. In fact, Article 6.2 provides opportunities for the exchange of mitigation units generated by non-market domestic policies, thus reducing the cost of mitigation across jurisdictional borders even in these cases. Article 6.4 has the potential to build upon the extensive experience gained from the Kyoto Protocol's Clean Development Mechanism, and possibly develop a new form of emission-reduction-credit system for a world in which all countries have mitigation obligations.

While Article 6 thus has considerable potential to advance GHG-emissions reduction, a great deal remains to be done to elaborate the Paris Agreement before this potential might be realized. The Harvard Project on Climate Agreements hosted a research workshop at Harvard Kennedy School on July 6, 2017, to discuss options for elaborating Article 6, the evolution of market-based systems, and how these two processes might best support each other. Participants included twenty of the world's leading researchers focusing on market mechanisms and the Paris Agreement, coming from the disciplines of economics, political science, international relations, and law — and based in Europe, the Republic of Korea, and the United States. An agenda and list of participants is included at the end of this monograph.

Workshop participants subsequently prepared the briefs that are included in this document.[1] The first, by way of background, examines lessons learned from implementation of ETSs. The other briefs are organized in three sections. The first section focuses on approaches to establishing international carbon price(s), crucial for developing broader multilateral carbon markets — especially in the context of the highly heterogeneous mitigation pledges characteristic of the Paris-Agreement regime. This section proceeds to consider the range of heterogeneity in national mitigation pledges with which market participants must deal. It concludes with a specific example of linkage with the aviation sector.

The second section provides a detailed analysis of Article 6 and its potential elaboration pathways. The third section examines the development of China's national ETS and prospects for linkage in East Asia, again in the context of the Paris Agreement.

Each brief provides a list of highlights in the form of key points, and a compilation of all of the key points is provided after this introduction. The briefs are designed to be readily accessible — and, it is hoped, useful — to negotiators and policy makers, as they consider how to elaborate the Paris Agreement in order to realize its potential to effectively address global climate change.

The July 2017 workshop and this report build upon previous work by the Harvard Project on Climate Agreements, the mission of which is to identify — and effectively communicate — scientifically sound, economically sensible, and politically pragmatic public policy options for addressing global climate change.[2] In particular, it builds upon a workshop examining the elaboration and implementation of the Paris Agreement more broadly, held in July 2016, and a subsequent publication similar in format to the current volume (Stavins and Stowe 2016).[3] The Harvard Project is grateful to the Harvard University Climate Change Solutions Fund for major support for both workshops and publications.[4]

Leading scholars from around the world have released 89 discussion papers through the Harvard Project on Climate Agreements. Robert N. Stavins, Director, and Joseph E. Aldy, former Co-Director, also published three edited volumes of research (Aldy and Stavins 2007, 2009, 2010). In addition, the Harvard Project has organized numerous research workshops and policy roundtables at Harvard and around the world — including at all but one UNFCCC Conference of the Parties since COP-13 in Bali — intended to advance scholarship on and

1 The editors are grateful to Bryan Galcik for layout and design of the document and to Marika Tatsutani for editing the briefs.

2 See the Harvard Project website: www.hks.harvard.edu/hpca.

3 For a report on the July 2016 workshop, see www.belfercenter.org/publication/harvard-project-hosts-research-workshop-paris-agreement.

4 Support was also provided by the Harvard University Center for the Environment, the Enel Endowment for Environmental Economics at Harvard University, and by BP.

analysis of policy options for global climate change, and to facilitate communication with negotiators and policy makers about these options.[5]

The Harvard Project's research has been one source of valuable guidance and options for negotiators and analysts over the last decade. We hope that the current volume may also stimulate thinking during this crucial period when the Paris Agreement must be elaborated and eventually implemented.

Robert N. Stavins
Director

Robert C. Stowe
Co-Director

5 Research workshops have been held at Harvard University and internationally, in collaboration with leading research institutes focusing on environmental economics and policy: *Fondazione Eni Enrico Mattei* (Venice and Milan); the Mercator Research Institute on Global Commons and Climate Change (Berlin); the National Center for Climate Change Strategy and International Cooperation (Beijing); and Resources for the Future (Washington, D.C.) The Harvard Project has conducted numerous roundtables engaging researchers, policy makers, and stakeholders (advocates and leaders in business and non-governmental organizations), in Brussels, Washington, D.C., Canberra, Rome, London, Paris, Tokyo, Seoul, Mexico City, Beijing, and Doha — among other locations. The Harvard Project has conducted side events presenting the results of policy-oriented research at the Thirteenth (Bali, Indonesia), Fourteenth (Poznan, Poland), Fifteenth (Copenhagen, Denmark), Sixteenth (Cancun, Mexico), Eighteenth (Doha, Qatar), Nineteenth (Warsaw, Poland), Twentieth (Lima, Peru), Twenty-First (Paris, France), and Twenty-Second (Marrakech, Morocco) COPs. At the COPs, Harvard-Project leaders have also held meetings with individual negotiating teams from over 50 countries.

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GUIDE TO ABBREVIATIONS

AAU	assigned amount unit (mitigation unit denominating Kyoto-Protocol emissions-reduction obligations, tradable through Kyoto's international-emissions-trading mechanism)
BAU	business as usual (referring in this context to levels or quantities of future GHG emissions in the absence of additional policy interventions)
CA	cooperative approaches (mechanism defined in Article 6.2 of the Paris Agreement)
CDM	Clean Development Mechanism (Kyoto-Protocol flexible mechanism — an emissions-reduction-credit system)
CER	certified emissions reduction (mitigation unit of the Kyoto Protocol's Clean Development Mechanism)
CMA	Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement)
CO_2	carbon dioxide
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change (with no modifier, referring to the Convention's legally-constituted governing body; or, for example as "COP-23," to one of the COP's annual meetings)
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation (ICAO emissions reduction scheme; see brief by Petsonk and Vinsonhaler)
EPA	(United States) Environmental Protection Agency
ERU	emission reduction unit (mitigation unit of the Kyoto Protocol's Joint Implementation)
ETS	emissions trading system (or "scheme"; also referred to as "cap-and-trade system")
EU	European Union
G20	Group of 20 (governments of major economies)
GDP	gross domestic product
GHG	greenhouse gas
ICAO	International Civil Aviation Organization (see brief by Petsonk and Vinsonhaler)
IET	international emissions trading (Kyoto-Protocol flexible mechanism)
IMF	International Monetary Fund
ITMO	internationally transferred mitigation outcome (see Article 6.2 of the Paris Agreement)
JI	Joint Implementation (Kyoto-Protocol flexible mechanism)

JCM	(Japanese government's) Joint Crediting Mechanism
MRV	measurement, reporting, and verification
NDC	Nationally Determined Contribution (national "pledges" submitted in support of the Paris Agreement)
NDRC	(China's) National Development and Reform Commission
R&D	research and development
SBI	(UNFCCC's permanent) Subsidiary Body for Implementation
SBSTA	(UNFCCC's permanent) Subsidiary Body for Scientific and Technological Advice
SCC	social cost of carbon (see especially briefs by Joseph Aldy and James Stock)
SDM	sustainable development mechanism (mechanism defined in Article 6.4 of the Paris Agreement)
TPS	tradable performance standard
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard (a non-governmental organization that develops and applies standards and methods used extensively to design and assess CDM projects and projects in other offset regimes)

THE PARIS AGREEMENT

The United Nations Framework Convention on Climate Change (UNFCCC) provides information on the Paris Agreement, including status of ratification, at (and linked to):

http://unfccc.int/paris_agreement/items/9485.php

The authentic legal text of the Paris Agreement, in the various official languages of the United Nations, is linked from the above page. The English version is at:

http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

The final, though not legally-authentic, text of the Paris Agreement, as embodied in Decision 1/CP.21 of the Twenty-First Conference of the Parties of the UNFCCC, is at:

http://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf

The UNFCCC Registry of Nationally Determined Contributions, submitted by national governments in support of the Paris Agreement, is here:

http://www4.unfccc.int/ndcregistry/Pages/All.aspx

COMPILATION OF KEY POINTS

Background

Richard Schmalensee and Robert N. Stavins: ***Lessons Learned from Cap-and-Trade Experience***

- Well-designed cap-and-trade systems have proven to be environmentally effective and cost-effective.
- Successful cap-and-trade systems have had accurate emissions monitoring, significant violation penalties, and high compliance.
- Banking excess emissions reductions has been an important source of cost savings, and price collars can reduce price volatility.
- The use of "complementary policies," such as subsidies for renewables that aim to reduce GHG emissions under the cap, will generally raise the total cost of emissions reductions, reduce innovation incentives, and yield no net environmental gain.

Carbon Pricing and Linkage in a Heterogeneous Paris Regime

Joseph E. Aldy: ***Carbon Price Focal Points and Carbon Markets***

- Shared perceptions about a salient focal point for the price of carbon can facilitate coordination.
- Given significant heterogeneity in the form and framing of mitigation pledges under the Paris Agreement, carbon price focal points could facilitate broader coordination in climate-change policy, such as through linking.
- The social cost of carbon or the least-cost carbon price pathway to limiting warming to 2° C could serve as focal points, although uncertainties in calculating either metric could undermine their salience.
- Carbon price focal points would enable countries to identify opportunities for linking their domestic mitigation programs.

James H. Stock: ***Developing and Maintaining a Reference Value for the Social Cost of Carbon***

- An internationally agreed upon target price of carbon would provide a benchmark for comparing the stringency of national and subnational mitigation policies. Both the Social Cost of Carbon (SCC) and the price path necessary to achieve a 2° C warming target are plausible candidates for this target price.
- Perhaps more important than the choice of benchmark is the legitimacy of the resulting price, which in turn hinges on the legitimacy of the process used to obtain and to update that price.
- Criteria for a process leading to a benchmark carbon price that is viewed as legitimate include scientific integrity, transparency, openness, admitting and explaining uncertainty, the ability of research to improve the estimate, a formal updating process, and international ownership of the process. International ownership does not necessarily mean ownership by the UNFCCC.

Ian Parry: ***Coordination through International Price Floors***

- Growing pressure for international carbon-price coordination is likely as countries implement their Nationally Determined Contributions (NDCs).
- Coordination over a minimum, rather than uniform, price has some attractions and precedents.
- There are practical implementation challenges for price floor arrangements, though they are not insurmountable.
- Article 6.2 of the Paris Agreement provides a potential vehicle for promoting broad participation in price-floor arrangements.

Brian P. Flannery: ***Establishment and Evolution of International Markets under the Paris Agreement***

- The Paris Agreement provides for international markets by recognizing that nations may voluntarily cooperate to implement NDCs, exchange mitigation outcomes under their own authority, and utilize the new mitigation mechanism under the CMA.[1] In practice, implementation remains to be determined, both domestically and internationally, and Parties' views differ on key aspects.
- Going forward, international markets will confront evolving challenges as nations review and renew contributions in five-year cycles under the Paris Agreement.
- This creates challenges, not only in terms of establishing markets to allow and account for international transfers now, but — even more — for linking markets over decades across multiple domestic jurisdictions, presumably with increasingly ambitious pledges. If the past is any indication, the domestic priorities of cooperating nations may change as a result of unforeseen and unforeseeable circumstances, and they are unlikely to share common motivations, timescales, and procedures for taking relevant decisions.
- The complex mosaic of evolving national circumstances will make it difficult to provide the flexibility and credibility that would allow firms to incorporate international market mechanisms with clarity about how these mechanisms can be utilized strategically to address transformational change.

1 Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement).

Michael A. Mehling, Gilbert E. Metcalf, and Robert N. Stavins: ***Linking Heterogeneous Climate Policies (Consistent with the Paris Agreement)***

- International linkage of regional, national, and subnational climate policies could play an important role in supporting the ramp up of ambition in NDCs over time and so contribute to the success of the Paris Agreement.
- Linkage has the potential to lower overall costs of mitigation, given the wide range of marginal abatement costs across countries, and also can lower administrative costs of compliance and help build political momentum, both of which can contribute to scaling up ambition.
- The bottom-up nature of the Paris Agreement has led to great heterogeneity of NDCs, which can pose challenges for linking. These challenges are not insurmountable, but will require thoughtful guidance for the effective operation of key provisions for linking in Article 6 of the Paris Agreement.
- Article 6 guidance can facilitate linkage by, among other things, providing clear definitions and principles for internationally transferred mitigation outcomes (ITMOs), taking into account the heterogeneous nature of NDCs.

Annie Petsonk and Charles Vinsonhaler: ***Count It Once: Climate Mitigation under the Paris Agreement and CORSIA***

- The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), established by the International Civil Aviation Organization (ICAO) in 2016, authorizes airlines to use emission reductions originating outside the aviation sector to offset the emissions of international flights. The environmental integrity of both the 2015 Paris Agreement and CORSIA can only be vouchsafed if these reductions are not double counted.
- We identify scenarios for transfers of emission reductions from the UNFCCC-Paris-Agreement "world" to the ICAO "world," and we propose rules to ensure these reductions are only counted once.

Analysis and Elaboration of Article 6

Sue Biniaz: ***Analyzing Articles 6.2 and 6.4 of the Paris Agreement along a "Nationally" and "Internationally" Determined Continuum***

- Like the Paris Agreement as a whole, Article 6 combines elements that are determined nationally with others that are determined internationally.
- Articles 6.2 and 6.4 have in common that they are voluntary — i.e., it is wholly within a Party's national discretion whether to use either one.
- Otherwise, there is a significant contrast between these provisions, as well as among various aspects of Article 6.2:
    - Article 6.4 is near the "internationally determined" end of the continuum.
    - Article 6.2 is near the "internationally determined" end of the continuum with respect to accounting, while other aspects are left to be "nationally determined."
- A Party is free to take on requirements beyond those under the Agreement.

Andrei Marcu: ***Article 6 of the Paris Agreement: Structure, Interpretation, Possible Outcomes***

- Little progress has been made in operationalizing the Paris Agreement and its Article 6 since COP-21, and it will be challenging, but not impossible, to produce a rulebook by the end of COP-24 in late 2018. This will require a focused approach by Parties, starting with their submissions ahead of COP-23, in late 2017.
- Parties need to consider whether issues must be negotiated in parallel ("nothing is agreed until everything is agreed"), or whether some issues are so fundamental that it would be better to give them priority. The scope of Article 6.2, and the definition and quantification of ITMOs, are examples of issues that may require early resolution.
- Articles 6.2 and 6.4 provide Parties with alternatives for the governance of ITMOs. While the distinction between these articles, in terms of standards and governance, may blur over time, it is important that they remain available as distinct options for now.

Axel Michaelowa: ***The Paris Market Mechanisms' Contribution to Global Greenhouse Gas Mitigation: Complementarities and Tensions between Article 6.2 and Article 6.4***

- The Paris Agreement's Article 6 market mechanisms may provide governments with access to less costly mitigation options than would be available domestically and therefore could provide an important incentive to increase the ambition of NDCs over time.
- There are, however, critical issues to be resolved if market participants are to have confidence in the new regime and the potential of the Paris Mechanisms is to be realized. Among these:
    - Additionality must be defined carefully in the Paris-Agreement context, especially if applied to policy instruments — in part through application of cost-benefit analysis.
    - The Article 6.4 mechanism should build on the strengths of the Clean Development Mechanism (CDM), applying CDM rules and accepting CDM projects and certified emission reductions (CERs) as far as possible.
- Resolution of these and other issues—and realizing Article 6's potential—depends heavily on formulating sound accounting rules and processes in the context of heterogeneous NDCs.

Michele Stua: ***A Transformational Club within the Paris Agreement: A Climate-Club Perspective on Article 6***

- The operationalization of Article 6 of the Paris Agreement is still incomplete, leaving windows of opportunity for alternative interpretations.
- For instance, it is possible to develop a legally sound interpretation of Article 6 based upon the literature on climate clubs.
- Such an interpretation could lead to a harmonious understanding of Article 6, significantly enhancing its potential usefulness in advancing the goals of the Paris Agreement.

Alex Hanafi and Jakub Jozwiak: ***Accelerating Country Cooperation to Reduce Climate Pollution under Article 6.2 of the Paris Agreement***

- Meeting the Paris Agreement's ambitious emissions-reduction goals requires early, sustained, and significant global reductions in greenhouse gas emissions.
- The Paris Agreement's Article 6.2 recognizes the role that carbon markets can play in catalyzing deeper cuts in climate pollution.
- While internationally transferred mitigation outcomes must be accounted "consistent with" any guidance agreed by the Parties to the Paris Agreement, countries and sub-national jurisdictions need not wait for internationally-agreed guidance before transferring mitigation outcomes.

Focusing on Asia

Jackson Ewing: ***China's Emissions Trading System in Context***

- Beyond addressing global climate change, China's national emissions trading system (ETS) is part of Beijing's effort to forge a cleaner and more dynamic modern economy, and this context is essential when considering its future direction and effectiveness.
- While China's national ETS launch will likely go forward in advance of the COP-23 negotiations in November 2017, continuing questions on coverage, allowance allocation, and compliance obligations are unlikely to be settled by then.
- Once launched, China's ETS will be uniquely placed to pursue market integration efforts in the Asia-Pacific region and beyond. Its success will hinge on domestic capacity building and operational discipline, and the effectiveness of its international engagement.

Valerie J. Karplus: ***Laying the Foundation for CO_2 Emissions Trading in China***

- China plans to launch a national CO_2 ETS by the end of 2017, substantially increasing the global share of greenhouse gases under carbon pricing.
- The capabilities required to support emissions trading — especially measurement, reporting, and verification of energy, emissions, and output data — remain unevenly developed and weakly coordinated across subnational governments and enterprises within China.
- China's staged approach involves strengthening emissions accounting prior to launching emissions trading, which will provide a strong foundation for domestic system expansion as well as an example for establishing emissions trading in other developing countries.
- Longer term, establishing high-quality energy and emissions data will be essential to evaluate the cost effectiveness of the system and to facilitate linkages with other systems.

Richard D. Morgenstern: ***China's National CO_2 Emissions Trading Program: A New Application of Tradable Performance Standards***

- China's new national CO_2 trading program, scheduled to begin in late 2017, differs in key respects from most programs operating in the West.
- An important design difference is the use of intensity- or rate-based tradable performance standards (TPS). Because these standards fix average rather than total emissions, they differ from more familiar command-and-control or cap-and-trade mechanisms.
- This approach has obvious advantages in terms of adapting to economic changes, but it is also inherently more complex to administer.
- Critical implementation issues include allowance allocation, the division of responsibilities among different Chinese authorities, actual measurement and verification of emissions and output, and the setting/adjusting of sector-specific benchmarks.
- Given these challenges, and given China's decentralized environmental management framework and lack of a strong tradition of national data collection, it will be important to strengthen systems for third-party verification, include incentives for accurate reporting, and provide for periodic program review and the flexibility to make modifications.

Lawrence H. Goulder: ***Linking China's Cap-and-Trade System with Other Systems: Key Challenges***

- China is introducing what will be the world's largest ETS.
- This ETS will take the form of a tradable performance standard, a structure that is different from most other national or regional ETSs.
- Despite the structural difference, there is potential for mutually beneficial gains from introducing trades of China-sourced emissions allowances on the international market.
- Linking China's ETS with other ETSs would not be beneficial in the short term, however. Before the potential gains from linkage can be realized, it would be necessary to:
    - improve the reliability of the data on China's emissions reductions;
    - achieve greater compliance;
    - assure a level of policy stringency comparable to what is promoted in other countries.

Suh-Yong Chung: ***Forming a Northeast Asian Carbon Market under the Paris Agreement***

- To develop a Northeast Asian Carbon Market, leaders in the region must build strong political momentum for their national climate-change agendas. This is possible if the formation of a carbon market is seen as a policy vehicle for developing major low-carbon projects, such as a regional supergrid.
- In establishing a carbon market for Northeast Asia, it will be very important to consider and reflect on the development of Article 6 of the Paris Agreement, including the cooperative approaches of Article 6.2 and the Mechanism of Article 6.4.
- Domestic carbon markets in Northeast Asia are at different levels of development. Therefore, flexibility in terms of participating stakeholders, market structure, and accounting rules is necessary to develop a carbon market at the regional level, as long as the regional market is compatible with Article 6 of the Paris Agreement.

BACKGROUND

Lessons Learned from Cap-and-Trade Experience

Richard Schmalensee
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Robert N. Stavins
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Key Points

- Well-designed cap-and-trade systems have proven to be environmentally effective and cost-effective.
- Successful cap-and-trade systems have had accurate emissions monitoring, significant violation penalties, and high compliance.
- Banking excess emissions reductions has been an important source of cost savings, and price collars can reduce price volatility.
- The use of "complementary policies," such as subsidies for renewables that aim to reduce GHG emissions under the cap, will generally raise the total cost of emissions reductions, reduce innovation incentives, and yield no net environmental gain.

Basic lessons

Article 6 of the Paris Agreement provides for cooperation among Parties to meet their collective GHG emissions-reduction targets, including through linkage. The simplest way for this to occur is by linking cap-and-trade systems, although linkage of heterogeneous policies, including carbon taxes and performance standards, is also possible in principle.[1] Linkages between well-designed national (or subnational) cap-and-trade systems can lower global mitigation costs and improve the functioning of national markets.

In order to provide information to policy-makers about the key attributes of well-designed cap-and-trade systems, we reviewed the available evidence on seven important cap-and-trade systems that aimed at pollution reduction (Schmalensee and Stavins 2017). Perhaps the most significant lesson from three decades of experience with cap-and trade systems is that cap and trade has proven to be environmentally effective and cost-effective in a variety of settings. The more abatement costs vary among covered entities, the greater the superiority of these systems over traditional command-and-control regulation.

1 See brief by Mehling, Metcalf, and Stavins in this volume.

A second key lesson is that all successful cap-and-trade systems have had accurate monitoring of emissions and non-trivial penalties for violations. The result has been high levels of compliance. Because implementation of cap-and-trade systems generally involves little administrative discretion, there are fewer opportunities to evade compliance by challenging administrative decisions than under traditional command-and-control regulation.

Design elements

Well-designed cap-and-trade systems contain a number of features aimed at reducing unnecessary price volatility. It is important that final rules be in place before the first compliance period. Otherwise, initial allowance price movements may largely reflect changing expectations regarding those rules, thus serving no useful purpose.

In several systems, the ability to bank allowances for later use has been an important source of cost savings. While there are obvious problems with allowing borrowing of allowances (which accordingly has never been done), the ability to bank provides a margin of intertemporal flexibility with positive economic and environmental consequences.

Changes in economic conditions can render caps non-binding (reducing incentives to invest in innovation) or drive prices to intolerable levels (risking political backlash). These problems can be mitigated by adding price floors and ceilings (that is, a price collar). The result is a hybrid, combining features of cap-and-trade and carbon-tax systems. (A carbon tax is equivalent to a cap-and-trade system in which the ceiling and floor are equal.)

To implement a price floor, a central authority buys and retires allowances if the price falls below the floor. A ceiling is usually implemented by having a central authority issue incremental allowances if the price rises above some threshold. These elements, especially a price ceiling, which eliminates a hard cap on emissions, may complicate linking cap-and-trade systems under Article 6.

Allowance allocation and use of revenue

Free allocation of allowances can be used to build political support, generally without compromising the cost-effectiveness of the resulting system. Total social cost could be reduced, however, if allowances were auctioned and the proceeds used to reduce distortionary taxes. In practice, there is generally strong political pressure to earmark auction revenues to fund specific government programs, usually "green" programs, though sometimes these revenues are used for deficit reduction. (Revenue from carbon taxes has been much less likely to be earmarked for "green" spending.)

Leakage and competitiveness

In the absence of a global cap-and-trade regime with equal allowance prices everywhere, producers of GHG-intensive products in high-allowance-price areas will become less competitive, and production and emissions will tend to shift from those areas. The importance of these competitiveness and leakage effects will vary among industries and with each system's geographic coverage. Competitiveness impacts can be mitigated by providing extra allowances to vulnerable firms based on past production levels. In contrast, unconditional grants of allowances do not affect competitiveness because they do not affect marginal cost.

Interactions with other policies

Because of other market failures that affect GHG emissions, there can be a case for supplementing cap-and-trade systems with policies aimed at those failures — for instance, government investment in climate-related R&D. But "belt-and-suspenders" regimes that involve so-called "complementary policies," which target GHG emissions that are under the cap, have apparent political appeal. Examples include the low-carbon fuel standard in California and subsidies for renewables in the European Union.

Policies of this sort can have significant adverse economic and environmental effects. When they subsidize or require relatively expensive mitigation options (e.g., residential-scale solar generation), they raise total mitigation costs. Unless a price floor or ceiling is binding, those higher costs produce no environmental benefit. Moreover, by depressing the allowance price, they reduce incentives to invest in innovation that could otherwise reduce future mitigation costs and thereby make more ambitious mitigation programs possible. Depressed allowance prices may have political appeal, but they are generally not in society's economic or environmental interest.

A caution

The design of future cap-and-trade systems can benefit from three decades of experience with such systems in the U.S. and Europe. Most covered entities in those systems have been private firms, however, and it is not clear how cost-effective cap and trade would be when many compliance entities are state enterprises, as, for example, in China. In general, the design of cap-and-trade systems needs to take careful account of the economic, political, and administrative environments in which they will operate.

Reference

Schmalensee, Richard and Robert N. Stavins. 2017. "Lessons Learned from Three Decades of Experience with Cap-and-Trade." *Review of Environmental Economics and Policy*, 11(1): 59-79. http://dx.doi.org/10.1093/reep/rew017.

CARBON PRICING AND LINKAGE IN A HETEROGENEOUS PARIS REGIME

Carbon Price Focal Points and Carbon Markets

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Key Points

- Shared perceptions about a salient focal point for the price of carbon can facilitate coordination.
- Given significant heterogeneity in the form and framing of mitigation pledges under the Paris Agreement, carbon price focal points could facilitate broader coordination in climate-change policy, such as through linking.
- The social cost of carbon or the least-cost carbon price pathway to limiting warming to 2° C could serve as focal points, although uncertainties in calculating either metric could undermine their salience.
- Carbon price focal points would enable countries to identify opportunities for linking their domestic mitigation programs.

Introduction

Carbon pricing has received increasing attention in climate-change policy design in recent years. By the end of 2016, about 40 countries and more than 20 cities priced carbon through cap-and-trade and carbon-tax policies (World Bank 2016). These domestic emission-mitigation programs reflect countries' initial efforts to implement their emission pledges under the Paris Agreement. While these countries have advanced quite heterogeneous mitigation pledges, the emergence of carbon pricing highlights the potential for the price of carbon to serve as a focal point for mitigation action.

The Nobel laureate Thomas Schelling (1960) noted that shared perceptions about a salient focal point can facilitate coordination. Drawing from this insight, this brief describes some examples of potential carbon price focal points and highlights how they could enable coordination, such as through linking, of emission-mitigation programs.

Examples of carbon price focal points

The UNFCCC process does not reveal obvious focal points. In the 1990s, a country's emissions in 1990 could have served as a focal point. Since then, differentiation in the base years used to define emission targets and in the form of mitigation pledges clearly indicates that there is no consensus about a base-year-1990 focal point. This reflects one of the disadvantages

of a nationally determined approach to mitigation: the emergence of significant heterogeneity in the form and stringency of national pledges. Such heterogeneity, in turn, suggests that there could be value in employing a common carbon-price benchmark for assessing mitigation pledges, especially in the context of evaluating opportunities for linking mitigation programs.

Let me suggest two potential candidates for carbon-price focal points. First, the social cost of carbon (SCC) — that is, the monetized damage of an incremental ton of carbon dioxide emissions — would provide a benchmark for comparing the cost of domestic mitigation programs with their benefits. Second, the carbon price path for globally-cost-effective attainment of a 2° C warming limit would provide a benchmark for an individual country's actions, relative to the long-term goal set in the Paris Agreement. Each of these has the appeal of connecting individual country mitigation policies to global social welfare (in the former case, under certain assumptions) or cost-effective attainment of the Paris goal (in the latter case). These characteristics could enhance the salience and acceptance of these benchmarks as focal points. Before describing their potential use as focal points, however, let me acknowledge some potential limitations.

A shared understanding of either of these metrics as a focal point may be difficult to realize, given the uncertainties and value judgments associated with each. Long-term integrated assessment models generate estimates of each type of metric. Uncertainty in the climate science and economics — in terms of the equilibrium climate sensitivity, damage functions, and catastrophic risk, as well as the potential role for adaptation and geo-engineering — influence estimates of the SCC (Aldy 2015; Metcalf and Stock 2017). Likewise, equilibrium climate sensitivity and technology uncertainty influence estimates of the 2° C least-cost pathway.

Value judgments can also influence these measures through the choice of discount rate and tolerance for risk, as well as whether to focus on domestic or global impacts. The wide range of estimates of the SCC — such as resulted from the scenario analysis conducted by the U.S. government in the Obama Administration and found in the broader academic literature — and the wide range of 2° C least-cost-pathway estimates in the IPCC AR5[1] scenario database — suggests that there may not be a common perception of either of these measures. This could undermine either's salience as a focal point.

Using focal points in practice

Deviations between a country's domestic carbon price — or the carbon price of a linked system — and the SCC or the least-cost 2° C price point to opportunities for policy learning and adjustment (Aldy, et al. 2016). In addition, a country could indicate that it is designing a domestic mitigation policy with a given carbon price as an input to its decision-making. For example, a country could state its plan to implement a cap-and-trade program expected

1 Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 2013. www.ipcc.ch/report/ar5.

to deliver an allowance price equal to the SCC. Doing so would enhance the transparency of mitigation pledges and also facilitate consideration of opportunities for linking mitigation efforts across countries (Aldy and Pizer 2016).

A country interested in linking its domestic mitigation programs with those of another country could voluntarily disclose the carbon price that its domestic programs would target. It could indicate whether this carbon price reflects the SCC, the least-cost 2° C price, or another objective (e.g., one that accounted for local co-benefits of mitigating carbon dioxide [Parry, et al. 2014]). This would reveal a government's preferences and values in its domestic program (Keohane and Victor 2016). A country could also specify two carbon prices — unlinked and linked price targets — analogous to unconditional and conditional mitigation pledges submitted by some developing countries under the Paris-Agreement framework.

A common focal point could facilitate efforts to identify opportunities for linking under two cases. First, consider governments that have an interest in linking their programs with other governments' programs that have similar carbon prices. These governments may prefer to avoid large resource transfers and the creation of large winners and losers through linking. Instead, the linking serves to create liquidity and price stability across the linked programs. Two countries sharing this interest and employing a carbon price focal point could then move forward with linking while also coordinating the design of key elements of their programs, such as price collars and non-compliance fines, based on the focal point.

Second, governments may identify opportunities to link with programs with different expected carbon prices, because this could signal large gains from trade. Linkage in these cases may also create de facto side payments that could encourage more substantial participation by potential laggards. A carbon price focal point, such as the SCC, could serve as a guide for welfare-improving links. If linked programs deliver a carbon price that is closer to the SCC than the price each unlinked market would deliver, then the linking increases social welfare. In a similar fashion, if linked programs deliver a carbon price closer to the least-cost 2° C price, then the linked effort is more cost-effective than the unlinked alternative.

A carbon-price focal point can facilitate coordination among domestic emission-mitigation programs and connect these domestic efforts with long-term global climate-policy goals. Employing such a benchmark promotes cost-effective implementation, enhances policy learning, and enables greater mitigation ambition over time.

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Developing and Maintaining a Reference Value for the Social Cost of Carbon

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Key Points

- An internationally agreed upon target price of carbon would provide a benchmark for comparing the stringency of national and subnational mitigation policies. Both the social cost of carbon (SCC) and the price path necessary to achieve a 2° C warming target are plausible candidates for this target price.
- Perhaps more important than the choice of benchmark is the legitimacy of the resulting price, which in turn hinges on the legitimacy of the process used to obtain and to update that price.
- Criteria for a process leading to a benchmark carbon price that is viewed as legitimate include scientific integrity, transparency, openness, admitting and explaining uncertainty, the ability of research to improve the estimate, a formal updating process, and international ownership of the process. International ownership does not necessarily mean ownership by the UNFCCC.

Background

Market-based carbon prices provide a natural way to compare the stringency of mitigation policies across jurisdictions and across policies. Such relative comparisons need an anchor — a benchmark global carbon price that represents a desired or appropriate level of effort. Two leading choices for such a benchmark are the global value of the SCC and the global carbon price associated with achieving the 2° C target.[1] Computing either benchmark requires making assumptions on topics about which very little is currently known: In the case of the SCC, the speed, impacts, and costs of climate change in the distant future; in the case of the 2° C target price, the quantitative effect of GHG concentrations on temperature and the cost of energy technologies through the end of this century and beyond.

The uncertainty associated with computing either of these benchmarks, or others that might be proposed, inherently stems from the long time horizons of climate policy. This uncertainty

1 The SCC is the monetized value of future benefits of reducing CO_2 emissions today by one ton, discounted to the present; this is the "externality value" of emitting an additional ton of CO_2 today, or at a specified future date. The 2° C target price is the carbon price path, typically a global carbon tax path, that elicits the switching to zero- and negative-emissions technologies sufficient to limit warming to 2° C, relative to the pre-industrial global average surface temperature.

makes both concepts ripe targets for criticism. For example, in the United States, critics of climate policy have seized on the uncertainty associated with estimating the SCC to argue that very conservative values of the SCC should be used, or even that the SCC should be disregarded altogether for policy purposes. Of course, policy-making must always be conducted in an environment of uncertainty, and waiting until uncertainty is resolved can mean waiting until it is too late. But for international climate policy to have a useful benchmark carbon price, that carbon price needs to be recognized as institutionally legitimate.

Process criteria

One way for a reference carbon price to be accepted as a benchmark for formal international comparisons is to have that price be the result of a *process* that is seen as intellectually and institutionally legitimate. To that end, I therefore suggest some criteria for a process to develop and maintain a benchmark international carbon price.

1. **Scientific integrity.** The estimate should incorporate the most recent scientific knowledge. For technology-based calculations, this should include both technology cost estimates and economic knowledge about technology adoption and innovation, as well as the most recent science on the climate system. For damages-based calculations, this should include the most recent knowledge about the climate system, damages, adaptation costs, and discounting.

2. **Transparency.** Scientific and modeling decisions need to be documented and publicly available. To the maximum extent possible, code should be public domain.

3. **Openness.** Providing formal opportunities for comment from stakeholders — academics not involved in the process, governmental units, and industry — and addressing those comments will build support for the process and understanding of the outcome.

4. **Admitting and explaining scientific uncertainty.** Pretending that a benchmark carbon price can be computed with precision is not a tenable position and doing so undercuts the credibility of a resulting benchmark price. Uncertainty can be communicated by avoiding false precision (the SCC is $40, not $42.25), by adopting ranges (the SCC is $35–$45), or by communicating conditional values (if it turns out that the transient climate response is only 1° C, the SCC is [], but if the transient climate response is 2.5oC, the SCC is []).

5. **Estimates can be improved by research.** An important part of ensuring scientific integrity is ensuring that areas of uncertainty are researchable. A

process that is judgmental or politically driven does not produce researchable topics. A process that is evidence-based and model-based provides researchable topics on the evidence and models.

6. **Regular updates.** Because ongoing research advances knowledge, the best scientific evidence will evolve. Thus the best scientific estimate of the benchmark carbon price will evolve. The process therefore needs to anticipate regular updates, for example on a five-year cycle, to keep pace with the science. In addition, institutional use of a reference carbon price needs to recognize that the reference price will evolve over time.

7. **Joint ownership.** For stakeholders to recognize the benchmark price as legitimate, the institutional process delivering that price needs to have international legitimacy, which points to an international agency taking the lead in coordinating the calculation. Ownership of the process does not mean that the computations need to, or ought to, be done in-house, but the process by which they are supported, reviewed, and adopted needs to have international legitimacy. Because the details of the carbon-price computation are technically difficult, an appropriate topic of discussion is what agency is the appropriate lead coordinating agency. In addition to the UNFCCC, the International Monetary Fund (IMF) and the World Bank have increasing expertise in the climate analysis area and might be appropriate lead agencies to run a benchmark-carbon-price process. Devolving responsibility for the calculation to an agency with technical expertise, but without operational responsibility for monitoring under the Paris Agreement, could have certain advantages.

Which benchmark concept?

This discussion has treated the SCC and the 2° C price even-handedly. Indeed, both concepts have advantages and disadvantages. The SCC is the economist's definition of the externality value of CO_2 emissions; as such, the SCC gives future generations a price-based "voice" in today's mitigation efforts. However, the SCC computation concerns relatively small reductions, which is consistent with valuing the 2025 reductions but not the larger reductions necessary in the longer term. In addition, computing the SCC requires making some assumptions on issues about which little is known, most notably the monetary value of damages in the distant future. Although the 2° C target price aligns with international outcome goals, computing that price requires projecting technology costs over the next century. Just in the past decade, experts and policy-makers have been surprised by the fall in the prices of oil, natural gas in the United States, and wind and solar, and have equally been surprised by technological problems in other areas, such as second-generation biofuels and carbon capture and sequestration. The task of projecting technology costs for a century is far more difficult.

Given these challenges, an argument could be made for developing both the SCC and 2° C price concepts as reference prices. Whatever the conceptual choice, however, critical to its acceptance is having a process that is viewed as legitimate by governments and stakeholders.

Coordination through International Price Floors

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Key Points

- Growing pressure for international carbon-price coordination is likely as countries implement their Nationally Determined Contributions (NDCs).
- Coordination over a minimum, rather than uniform, price has some attractions and precedents.
- There are practical implementation challenges for price floor arrangements, though they are not insurmountable.
- Article 6.2 of the Paris Agreement provides a potential vehicle for promoting broad participation in price-floor arrangements.

Pressure for price coordination

The emissions prices consistent with NDCs—either explicitly in the form of carbon taxes and emissions trading systems (ETSs) or implicitly in the form of regulations and other incentives—likely differ substantially across countries.

One reason is the substantial variation in the stringency of emissions pledges. For example, most G20 countries have specified percent emission-reduction targets but these vary between 15 and 40 percent. Moreover, in some cases these reductions are relative to a historical year (either 1990 or 2005), while in other cases they are relative to business-as-usual (BAU) projections (i.e., emissions in the absence of mitigation measures) for 2030.[1] The latter are generally less onerous as BAU emissions tend to grow over time.

A second reason is the substantial variation in the responsiveness of emissions to pricing across countries. Emissions tend to be more price responsive in heavy-coal-using countries like China, India, and South Africa, given that carbon pricing has a much larger proportionate impact on coal prices than for other fuels.

With unilateral action on NDCs, cross-country divergences in (explicit or implicit) carbon prices are therefore likely to increase over time, which should generate growing interest in price-coordination mechanisms.

1 See http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx.

Price-floor arrangements

One promising coordination mechanism, which could be implemented as a complement to the NDC process, is a minimum-carbon-price agreement among a group of (preferably large) emitting countries. This arrangement would provide some protection against losses in international competitiveness from pricing for both participating and non-participating countries. (Indeed the agreement may also help non-participants raise carbon prices.)

Individual countries in the agreement, moreover, would have flexibility to exceed the floor, which might make sense for several reasons. First, a high carbon price can be in a country's own national interest if it generates substantial domestic environmental benefits, most notably health benefits from better local air quality as carbon pricing reduces combustion of coal and other polluting fuels. It has been estimated, for example, that phasing in a $70-per-ton carbon price in China between 2017 and 2030 would save almost four million deaths from air pollution.

Second, high carbon prices may raise badly needed revenues, not least in countries where extensive informal activity hinders adequate revenue mobilization from broader fiscal instruments. In India, for example, a $70 carbon price could raise revenues of over 3 percent of GDP.

Third, high carbon prices may also be needed in countries where implementing the agreed floor price would not be sufficient to meet their NDC commitments.

Precedents for carbon-price-floor arrangements include the federal requirement in Canada that provinces phase in a minimum carbon price of CAN $50 (US $40) per ton by 2022. More broadly, tax floor regimes are commonly used in trading blocs to counteract underpricing from tax competition. For example, the European Union (EU) imposes tax minima for alcohol, tobacco, energy products, and value added tax.

Implementation issues

One implementation issue is the choice of instrument for meeting the price floor. Carbon taxes may be the most natural instrument. However, ETSs are also compatible with a floor, for example, by setting the cap to yield expected prices in line with the floor. Another option would be to employ the type of variable tax the U.K. imposes on emissions sources covered by the EU ETS, where the variable tax is designed to bring the combined (U.K. and EU ETS) charge up to a target level.

Another issue is the need to account for practical, country-specific circumstances, such as relief from carbon pricing for especially sensitive fuels or sectors, or reductions in pre-existing energy taxes motivated by domestic considerations that might partly offset the effectiveness

of direct carbon pricing. Nonetheless, it should be feasible to develop analytical conventions for measuring countries' "effective" carbon prices taking country circumstances into account. Policymakers may then pledge to increase this effective price by a given amount, allowing them considerable flexibility (e.g., through setting higher prices for other fuels to compensate for price relief for a sensitive fuel).

A third issue is deciding the level of the price floor (or the required increase in effective carbon prices). One possibility is to set a floor equal to the "social cost of carbon," that is, the estimated future global climate damages associated with an additional ton of CO_2 emissions, though these estimates are contentious, even among economists, let alone countries.[2] Alternatively, the price floor could be aligned with global prices consistent with warming targets, but again these are uncertain, and the estimated prices—around $40-$80 per ton by 2020 for the 2° C target—are ambitious relative to the current global average price of around $1 per ton. More pragmatically, the floor might be set based on catching up to an existing price established by an environmental leader, such as Canada.

Article 6.2

Some countries may have little incentive to join a price floor arrangement if they meet their NDC pledges with emissions prices well below the floor price. However, by recognizing internationally traded mitigation units, Article 6.2 of the Paris Agreement provides a potential vehicle for encouraging their participation, as these countries can gain from exceeding their NDCs and selling the excess mitigation units at the floor price. Conversely, countries with stringent NDCs can also benefit from participation as international purchase of mitigation units at the floor price may help them meet their mitigation requirements at lower cost.

In short, carbon-price floor arrangements initiated by a small group of countries could conceivably encourage broad country participation over time (regardless of the stringency of countries' NDCs) via Article 6.2, without the need to impose penalties on countries outside of the agreement.

2 See also the brief by James Stock in this volume.

Establishment and Evolution of International Markets under the Paris Agreement

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Key Points

- The Paris Agreement provides for international markets by recognizing that nations may voluntarily cooperate to implement Nationally Determined Contributions (NDCs), exchange mitigation outcomes under their own authority, and utilize the new mitigation mechanism under the CMA.[1] In practice, implementation remains to be determined, both domestically and internationally, and Parties' views differ on key aspects (Marcu 2016).[2]
- Going forward, international markets will confront evolving challenges as nations review and renew contributions in five-year cycles under the Paris Agreement.
- This creates challenges, not only in terms of establishing markets to allow and account for international transfers now, but — even more — for linking markets over decades across multiple domestic jurisdictions, presumably with increasingly ambitious pledges. If the past is any indication, the domestic priorities of cooperating nations may change as a result of unforeseen and unforeseeable circumstances, and they are unlikely to share common motivations, timescales, and procedures for taking relevant decisions.
- The complex mosaic of evolving national circumstances will make it difficult to provide the flexibility and credibility that would allow firms to incorporate international market mechanisms with clarity about how these mechanisms can be utilized strategically to address transformational change.

International GHG markets have been active for years, both under the Kyoto Protocol, and as a result of national and subnational programs that recognize mitigation actions taken elsewhere (including some programs that link jurisdictions across borders). Two major constituencies drive these markets: (1) nations seeking to satisfy international agreements and (2) firms (and other actors) with legally binding domestic obligations to mitigate emissions. Under the

1 Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement).

2 See also brief by Andrei Marcu in this volume.

Kyoto Protocol, market instruments and processes (e.g., emissions trading, allowances, and credits from offset projects) were used by both constituencies.

Going forward, firms, especially, will need far more clarity than provided by NDCs regarding domestic markets and how they may link to markets in other nations. For example, many nations have put forward NDCs that state objectives at a point in time rather than as a budget over time, and it appears unlikely that all relevant offset projects will share common, internationally recognized procedures or metrics.

Economists and some policymakers hope that markets will help minimize the effort and cost to achieve long-term mitigation goals. Although initial requirements are modest, achieving the ambitious goals of the Paris Agreement will require transformational change on a vast scale in a relatively short period of time. For international markets to play an important role, policy and process must provide firms with credible yet flexible guidance to inform strategic planning on, for example, research and development, investments, divestments, mergers and acquisitions, and management of supply and value chains.

The Kyoto Protocol provided a moderately coherent basis for existing international markets, but it remains unclear how markets will work for nations with voluntary, renewable pledges under the Paris Agreement and for firms and other actors. Because of the "evolutionary" nature of the Paris Agreement, multinational firms will face the complexity of participating in international markets in a way that complies with national regulations (and internal audit and control procedures), under mixed criteria from multiple jurisdictions, and subject to regulations and procedures that may be changing frequently, with a bewildering array of decision-makers acting under different pressures, rules, and time frames in different jurisdictions.

Some argue that it is necessary (or desirable) for policies to provide long-term certainty for businesses to manage the transformation to a low-carbon future. However, events of the last few decades demonstrate that this is impossible. Unforeseen and unforeseeable events—including natural disasters (e.g., tsunamis), breakthroughs or bottlenecks in anticipated technological change (e.g., fracking and the "hydrogen economy"), and the inevitable disruption brought about by changes in government through elections or otherwise—preclude long-term certainty. A major concern is that political and policy changes may alter or disrupt markets on timescales far shorter than the time horizon to plan, implement, and manage major investments in facilities and infrastructure. Nonetheless, it should be possible to provide clarity on ultimate policy intentions, and on the criteria and procedures to be used in updating national contributions under the Paris Agreement and in identifying the domestic obligations of firms.

To date most discussions of future international markets have wrestled with the challenge of establishing these markets now, in the emerging framework of the Paris Agreement and national regimes for initial NDCs. An interesting and perhaps more important issue will be to

consider options and design elements to guide their evolution over multiple cycles to review and update future NDCs. Parties to the Paris Agreement must confront complications arising not only from the Agreement's five-year cycles, but also from the challenges inherent in coherently linking evolving domestic markets and mitigation obligations given differences in legislation and regulation across multiple jurisdictions, each with its own procedures, constraints, and timescales, including the possibility of lengthy legal challenges.

For insight into markets in the evolving mosaic world established by the Paris Agreement, it would be useful for analysts to move away from consideration of ideal, first best policies based, for example, on an economy-wide carbon price applied to all GHG emissions that is identical in all nations. While such ideal policies would indeed have many benefits, they are completely unrealistic and irrelevant, certainly over the next few decades. Key political actors are more concerned about the implications of control and distribution policies for their constituents than they are about satisfying some abstract, amorphous global community that plays little role in setting or implementing policy, or electing domestic officials.

In the real world, policies result in a mosaic of approaches depending on circumstances, priorities, and institutions in each nation. In the context of establishing and developing international markets in a setting of perpetual negotiation tied to five-year cycles under the Paris Agreement, linked national (and subnational) markets face a daunting challenge to maintain coherence. Taken together, the Paris-Agreement architecture runs the serious risk of creating chaos in efforts to implement stable and effective long-term international markets.

Academics, policy advisors, and firms should consider how international GHG markets can be designed to provide credibility and flexibility and thereby contribute to a coherent strategic framework for efficiently managing transformational change. Ideally this should involve not only research, but also dialogue among participants from government, business, academia, and other domains—from a variety of nations—to better understand the implications of choices and inform both analyses and policy design.

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Linking Heterogeneous Climate Policies (Consistent with the Paris Agreement)

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Key Points

- International linkage of regional, national, and subnational climate policies could play an important role in supporting the ramp up of ambition in Nationally Determined Contributions (NDCs) over time and so contribute to the success of the Paris Agreement.
- Linkage has the potential to lower overall costs of mitigation, given the wide range of marginal abatement costs across countries, and also can lower administrative costs of compliance and help build political momentum, both of which can contribute to scaling up ambition.
- The bottom-up nature of the Paris Agreement has led to great heterogeneity of NDCs, which can pose challenges for linking. These challenges are not insurmountable, but will require thoughtful guidance for the effective operation of key provisions for linking in Article 6 of the Paris Agreement.
- Article 6 guidance can facilitate linkage by, among other things, providing clear definitions and principles for internationally transferred mitigation outcomes (ITMOs), taking into account the heterogeneous nature of NDCs.

The Paris Agreement features a hybrid policy architecture, combining top-down elements for monitoring, reporting, and verification, and bottom-up elements, including NDCs.[1] The Agreement has achieved a key necessary condition for ultimate success, namely adequate scope of participation, with participating nations accounting for approximately 97 percent of global GHG emissions.

1 The arguments in this brief are developed more fully in Mehling, et al. (2017). Citations to the relevant literature are provided there.

The other key necessary condition for ultimate success of this new approach is adequate, collective ambition of the individual NDCs to put the world on a path toward achieving the global political target of limiting temperature increases to 2° C. A central question is how to provide a structure and/or incentives that will facilitate such increases in ambition over time. International linkage of regional, national, and subnational policies can be part of the answer.

A challenge is the substantial degree of heterogeneity that characterizes climate policies along three dimensions: types of policy instruments, levels of political jurisdictions implementing those policies, and types of targets. Our research examines such heterogeneity and identifies (a) which linkages are feasible; (b) of these, which are most promising; and (c) what accounting mechanisms would make their operation consistent with the Paris Agreement.

Why focus on linkage?

The major economic argument for linkage is cost effectiveness — the ability to achieve a given level of emission reductions at lowest cost. Since a major impediment to ambitious climate policy is concern about the cost of mitigation, any policy that can lower costs can also lower political resistance to ambitious policy. It has been estimated that international linkage could reduce the cost of achieving the emissions reductions specified in the initial set of NDCs under the Paris Agreement by 32 percent by 2030 and by 54 percent by 2050 (World Bank 2016, 83, 86).

Linkage can be valuable even when the linking jurisdictions have similar carbon prices. Here the benefits are political and administrative rather than economic. The political benefits from linking policies may stem from providing a sense of momentum to which political supporters of climate policy can point and so build support. Since GHG emissions are a global pollutant, no politician wants to appear to be acting unilaterally to control emissions. Linking with other jurisdictions is a tangible signal of a multilateral approach to the problem. There are also administrative economies of scale through linkage. Jurisdictions can share best practices in designing and operating emission control policies and so learn from each other. They can also share administrative and oversight costs and avoid costly duplication of control efforts.

Linkage and heterogeneous systems

The bottom-up nature of the Paris Agreement has led to great heterogeneity in the submitted NDCs. In addition, it is important to consider the possible role of non-party states and subnational governments in the wake of the Trump election in the United States and the announced intention to withdraw from the Paris Agreement. We separate these heterogeneous attributes into three categories: policy instrument, political jurisdiction, and target. We divide our consideration of political jurisdiction into two types of heterogeneity: levels of government engaged in the prospective linkage (regional, national, or subnational) and status under the Paris Agreement (Party or non-Party). Finally we focus on two types of target heterogene-

ity: the type of policy-instrument target and the type of NDC target. Our research suggests that heterogeneity *per se* is not an impediment to linkage. But there is a role for guidance on the key provision in the Paris Agreement for linking—Article 6.2.

Priorities for effective Article 6 guidance

Guidance elaborated by the Parties should direct attention to those potential transfers that present meaningful risks to environmental integrity. This would include the potential for "hot air," consideration of heterogeneous target types, differing base years among linking parties, and differences in degree of geographic coverage of NDCs and the resulting potential for leakage, among other factors.

Key issues when accounting for international transfers facilitated through Article 6 include: quantifying mitigation targets and outcomes; avoiding double-counting of emission reductions; and accommodating different metrics for, and vintages of, targets and outcomes.

In order to track and account for international transfers through Article 6.2, definitions, principles, and accounting rules will be needed. Among the approaches that could be specified in guidance on Article 6 are: standards and procedures for quantifying mitigation outcomes (whether through carbon taxes, cap-and-trade instruments, performance standards, or other policy instruments); registry tracking of the transfer and use of ITMOs; guidance on NDC elements that would increase clarity; and guidance to move NDCs to greater consistency, such as with regard to assumed Global Warming Potential values. Guidance could also establish whether and how transfers to or from non-Parties (or subnational jurisdictions therein) can be accounted for.

Guidance on Article 6 also needs to focus on the nature and scope of ITMOs. One issue is the metric for ITMOs: Will there be a single common metric, presumably tons of CO_2 equivalent, or will there be multiple metrics, such as installed capacity of renewable power? This relates to a broader question of whether ITMOs will be, in effect, a single or multiple type of compliance unit.

As they negotiate the work program on implementation of the Paris Agreement, Parties have an opportunity to establish clear and consistent guidance for operationalizing Article 6. If they can set aside political differences and agree on a robust framework for ITMO transfers, they will not only avoid impeding future linkage of climate policies across jurisdictions, but could create an enabling context with common definitions and modalities. Such a harmonized set of parameters could help accelerate linkage and allow for broader and deeper cooperation. It could also enhance Parties' ability to scale up the ambition of their NDCs and potentially foster constructive engagement between Parties and non-Parties, as well as subnational jurisdictions.

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Count It Once: Climate Mitigation under the Paris Agreement and CORSIA

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Key Points

- The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), established by the International Civil Aviation Organization (ICAO) in 2016, authorizes airlines to use emission reductions originating outside the aviation sector to offset the emissions of international flights. The environmental integrity of both the 2015 Paris Agreement and CORSIA can only be vouchsafed if these reductions are not double counted.
- We identify scenarios for transfers of emission reductions from the UNFCCC-Paris-Agreement "world" to the ICAO "world," and we propose rules to ensure these reductions are only counted once.

Two "worlds" of mechanisms

UNFCCC Paris Agreement. The Paris Agreement seeks to achieve its mitigation aims through successive Nationally Determined Contributions (NDCs) offered by each Party. The Agreement recognizes that, in implementing their NDCs, Parties may choose to pursue voluntary cooperation (Article 6.1).[1] The Paris Agreement specifies that when using internationally transferred mitigation outcomes (ITMOs) toward NDCs, Parties "shall apply robust accounting to ensure, *inter alia*, the avoidance of double counting," and that this shall be done "consistent with guidance adopted by the [CMA[2]]", in the event the CMA adopts such guidance (Article 6.2). The Paris Agreement also establishes, under CMA authority, a mechanism — to be supervised by a CMA-designated body under rules adopted by the CMA — to aim to contribute to the reduction of emission levels in a host Party that can also be used by another Party to fulfill its NDC and "deliver an overall mitigation in global emissions" (Articles 6.4 and 6.7).

1 The text of the Paris Agreement is at: http://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf.

2 Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement).

ICAO-CORSIA. ICAO was established in 1944 by the Chicago Convention on International Civil Aviation. ICAO's 2016 Assembly established CORSIA to address any annual increase in total CO_2 emissions above 2020 levels from flights departing one country that arrive in a different country. All non-exempted countries must participate from 2027 to 2035, and any country may choose to participate from 2021 to 2026 (ICAO 2016, pars. 5, 9–14). ICAO's Council and its Committee on Aviation Environmental Protection (CAEP) are currently developing Standards and Recommended Practices (SARPs) and related guidance to support the purchase of appropriate emissions units by aircraft operators under CORSIA, for adoption by the Council as soon as possible but not later than 2018, taking into account developments in the UNFCCC and under Article 6 of the Paris Agreement. The Council will periodically review the SARPs and guidance to promote compatibility with future relevant decisions under the Agreement (ICAO 2016, par. 20).

Draft criteria for CORSIA's eligible emissions units provide that offset credits for purchase by aircraft operators should only be "counted once towards a mitigation obligation" (ICAO 2017, p. 18). Emissions units generated from mechanisms established under the UNFCCC and the Paris Agreement are eligible for use in CORSIA, provided that they meet criteria for avoiding double counting and for eligible vintage and timeframe (ICAO 2016, par. 21).

Two "worlds" of reporting

The *Paris Agreement* requires each of its Parties to regularly provide a "national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases" (Article 13.7 (a)). While the UNFCCC and the Paris Agreement require Parties to report emissions from international aviation and international shipping, those are to be reported separately,[3] and are not covered by NDCs.

To implement *CORSIA, ICAO* is developing SARPs that will require all Member States to require airlines to report the emissions of international flights (ICAO 2016, par. 16). If CORSIA SARPs also require reporting of emissions units cancelled by airlines to offset their emissions above 2020 levels, and if both types of reports are made public, ICAO Member States and the world will be able to see if CORSIA is working.

Count it once

Most emission reductions that could be used in CORSIA originate in the UNFCCC-Paris-Agreement "world," in the territory of a nation. Double counting could occur if an airline counts emission reductions toward its CORSIA compliance *and* the host nation also counts the reductions. The result would be to overstate the effectiveness, and undermine the integrity,

3 See UNFCCC, "Emissions from fuel used for international aviation and maritime transport (international bunker fuels)": http://unfccc.int/methods/emissions_from_intl_transport/items/1057.php.

of both the Paris Agreement and CORSIA. We consider four distinct cases and the corresponding steps needed to ensure reductions are only counted once:

> *Case I: Offsets originating in a sector covered by a Paris-Agreement Party's NDC.*
> Example: A Paris-Agreement Party with an NDC covering the electricity sector replaces a thermal power plant with solar electricity. The resulting emission reduction is transferred to an airline for use in CORSIA.
>
> *Case II: Offsets originating in a Paris Party's non-NDC sector.*
> Example: A Paris Party reduces emissions in its agriculture sector — a sector not covered by its NDC. The resulting emission reduction is transferred to an airline for use in CORSIA.
>
> *Case III: Offsets originating in a non-Party to the Paris Agreement.*
> Example: An offset program verifies reductions in a subnational jurisdiction of a UNFCCC Party that is not a Party to the Paris Agreement, and those are transferred for use in CORSIA.
>
> *Case IV: (Sustainable) Alternative Aviation Fuels ((S)AAF).*
> Example: An airline claims that it used SAAF on CORSIA-covered international flights and thereby reduced its offset obligation.

In each case, to prevent double counting, before an airline cancels emissions units for CORSIA compliance (or receives CORSIA credit for SAAF), the host Party should undertake three accounting steps. First, it must subtract the emissions units from the relevant pool of transferable units that it hosts, publicly showing the transfer of title in a registry where the units are uniquely recorded. Second, if the reductions come from a sector covered by the host country's NDC, then the transfer of this mitigation outcome from the Paris-Agreement "world" to the ICAO "world" must be reported in the Party's progress-toward-NDC report required under Paris Agreement Article 13.7(b).

Third, regardless of whether the reductions come from an NDC or non-NDC sector, the host Party must account for the transfer of the reductions undergirding the transfer by recording, in an account based on its inventory,[4] the addition of a corresponding amount of emissions. This requirement ensures no double counting. This requirement therefore should apply regardless of the originating program under which the units were generated (which might

4 This account would be based on the host Party's national inventory report under Paris Agreement Article 13.7(a) — or on its national inventory under the UNFCCC, if the host Party is not a Party to the Paris Agreement — and would reflect the addition described in the text.

include Paris Agreement Article 6.4 or national/subnational programs with which compliance is mandatory, or voluntary programs).[5]

With regard to alternative fuels, CORSIA provides that "a methodology should be developed to ensure that an aircraft operator's offsetting requirements…in a given year can be reduced through the use of sustainable alternative fuels" (ICAO 2016, par. 6). A CAEP task force is currently developing life-cycle assessments of various alternative fuels. Before an airline may claim these fuels as justifying a lowering of its CORSIA offsetting requirements, the fuels used must be subtracted from the pool of available fuels, and the host Party, in its national inventory report,[6] must account for the export of the reductions undergirding the transfer by recording the addition of a corresponding amount of emissions.

Timing issues around these accounting steps, and inter-related questions about equivalent steps that could provide the same degree of accounting integrity, are quite important and bear further consideration. For example, suppose an airline executes an option contract for the future purchase of emissions reductions (or SAAF). If the host Party is not notified of the contract in advance, and the airline exercises the option many years later and purchased reductions that occurred in an already-passed year, then the addition of the corresponding amount of emissions into its inventory for the already-passed year could raise Paris-Agreement-compliance concerns for the host Party. Such considerations weigh in favor of timing the accounting steps — or equivalent steps — to ensure that governments are not caught short by emissions-unit transfers.

Conclusion

Including these simple accounting steps in any "guidance" or "rules, modalities, and procedures" for the Paris Agreement (see Articles 6.2, 6.4, and 6.7), as well as in CORSIA SARPs, could play a crucial role in ensuring that when reductions are transferred from the UNFCCC-Paris-Agreement "world" to the ICAO-CORSIA "world," they are counted only once.

5 For reductions transferred under Paris Agreement Article 6.4, Article 6.5 specifies that these "shall not be used to demonstrate achievement of the host Party's NDC if used by another Party to demonstrate achievement of its NDC." While Article 6.5 does not mention CORSIA (understandably, since CORSIA was established a year later), the lack of mention of CORSIA in Article 6.5 cannot be read as implicitly authorizing double counting vis-à-vis CORSIA, since double counting would breach the Agreement's requirement that the Article 6.4 mechanism aims to "deliver an overall mitigation in global emissions" (Paris Agreement Article 6.4(d)).

6 Or in its national inventory under the UNFCCC, if the host Party is not a Party to the Paris Agreement. The text of the Convention is at: https://unfccc.int/resource/docs/convkp/conveng.pdf.

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ANALYSIS AND ELABORATION OF ARTICLE 6

Analyzing Articles 6.2 and 6.4 of the Paris Agreement along a "Nationally" and "Internationally" Determined Continuum

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Key Points

- Like the Paris Agreement as a whole, Article 6 combines elements that are determined nationally with others that are determined internationally.
- Articles 6.2 and 6.4 have in common that they are voluntary — i.e., it is wholly within a Party's national discretion whether to use either one.
- Otherwise, there is a significant contrast between these provisions, as well as among various aspects of Article 6.2:
    - Article 6.4 is near the "internationally determined" end of the continuum.
    - Article 6.2 is near the "internationally determined" end of the continuum with respect to accounting, while other aspects are left to be "nationally determined."
- A Party is free to take on requirements beyond those under the Agreement.

Introduction

The negotiation of the Paris Agreement was, to a large extent, about the appropriate balance between what is left to each Party to decide and what is decided (or at least encouraged) internationally. Negotiators searched for the sweet spot between the Kyoto Protocol's "top down" approach and the Copenhagen Accord's "bottom up" approach. The resulting Agreement reflects a hybrid approach, with the core element (emissions targets) being nationally determined and other elements at varying points along a continuum from nationally to internationally determined. Article 6 likewise reflects a hybrid approach, with paragraphs 2 and 4 taking very different approaches, and paragraph 2 itself taking different approaches internally.

A Continuum

The terms "nationally determined" and "internationally determined" (as well as "bottom up" and "top down"), while convenient shorthand, do not adequately convey the range of possibilities upon which negotiators can draw when designing an agreement. Rather, nationally and internationally determined elements can be combined in many different ways. (Even

"continuum" does not quite capture the possibilities, as they run along several different lines, for example, determination of content, precision, "bindingness," and enforcement.)

An agreement might allow a Party to decide whether to take on a particular commitment and, if so, allow the Party to shape its content. On the other hand, an agreement might obligate a Party to take on a commitment, dictate its terms, and make the fulfillment of the commitment not only legally binding but subject to international enforcement.

Between these extremes, an agreement might provide for:

- Parties to follow an internationally agreed requirement but leave to each Party how to apply it;
- Parties to follow an internationally agreed requirement, authorize the Conference of Parties to elaborate the requirement in a legally binding manner, and require Parties to report internationally on how they are implementing it, but stop short of an international enforcement mechanism; or
- the voluntary assumption of a commitment but dictate the terms of the commitment if a Party chooses to assume it.

The exact combination of elements with respect to each provision will depend upon the agreement's objective, national sensitivities, the need for various accommodations in both directions, and other factors.

Article 6.4

On the one hand, Article 6.4 is wholly discretionary (i.e., it is up to a Party to determine whether to use it). A Party is under no obligation to be a host. Likewise, a Party with a Nationally Determined Contribution (NDC) is under no obligation to use a 6.4 reduction toward meeting its NDC. The Party might choose to implement its NDC wholly within its territory or use internationally transferred units/reductions from sources other than 6.4. (Article 6.4 is, by its terms, only "a" mechanism.)

On the other hand, should a Party choose to use 6.4, there appears to be very little discretion in *how* to use it. The Agreement and accompanying decision set forth extensive international criteria, both substantive and procedural. The CMA[1] is authorized to adopt further rules, modalities, and procedures. Moreover, the operationalization of the criteria, rules, etc. falls to an international body, not individual Parties. Thus, even if a Party completely followed the relevant international criteria, it would not have succeeded in creating a qualifying reduction under 6.4. That must be done by the international body.

1 Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement).

It is interesting to note that, while 6.4 bears a strong resemblance to the Kyoto Protocol's Article 12, the impetus for the extensive "internationally determined" nature of 6.4 is not the same as it was for the Clean Development Mechanism (CDM). Under Kyoto, the Annex I Parties had emissions caps under which all traded/transferred units needed to be fungible. There was concern that if the CDM were to give Parties significant discretion to devise their own criteria or even to apply the international criteria themselves, non-fungible units would contaminate the system. In contrast, NDCs under the Paris Agreement are heterogeneous and not based on fungible units. In addition, they are not legally binding. Article 6.4's design is more likely based on the desire to have readily available reductions with a pre-existing international "stamp of approval."

Article 6.2

With the exception of being wholly voluntary, i.e., up to each Party to determine whether or not to transfer or use internationally transferred mitigation outcomes (ITMOs), Article 6.2's place on the continuum is quite different from that of 6.4. Article 6.2 contains three legally binding requirements:

- to "promote sustainable development";
- to "ensure environmental integrity and transparency"; and
- to "apply robust accounting to ensure" (among other things) "the avoidance of double counting."

Only the robust accounting requirement is subject to international guidance, to be elaborated by the CMA.

- (Notwithstanding use of the word "guidance," which sounds non-binding, 6.2 clearly authorizes the CMA to develop legally binding guidance. It provides that Parties "shall" apply robust accounting "consistent with" the guidance to adopted by the CMA. The CMA has discretion whether to take advantage of that authorization. It could decide to adopt legally binding guidance, non-binding guidance, or a combination.)

The absence of guidance would not affect the ability of Parties to transfer/use ITMOs. They would still have an obligation to apply robust accounting and would report through the transparency framework how they were doing so.

Significantly, unlike 6.4, Article 6.2 does not define (or authorize the CMA to define) "what" can be transferred or from whom.

In sum:

- The CMA cannot limit what constitutes an ITMO under 6.2 (such as confining transfers to particular types of NDCs or globally fungible units). As such, there might be a variety of linkages among heterogeneous systems/policies.
- Each Party will decide nationally how to promote sustainable development and ensure environmental integrity and transparency.
- With respect to accounting, a Party's national discretion is limited. Its approach to accounting must comport with any CMA guidance.
- Each Party would report under the transparency framework on how it is implementing each of the above requirements, including how it is ensuring environmental integrity.

Going beyond Paris requirements

Nothing in Article 6.2 or 6.4 limits a Party's ability to go beyond its requirements where it deems appropriate. Reporting and review under the transparency framework may provide motivation for additional stringency. For example:

- A Party might unilaterally decide not to acquire or use particular types of ITMOs.
- A group of Parties or other relevant entities might pledge (such as through a "carbon club") to abide by stricter requirements.
- A Party or Parties might decide to allow the acquisition of particular ITMOs from other Parties/entities for purposes of domestic law but not for purposes of fulfilling an NDC.

Article 6 of the Paris Agreement: Structure, Interpretation, Possible Outcomes

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Key points

- Little progress has been made in operationalizing the Paris Agreement and its Article 6 since COP-21,[1] and it will be challenging, but not impossible, to produce a rulebook by the end of COP-24 in late 2018. This will require a focused approach by Parties, starting with their submissions ahead of COP-23, in late 2017.
- Parties need to consider whether issues must be negotiated in parallel ("nothing is agreed until everything is agreed"), or whether some issues are so fundamental that it would be better to give them priority. The scope of Article 6.2, and the definition and quantification of internationally transferred mitigation outcomes (ITMOs), are examples of issues that may require early resolution.
- Articles 6.2 and 6.4 provide Parties with alternatives for the governance of ITMOs. While the distinction between these articles, in terms of standards and governance, may blur over time, it is important that they remain available as distinct options for now.

Overview

Almost two years after concluding the Paris Agreement at COP-21, Parties have not made significant progress towards operationalizing its provisions. In particular, there is growing concern about prospects for completing the rule book for Article 6 by the end of COP-24, given the complexity and very technical nature of the issues in front of negotiators, and the "constructive ambiguity" found in parts of the text.

Article 6 has sometimes been mislabelled the "markets article," when in fact it is much more than that. The inclusion of robust provisions for emissions markets in the Paris Agreement was a surprise, but should not be, if the contents of Article 6 are properly understood.

In fact, Article 6 addresses the role of international cooperation in meeting the goals and objectives of the Paris Agreement, and is intended to help Parties meet their Nationally Deter-

1 Twenty-First Conference of the Parties to the UNFCCC.

mined Contributions (NDCs). Its specific provisions for the creation and transfer of mitigation outcomes under UNFCCC rules represent, and should be seen as, special cases of international cooperation.

Components of Article 6

Article 6 has four distinct provisions. *Article 6.1* recognizes that broad cooperation will play a role in implementing NDCs. However, Article 6.1 stops short of being an enabling article, as it works under the overall assumption that Parties do not need to seek permission to cooperate.

Articles 6.2 and 6.3 refer to the special case of international cooperation, when an international transfer of mitigation outcomes takes place. There appear to be no provisions in the Paris Agreement that limit the scope of ITMOs. ITMOs may be used towards NDCs, provided that they meet a number of "shall" provisions: promote sustainable development; ensure environmental integrity and transparency, including in governance; and are consistent with guidance for accounting rules, as developed by the CMA.[2]

It is fairly clear that Articles 6.2 and 6.3 are meant to give Parties the option of using ITMOs under a governance structure that largely devolves accountability to the cooperating Parties. It must be highlighted that Parties have different opinions concerning the use of ITMOs, absent accounting guidance being developed by the CMA. Some Parties argue that there is nothing to prevent the use of ITMOs in the absence of such guidance.

Possible outcomes under Article 6.2 include the emergence of multiple ITMOs as NDC compliance instruments (or currencies). The Paris-Agreement-compliance value of these ITMOs would be nationally determined, but could be capped at the face value of the mitigation outcome in the issuing jurisdiction. In addition, given the different levels of effort reflected in different countries' NDCs, these ITMOs may have a floating value.[3] Another obvious role for Article 6.2 could be to provide a framework for directly linking individual countries' domestic emissions trading schemes.

Articles 6.4–6.7 are widely seen as similar to Article 6.2 (in terms of what they deliver), but with two essential differences: First, governance under these articles is placed squarely and overwhelmingly under the authority of the CMA; second, unlike Article 6.2, they provide rules for the creation of mitigation outcomes. Mitigation outcomes produced under Article 6.4 ought to become ITMOs, after their initial issuance by the CMA. Beyond the initial issuance, in what could be seen as transfer in the secondary market, mitigation outcomes issued

2 Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement).

3 See also briefs by Aldy, Stock, and Parry in this volume.

under Article 6.4 should be treated as any other transfer between Parties, and become ITMOs covered by the rules of Article 6.2

Possible outcomes from Articles 6.4–6.7 could include the emergence of compliance instruments that, like currency, would be good for NDC compliance, would be issued by the CMA, and could be used by all Parties. Similar to certified emission reductions (CERs) and emission reduction units (ERUs),[4] such compliance instruments could be used to indirectly link domestic trading schemes. Article 6.4 can be seen as providing multiple "windows," such as CDM+,[5] certification of non-UNFCCC mechanisms (e.g., VCS, JCM[6]), or as providing unbundled services (e.g., UNFCCC MRV for the Green Climate Fund).

Articles 6.8 and 6.9, the non-market portions of Article 6, have been seen, unfairly, as a "give-away" to some Parties in exchange for the market provisions of Article 6. Key aspects of these articles, including their purpose and the types of cooperation they cover, are not yet well defined. The scope of these articles could evolve over time, with some countries arguing that they could play an important role in addressing the sustainability of the economic and social transitions necessitated by climate-change mitigation, including addressing the competitive aspects of international climate policy, which will become a very significant issue — sooner rather than later.

Ambiguities in Article 6

As in all international agreements, there are "constructive ambiguities" in the Paris Agreement. Article 6 is no exception. Many Parties seem determined to explore different interpretations of what they see, or want to see, as ambiguity in the text of the Agreement.

These ambiguities have been captured in the "informal information notes" of the Co-Facilitators from the 46th session of the SBSTA[7] in May 2017.[8] The informal notes aim to collect all issues that Parties may want to discuss at future sessions. While these documents are well intended, the list of issues they present is heavily politicized and difficult to use. Some Parties object strongly to the inclusion of issues on any list, and want, at all costs, to avoid returning to protracted negotiations over issues that they see as having "already been put to bed" in Paris.

4 CER is the mitigation unit of the Kyoto Protocol's Clean Development Mechanism; ERU is the mitigation unit of the Kyoto Protocol's Joint Implementation mechanism.

5 I.e., an enhanced or elaborated version of the Kyoto Protocol's Clean Development Mechanism.

6 Verified Carbon Standard (www.v-c-s.org); Japan's Joint Crediting Mechanism (www.jcm.go.jp).

7 UNFCCC's Subsidiary Body for Scientific and Technological Advice.

8 https://unfccc.int/meetings/bonn_may_2017/in-session/items/10276txt.php.

The disclaimers in the Co-Facilitator documents provide a good indication of the difficulties that lie ahead: *"The informal list does not attempt to capture convergence or divergence. The informal list does not represent agreement; and does not represent agreed views, or agreed ideas or agreed text. The informal list does not represent…"*[9] So, in the end, what does the list represent? If negotiations continue at this pace and in this spirit, the likelihood of completing a rule book for Article 6 at COP-24 is not very high.

If, on the other hand, Parties do expect to complete the rule book for Article 6 at COP-24, the next logical step for them was to provide, in their submissions for SBSTA 47, which were due October 2, 2017, their views on the issues that need to be addressed and that are captured in the above-mentioned informal notes. Time will tell how disciplined and focused the submissions are.

One question that needs to be considered is whether issues must be negotiated in parallel (i.e., "nothing is agreed until everything is agreed") or whether some issues are so fundamental that their resolution significantly affects other issues and thus requires that they be addressed first. For illustrative purposes only, and not by way of offering an exhaustive list of potentially fundamental issues, some items in this category may include: (a) What is an ITMO? (b) Do ITMOs need to be quantified in CO_2-equivalent terms only? (c) What is the relationship between Articles 6.2 and 6.4, and when does a mitigation outcome issued under Article 6.4 become an ITMO?

On the question of what constitutes an ITMO, some Parties would like to essentially recreate Article 17 of the Kyoto Protocol, and allow the use of Article 6.2 only by Parties that have quantified absolute caps and can issue a new type of assigned amount unit (AAU). The initial reaction from other Parties is that such an approach is not justified by any reference in the Paris Agreement. In addition, it would negate the "nationally determined" part of the NDC. Finally, it can be seen as a renegotiation of the Paris Agreement or, at best, a special/simplified case of the Paris Agreement.

Another significant issue is whether ITMOs need to be quantified in CO_2-equivalent terms only. Several points argue against this approach. First, it negates the bottom-up ethos of the Paris Agreement. Second, there is no justification for such a requirement under the Paris Agreement. Third, the Paris Agreement, including the "institutional memory" of its negotiators and stakeholders, and other submissions, points to a very broad scope for ITMOs. Fourth and finally, such an approach "pierces the national veil" — that is, many NDCs are not expressed in CO_2-equivalent terms and would need to be translated to become ITMOs. In that case, who would decide what the appropriate conversion factor is for translating different types of mitigation commitments to CO_2-equivalents?

9 Emphasis added. See, for example, https://unfccc.int/files/meetings/bonn_may_2017/in-session/application/pdf/sbsta_10a_informal_note_final.pdf.

The Paris Market Mechanisms' Contribution to Global Greenhouse Gas Mitigation: Complementarities and Tensions between Article 6.2 and Article 6.4[1]

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Key Points

- The Paris Agreement's Article 6 market mechanisms may provide governments with access to less costly mitigation options than would be available domestically and therefore could provide an important incentive to increase the ambition of Nationally Determined Contributions (NDCs) over time.
- There are, however, critical issues to be resolved if market participants are to have confidence in the new regime and the potential of the Paris Mechanisms is to be realized. Among these:
    - Additionality must be defined carefully in the Paris-Agreement context, especially if applied to policy instruments — in part through application of cost-benefit analysis.
    - The Article 6.4 mechanism should build on the strengths of the Clean Development Mechanism (CDM), applying CDM rules and accepting CDM projects and certified emission reductions (CERs) as far as possible.
- Resolution of these and other issues—and realizing Article 6's potential—depends heavily on formulating sound accounting rules and processes in the context of heterogeneous NDCs.

The legacies of the Kyoto Mechanisms

A key innovation of the Kyoto Protocol agreed in 1997 was the set of three market mechanisms made available to countries with national emission commitments — the CDM, Joint Implementation (JI), and International Emissions Trading (IET). The CDM enabled greenhouse gas mitigation projects in countries without commitments to generate emissions credits, while JI was limited to projects in countries with commitments. IET allowed governments to directly transfer emissions units from their national emissions budgets.

1 I would like to thank the German Ministry of Education and Research for funding the project "Transformative Ambitionssteigerung – Der Beitrag effektiver Klimapolitikinstrumente (TABEK)" (01LS1621A) in whose context this article has been written.

The CDM became the most heavily used of the three Kyoto Mechanisms. Until the end of the Kyoto Protocol's first commitment period, over 1.8 billion CERs were issued from projects in over 90 developing countries. Over 8,000 projects and activities under programs have been formally registered to date. A critical aspect of the CDM's success was the monetary incentive it created for private sector players, coupled with limited interference by government agencies. JI suffered from governance challenges in countries in transition, while the IET faced a lack of demand due to the unwillingness of governments in Western Europe to buy emissions units perceived as "hot air" (i.e., emission reductions that were surplus in the sense that they were not due to specific mitigation efforts).

The ambition of the Paris Agreement and how market mechanisms can contribute

Although it relies on a "bottom up" regime of voluntary individual country commitments, the Paris Agreement of 2015 is noteworthy for its high ambition. It seeks to limit the increase in global average temperature from preindustrial levels to "well below" 2° C, and specifies that a balance of emissions and sinks is to be achieved in the second half of the century.

Given that each country has full freedom to determine its NDC under the Paris Agreement, it is crucial to allow full access to all globally available mitigation options. If governments develop trust that they can access cheap mitigation worldwide, they may be willing to increase the ambition of their NDCs over time. Thus, market mechanisms are even more important under the Paris-Agreement architecture than they were under Kyoto. The negotiators in Paris realized this, and, against all expectations, put an entire article on market mechanisms in the text of the Agreement.

The skeleton of the rulebook for mechanisms in Articles 6.2 and 6.4

As was the case under the Kyoto Protocol, the Paris Agreement only provides key principles for market mechanisms; the detailed rulebook is still under negotiation with a deadline of 2018. The Agreement defines two mechanisms: one under international oversight ("sustainable development mechanism" [SDM], Article 6.4) and one based on agreement between governments ("cooperative approaches" [CA], Article 6.2). Common principles include environmental integrity, transparency, and prevention of double counting. The latter is important as, in contrast with the Kyoto regime, all countries contribute to mitigation under the Paris Agreement. This necessitates a clear allocation of mitigation outcomes to the host and the buyer country's NDC. It is likely that the Paris mechanisms will allow crediting on the scale of policy instruments or entire sectors, thus going beyond projects and programs.

Critical issues to be resolved in the UNFCCC negotiations

Market mechanisms have often been criticized as generating emission credits that do not reflect real mitigation. In this context, the concept of "additionality" is paramount. Any credit generated by an activity that only reflects "business-as-usual" dilutes overall mitigation ambition. While tests for additionality have been refined and made robust for projects and programs in the context of the CDM, efforts to develop such tests for policy instruments are still in their infancy. The issue becomes challenging in the context of the Paris Agreement, where there is no international oversight for the baselines used in the context of NDCs. This makes it likely that a number of NDCs will generate "hot air" because their mitigation scenario is actually less ambitious than the real "business-as-usual" scenario.

Also, the issue of how far CDM projects and programs, as well as already issued CERs, are to be brought into the Paris mechanisms is of considerable importance (Michaelowa 2016 and Michaelowa and Hoch 2016). Due to the crash of CER prices to extremely low levels after 2012, a large volume of CERs has piled up. Between 2012 and 2020, over 9 billion CERs could accrue, while the decade 2020–2030 could generate another 8 billion CERs. These volumes could provide a kick-start to the first round of NDC strengthening from 2018 onwards.

Accounting rules with regard to the nature of units that can be transferred, types of registries, and eventual buyer or seller liability need to be specified. Positive experiences with accounting under the Kyoto Protocol would call for a continuation of that system, while significant differences between NDCs will make it difficult to agree on a common unit and approach.

Recommendations to maximize the contribution of market mechanisms

Additionality determinations for policy instruments should theoretically be based on a cost-benefit analysis. Only policies whose costs exceed their benefits should be seen as additional. A pragmatic approach would be to deem all carbon pricing policies additional once the carbon price exceeds a threshold value. This value would ideally reflect the social cost of carbon[2]; in practice, it should be differentiated according to the development status of the host country. For regulatory policy instruments, additionality could depend on the payback period of the technologies that need to be applied due to the regulation; a level of 3–4 years would reflect industrial reality.

Pilot activities for upscaled crediting should put an emphasis on testing such additionality approaches, supported by political and economic research regarding choice of policy instru-

2 See also briefs by Joseph Aldy and James Stock in this volume.

ments. To ensure that CAs under Article 6.2 do not function as generic loopholes,[3] minimum rules for demonstrating additionality should be the same for Article 6.4 and Article 6.2.

Article 6.4 should apply CDM rules and accept CDM projects and CERs as far as possible. This sustains the trust of participants in the CDM market who might otherwise be alienated from market mechanisms and thus maximizes the mitigation contribution of market mechanisms.

With regard to accounting, basic eligibility criteria for the use of credits from market mechanisms could be envisaged. Universal adjustments for transfers, cancellations, and banking, and common reporting rules on cooperation, systems, and annual transactions, would increase trust in market mechanisms.

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3 The experience from JI shows that available loopholes will be found and exploited. When the direct sale of "hot air" through IET was prohibited at the Doha conference in 2012, Russia and Ukraine used Track 1 of JI, which was devoid of international oversight, to create several hundred million JI credits from doubtful projects within a few weeks.

A Transformational Club within the Paris Agreement: A Climate-Club Perspective on Article 6

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Key Points

- The operationalization of Article 6 of the Paris Agreement is still incomplete, leaving windows of opportunity for alternative interpretations.
- For instance, it is possible to develop a legally sound interpretation of Article 6 based upon the literature on climate clubs.[1]
- Such an interpretation could lead to a harmonious understanding of Article 6, significantly enhancing its potential usefulness in advancing the goals of the Paris Agreement.

Introduction

Uncertainty surrounds the operationalization of the Paris Agreement. For instance, no shared interpretation of its Article 6 exists, and the ongoing debate seems unlikely to improve clarity over its three main components, all of which represent approaches to the exchange of mitigation outcomes: (a) cooperative approaches (paragraphs 1–3), (b) the Sustainable Development Mechanism (paragraphs 4–7), and (c) non-market mechanisms (paragraphs 8–9).

Although Article 6 is only one of a number of issues within the Paris Agreement that require negotiation, it is regarded as crucial to operationalizing the Agreement. Article 6 is widely perceived as a heterogeneous, last-minute compromise, in which the needs and demands of all the different parties have been bundled together; this rather limiting view prevails largely because the three approaches contained within paragraphs 1 to 9 of the Paris Agreement are considered to be independent of one another.

This paper offers a new, legally sound interpretation of Article 6. Applying a "climate-club" perspective, this interpretation could lead to a homogeneous framework that would enable different approaches to exchanging mitigation outcomes, assuming the enhancement of a mitigation outcome demand-and-supply system. If properly adopted, this interpretation could lead to Article 6 being used to help achieve the Paris Agreement's primary objectives.

1 This paper is mainly based upon sections 4.4 and 4.5 of Stua (2017).

Climate clubs and Article 6

A review of Article 6 based on the literature concerning climate clubs can be used to identify elements of any typical club. Such an exercise highlights the deep connection between climate clubs and Article 6. This analysis leads to a view of Article 6 as a "tool" for implementing a transformational club as defined by Weischer, et al. (2012), and characterized by the major conditions for a successful club identified by Nordhaus (2015, p. 1340). The review provides a homogeneous interpretation of Article 6, in which its elements fit together like puzzle pieces, framing a single pattern that can accommodate any instance related to the current debate on Article 6 and beyond.

A review of Article 6 based on the literature highlights significant analogies between clubs and Article 6, summarized in the following key points:

- **Voluntary cooperation.** The founding principle of Article 6, expressed in its first paragraph, represents one of the keystones of the literature on climate clubs (Hale 2011; Das 2015; Nordhaus 2015; Orsato, et al. 2015; Potoski 2015).
- **Ambition.** Expressly cited as Article 6's primary objective (paragraph 1), ambition recurs in the literature, with authors (Das, 2015; Falkner, 2016) considering it as the key to unleashing the power of clubs. Keohane, et al. (2015) identify in clubs a resource for broadening ambition in mitigation, while Weischer, et al. (2012) include ambition in the list of features that are central to a transformational club.
- **Equity, speed, and participation.** Together with ambition, equity, speed, and participation are the other essential features of a transformational club (Weischer et al, 2012). While the aim for participation is explicit within paragraph 4(b) of Article 6, equity and speed are only implied—equity is a theme throughout the Paris Agreement, while speed is the aim of paragraphs 2 and 4 of Article 6, which provide a mechanism for supporting NDCs and fostering mitigation in global emissions.
- **Transparency, environmental integrity, accounting.** Paragraphs 2, 4, and 5 of Article 6 make explicit reference to the need for mechanisms to guarantee environmental integrity and accounting, while calling for greater transparency. Effective implementation measures for transparency, accounting, and environmental integrity represent core elements in the literature on climate clubs (Stewart, et al. 2013; Keohane et al 2015; Falkner 2016), including non-compliance criteria analyses and related legal implications (Eckersley 2012; Weischer, et al. 2012; Stewart, et al. 2013; Bulkeley, et al. 2014).

- **Certification mechanisms.** The literature discusses the use of certification mechanisms as enhancing tools for action. Some scholars favor certification to facilitate carbon market approaches and to enhance transparency (Reid and Toffel 2009; Potoski 2015). Paragraphs 4 to 7 of Article 6 entirely focus on the design and implementation of a certification mechanism; in principle, these paragraphs are in line with the goal of clubs. While analyzing how these mechanisms function, Keohane, et al. (2015) emphasize their significance in avoiding double counting, which concurs with paragraph 2 of Article 6.

- **International legitimacy.** Weischer, et al. (2012) introduce the concept of "bringing in," defining this concept in terms of "groups of countries who are willing to undertake particular commitments or actions agree to have those negotiated, recognized and monitored within the UNFCCC" (Weischer, et al. 2012, p. 191). Stewart, et al. (2013) suggest that the clubs' regimes should be linked to the UNFCCC process "in a way that respects the need for multilateralism in addressing the global character and consequences of climate change" (Stewart, et al. 2013, p. 10). Other scholars reiterate the need for such legitimation (Eckersley 2012; Das 2015; Falkner 2016), and indeed the rules contained in paragraphs 2, 3 and 7 of Article 6 could satisfy the demands of international legitimacy for climate clubs.

- **Adherence to social, economic, and policy circumstances.** The literature calls for clubs to be designed with rules and features that fit the social, economic, and policy circumstances in which they operate (Potoski and Prakash 2009). Article 6 implies similar needs when referring to the promotion of sustainable development (paragraphs 2, 4, 8, and 9) and links with NDCs (paragraphs 1–5 and 8).

- **Quantified aggregate and individual mitigation targets.** The call for aggregate targets is a recurring theme in the literature (Weischer, et al. 2012; Stewart, et al. 2013; Victor 2015). It is also implicit in sections (c) and (d) of paragraph 4 in Article 6, identifying the described mechanism as a tool for achieving mitigation targets at national and global levels.

- **Excludable benefits.** Assigned to members through clubs' specific design, excludable benefits are key to stimulate participation in clubs and are extensively discussed in the literature (Weischer, et al. 2012; Stewart, et al. 2013; Keohane, et al. 2015; Nordhaus 2015; Orsato, et al. 2015; Falkner 2016). Article 6 does not explicitly refer to excludable benefits, but such benefits would seem necessary to guarantee the efficacy and durability of any Article 6-generated structure for advancing mitigation outcomes.

Conclusions

The solid links between Article 6 and climate clubs suggest that clubs present the ideal framework for effectively operationalizing Article 6. Nonetheless, a significant issue still requires resolution. While describing the major conditions for a successful climate club, Nordhaus defines the club approach as "top-down," comparing it to Bretton Woods as an ideal model (Nordhaus 2015, p. 1344). Any club-based structure eventually resulting from Article 6 would then be top-down, which would appear to directly contradict the "pledge and review" approach envisaged by the Paris Agreement. However, this apparent contrast is balanced by the voluntary nature of cooperation within Article 6, which means that members of an Article 6-based transformational club may freely decide to adopt a top-down structure for their club, without infringing on the general rules of the Paris Agreement.

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Accelerating Country Cooperation to Reduce Climate Pollution under Article 6.2 of the Paris Agreement

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Key Points

- Meeting the Paris Agreement's ambitious emissions-reduction goals requires early, sustained, and significant global reductions in greenhouse gas emissions.
- The Paris Agreement's Article 6.2 recognizes the role that carbon markets can play in catalyzing deeper cuts in climate pollution.
- While internationally transferred mitigation outcomes must be accounted "consistent with" any guidance agreed by the Parties to the Paris Agreement, countries and sub-national jurisdictions need not wait for internationally-agreed guidance before transferring mitigation outcomes.

The Paris Agreement represents a paradigm shift in the global response to climate change. Instead of establishing binding reduction targets for only some countries, the Agreement sets a "top-down" maximum long-term temperature goal and calls on all countries from the "bottom-up" to present their own voluntary, Nationally Determined Contributions (NDCs) toward that global goal.

Carbon markets, used today in about 40 national jurisdictions and over 20 cities, states, and regions (World Bank 2016), deliver emission reductions at significantly lower cost than other approaches (Schmalensee and Stavins 2017). Savings in the context of the Agreement's ambitious climate goals could be substantial — reducing the cost of meeting NDCs by approximately 32 percent by 2030 and by 54 percent by 2050 (World Bank 2016). By reducing costs and unlocking finance, carbon markets can catalyze more ambitious global emissions reductions. Article 6 of the Paris Agreement may be said to reflect widespread recognition of this fact.

Article 6 also reflects the hybrid design of the Paris Agreement, with its top-down and bottom-up elements. It recognizes the broad prerogative of sovereign countries to use carbon markets to help achieve their NDCs, including via a new, top-down centralized mechanism (Article 6.4) and through bottom-up, decentralized "cooperative approaches" (Article 6.2), negotiated and authorized by cooperating countries (Article 6.3). While the 6.4 mechanism is placed

under the "authority and guidance" of the CMA,[1] Article 6.2 confines the CMA's role to developing "guidance" for Parties engaging in cooperative approaches, with a particular focus on "robust accounting" to avoid "double-counting" of emission reductions.

Ongoing negotiations among Parties reveal divergence on a number of crucial issues, including the scope of Article 6.2 guidance. (Some Parties also urge a formal regulatory role for the CMA under Article 6.2, although nothing in the text of the article or its negotiating history support such a role.) However, lack of agreement at the multilateral negotiations on the scope of CMA guidance need not delay bilateral or "minilateral" carbon market cooperation. Indeed, some countries may wish to begin working together to develop "model" transactions that could transparently fulfill the obligations that Article 6.2 and 6.3 place on transacting Parties.

Such early initiatives should be encouraged, for four reasons. First, and most importantly, unlocking early cooperation and finance can accelerate the pace of emissions reductions. This is particularly important because rapid and early emissions cuts are the single most important determinant of whether the global community is likely to meet the Paris Agreement's long-term temperature goal (Rogelj, et al. 2013). Second, delaying action to reduce emissions increases costs for Parties and the global economy (IEA 2011).

Further, an early start would provide Parties, investors, and domestic regulated entities with the time to hammer out details and deliver much-needed predictability. Repeatedly, we have seen that when countries set clear "rules of the road" for emissions trading, investments begin flowing into lower-emitting technologies and processes, and emissions drop. Lastly, standards developed by a subset of countries — particularly those with interest in and experience with high-integrity market cooperation — may be of a quality and detail that would be difficult to agree by consensus among all Parties to the Paris Agreement. Evidence of the benefits of rigorous standards among partner countries could demonstrate the usefulness and practicality of setting a high bar for market cooperation, helping to inform and accelerate the development of similar standards globally.

Engaging in carbon market cooperation under Article 6.2 is not dependent upon the CMA's adoption of guidance. Article 6.2 simply provides that, if such guidance is adopted, Parties' accounting must be "consistent with" it. Article 6.1 explicitly "recognize[s]" the existing sovereign prerogative of Parties — coequal sovereigns under international law — to choose "voluntary cooperation in the implementation of their [NDCs]." The only "authorization" required is from a participating partner(s), under Article 6.3. International law generally recognizes

1 Conference of the Parties [to the UNFCCC] serving as the meeting of the Parties to the Paris Agreement (the governing body for the Paris Agreement).

that sovereign states are free to act so long as they do not contravene an explicit international prohibition (the *Lotus* principle[2]).

Of course, states are also free to constrain their sovereignty through international agreements. An example is Article 6.4 of the Paris Agreement, in which the UNFCCC Parties established a new, centralized market mechanism "under the authority" of the CMA. This article states that the new mechanism "shall be supervised" by a body designated by the CMA. Article 6.7 states that the CMA "shall adopt rules, modalities and procedures" for the new mechanism. These provisions expressly mandate that the CMA take on a direct regulatory role, and indicate that Parties cannot unilaterally create 6.4-compliant emission reduction units. Article 6.4 thus differs significantly from Article 6.2, which does not require that the CMA "shall" do anything before Parties engage in cooperation.

Mirroring the Paris Agreement as a whole, Article 6.2's hybrid design — obligatory, high-level principles implemented by participating Parties via a flexible, decentralized framework — may provide a roadmap for the future of international cooperation on carbon markets. Ultimately, it is up to interested partner countries to agree on the detailed rules of the road that can catalyze high-integrity international carbon market cooperation under Article 6.2 (Keohane, et al. 2015). Recognizing both the need and opportunity, cooperating countries themselves can make substantial, early progress, ultimately informing and complementing the longer-term UNFCCC process.

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2 Named after the 1927 case between France and Turkey at the Permanent Court of International Justice (PCIJ), the Lotus decision is commonly understood to stand for the broad proposition that — in the absence of an international prohibition to which it has consented — a state is free to act (PCIJ 1927).

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FOCUSING ON ASIA

China's Emissions Trading System in Context

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Key Points

- Beyond addressing global climate change, China's national emissions trading system (ETS) is part of Beijing's effort to forge a cleaner and more dynamic modern economy, and this context is essential when considering its future direction and effectiveness.
- While China's national ETS launch will likely go forward in advance of the COP-23[1] negotiations in November 2017, continuing questions on coverage, allowance allocation, and compliance obligations are unlikely to be settled by then.
- Once launched, China's ETS will be uniquely placed to pursue market integration efforts in the Asia-Pacific region and beyond. Its success will hinge on domestic capacity building and operational discipline, and the effectiveness of its international engagement.

Introduction

China's GDP has grown by more than 500 percent since 1980, bringing quality of life improvements and strategic ascension alongside wealth gaps, economic inefficiencies, and wide-ranging pollution. These wealth gaps are driving efforts for more balanced growth, economic inefficiencies are leading to glut and waste reductions and higher-value economic activity, and pollution is moving environmental policy up the strata of government priorities.

Beyond addressing global climate change, China's national ETS is part of Beijing's effort to address all of these challenges, and to forge a cleaner and more dynamic modern economy. The ETS's design, goals, and position within China's wider policy landscape reflect this context — a recognition that is essential for considering its future direction and effectiveness.

Busy times in Beijing

China's national ETS is set to become the principal policy tool for transitioning the country to a lower emissions future. The task is daunting. Building on seven pilot systems that began operation in 2013, China's national ETS will cover the highest emitters in the most emissions-intensive sectors across the country. Since 2015, the National Development and Reform Commission (NDRC) has worked to determine the scope of industry coverage, construct

1 Twenty-Third Conference of the Parties to the UNFCCC.

a national MRV system, coordinate provincial reporting on the carbon inventories of more than 8,000 entities, and feed this information into a coherent national quota allocation plan. As the launch approaches, the NDRC is revising offset rules, picking a national exchange platform from among the pilots, codifying how authority will be delegated, and putting ETS management practices and technical standards in place. Throughout this process the NDRC also serves as the champion and decipherer of the national ETS to the ultimate decision-makers in China's State Council.

Given this workload, it is unsurprising that ambition for the national ETS launch is steadily tempering. While the launch will likely go forward in advance of the COP-23 negotiations in November 2017, continuing questions on coverage, allowance allocation, and compliance obligations are unlikely to be settled by then. Initial ETS coverage of eight sectors has been pared down for 2017 to power generation, aluminum, cement, and aviation — which alone would constitute a cap of 4–5 billion tons of CO_2 (roughly 1.5 times the size of the European Union [EU] ETS) (Shanghai Zhixin Carbon Assess Management 2017). Reports from mid-August 2017 suggest more culling may be in the works, and that China may begin by launching a power-sector-only ETS in response to lingering uncertainties and industry concerns on allocation methodologies and overall ETS operations (Reklev and Chen 2017). This scenario breeds further difficulties for an ETS designed to see trade across different industries facing different mitigation costs. With only months to go, basic questions remain on when the scheme will start, what the rules will be, where it will be housed, and who will participate.

China's approach of pilot systems followed by a multiphase national rollout anticipates such growing pains, which will continue in varied forms even as future progress is made. More fundamental questions surround the interaction of China's ETS with other policy instruments. While the ETS is under NDRC leadership, its rules spread across the jurisdictions of multiple government agencies. Poor coordination and collaboration between these players is behind many current ETS design struggles.

The national ETS also exists in a complicated and often overlapping environmental policy space marked by existing and proposed trading and subsidy policies for renewable energy, energy efficiency, and air pollution. These policy tools, which include a newly-launched tradeable green certificate scheme to support clean technologies, expand the risk of double counting and create complex interactions with the supply and demand of carbon credits. EU experiences have shown how subsidizing renewable energy can decrease demand for carbon credits and erode the value of an ETS, and recent modelling of these interactions in China suggest similar challenges (Wu, et al. 2017).

Looking abroad

Outside its borders, China's ETS will impact international carbon trading and climate mitigation efforts in unforeseeable ways. The scale of its market and presence of covered industries in international supply chains means that China's ETS will have myriad impacts on trade, competitiveness, and carbon prices in other markets around the world (Swartz 2016). China is also uniquely placed to pursue market-integration efforts in the Asia-Pacific region and beyond. Like China, the Republic of Korea is in a formative phase in its construction of a national ETS, while Japan operates subnational carbon trading schemes and international offset projects.[2] Countries in South, Southeast, and Central Asia are likewise constructing carbon markets, and these efforts may accelerate with China's 2017 national ETS launch (Ewing 2017).

Targeted links connecting Asian markets, along with potential links with Europe and the Americas, would widen the emissions reduction options available for emitters and help provide the scale and liquidity needed for robust trading platforms. Such links would also reflect the economic connections that define much of Asia and the global economy, and discourage the leakage of emissions to less regulated jurisdictions. For China, market cooperation and selective links could lead to revenue generation as it sells credits to neighbors that face higher abatement costs, and yield geopolitical dividends as a form of regional and international climate change leadership.

Forging such links would take time and require technical expertise, strategic vision, and diplomatic energy. Work is underway to move carbon market cooperation up regional political agendas and create a regional epistemic community. To be successful, these efforts must forge symbiotic relationships that contribute to disparate national interests in Asia and beyond (Ewing 2016). Building these relationships will require patient experimentation and creative bargaining during the formative years of market operations. China's willingness to create a "linkage-ready" ETS is essential, and while Beijing is understandably fixated on its domestic rollout, indications suggest it will do just that.

Raison d'etre

China's national ETS launch will likely draw international acclaim and support the sense that Beijing is becoming a global climate change leader. While it addresses greenhouse-gas mitigation most directly, China's ETS is perhaps equally important in the minds of Chinese leaders as a way to curtail crippling air pollution, encourage growth in emergent sectors, and transfer wealth to peripheral provinces. Whether these intentions will impede its effectiveness as a mitigation tool is unclear. The ETS may follow the Deng Xiaoping maxim that "it does not matter whether a cat is white or black, as long as it catches mice," and lead to robust climate

2 See also brief by Suh-Yong Chung in this volume.

change mitigation alongside the co-benefits Chinese leaders seek. It may rather demonstrate that the multiple drivers of the ETS and overlapping policies that exist alongside it render the mechanism convoluted and ineffective.

The outcome will depend largely on China's domestic capacity building and operational discipline, and the effectiveness of its international engagement. At home, Chinese authorities must create and maintain effective systems with judicious caps and allocations, and then provide these systems the policy space and freedom from government intervention to work. Since international market cooperation requires that China develop dependable MRV, strong trading platforms, and clear rules, such engagement would enhance the climate impacts of China's ETS while creating opportunities for stakeholders beyond its borders.

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Laying the Foundation for CO_2 Emissions Trading in China

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Key Points

- China plans to launch a national CO_2 emissions trading system (ETS) by the end of 2017, substantially increasing the global share of greenhouse gases under carbon pricing.
- The capabilities required to support emissions trading — especially measurement, reporting, and verification of energy, emissions, and output data — remain unevenly developed and weakly coordinated across subnational governments and enterprises within China.
- China's staged approach involves strengthening emissions accounting prior to launching emissions trading, which will provide a strong foundation for domestic system expansion as well as an example for establishing emissions trading in other developing countries.
- Longer term, establishing high-quality energy and emissions data will be essential to evaluate the cost effectiveness of the system and to facilitate linkages with other systems.

Emissions trading as a major climate policy tool in china

China plans to launch a national CO_2 ETS before the end of 2017. Emissions trading is expected to play an important role in supporting the implementation of China's 2015 Paris-Agreement pledge commitments, which include reducing the CO_2 intensity of the economy by 60–65 percent between 2005 and 2030 and reaching peak CO_2 emissions by 2030.[1] Importantly, system designers intend for a CO_2 ETS to promote the development of energy and emissions management capabilities at all levels of government and within enterprises. These capabilities will be essential to demonstrating achievement of China's Paris-Agreement pledge.

China's ETS is designed as a tradable performance standard based on emissions indexed to physical output. It will cover organizations that consume more than 10,000 tons of coal-equivalent energy or emit more than 20,000 tons of CO_2 per year. Approximately 7,000 enterprises across the electric-power, energy-intensive-manufacturing, and civil-aviation sectors are expected to be covered when the system reaches full scale, accounting for approximately half of the nation's CO_2 emissions.

1 China's Nationally Determined Contribution is available at: http://www4.unfccc.int/Submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf.

The tradable performance standard approach is intended to support implementation of national energy-saving and emissions-reduction goals at the enterprise level. Indexing emissions-reduction targets to physical output was chosen to mitigate the overall economic burden, while the opportunity to transfer emissions rights is designed to limit enterprises' abatement costs. Given that a significant share of enterprises are quantifying their CO_2 emissions for the first time, and many are still learning about abatement opportunities and costs, the cost effectiveness of the system is likely to improve over time if these efforts are appropriately incentivized. The trading-system architecture is also expected to help regulators track and manage national energy use and CO_2 emissions, in line with policy goals.

Ensuring data quality is critical

Reliable data on output-indexed emissions from covered enterprises are critical for a tradable-performance standard to function. Systematically inaccurate, exaggerated, or falsified emissions reductions would quickly render the system ineffective by displacing otherwise least-cost-reduction opportunities, while compliant participants would be penalized. Obtaining energy, emissions, and physical output data of sufficient quality from covered enterprises has proven to be a major challenge in China. Wide variation across regions in China in per-capita wealth and economic composition lead to divergent priorities within the regulatory bodies of regional governments. This influences the level of familiarity with energy and emissions accounting standards as well as the capabilities and commitment of the state to enforce them.

Pilot CO_2 ETSs in China have demonstrated strategies for establishing high-quality data systems. For instance, the Beijing CO_2 pilot ETS required government-certified, independent third parties to evaluate the quality of enterprise compliance data. An additional round of external review was then required for a subset of the third-party audits. Governments administering the pilot systems funded independent verification, reducing the potential for conflicts of interest between covered enterprises and verifiers.

At the outset, awareness of accounting principles among enterprises was relatively low and uneven. China's system additionally requires accurate estimates of a firm's annual output, which is commercially sensitive information for many firms and difficult to verify without real-time monitoring. A robust data system requires several reporting cycles to establish; further accelerating this process can undermine the organizational learning required to develop an effective and durable system.

Evaluating foundations in tandem with policy

Efforts within China to resolve data-quality issues prior to system launch are essential. Central-government architects of China's ETS are deeply concerned about data-quality issues. As a result, the system may launch trading in one or a few sectors at a time, with the first sectors expected to be electric power, cement, and aluminum smelting. Emissions-abatement

potential and costs in these sectors are relatively well understood, as production processes and products are highly comparable across enterprises. The difficulty of verifying emissions—and thus the strength of incentives to displace least-cost with fictitious abatement—varies across sectors. This should be a major consideration in deciding whether to launch trading in a sector or to delay and invest first in improving data-verification capabilities.

The national ETS in China illustrates the importance of considering what foundations are needed for climate policy to work as intended. That the architects of China's ETS have made rollout contingent on a strong data foundation is very encouraging. Other developing countries will face similar challenges in developing comprehensive energy and emissions inventories capable of supporting ETS operation. Beyond emissions trading, there may be value in evaluating and strengthening energy and emissions accounting as a complement to regular stock-taking of policy pledges in the international arena. This additional focus would ensure that mismatches between policy pledges and enabling conditions are more quickly identified, as the latter will ultimately affect the achievement of mitigation goals.

Attention to the readiness of enterprises and governance systems to track data accurately for compliance purposes will be critical to the success of emissions trading in China as well as in other countries. Establishing rigorous and transparent emissions accounting has the added benefit of preparing national systems for international linkage, as the credibility of the actions taken by distant parties grows even more important in this context.

China's National CO_2 Emissions Trading Program: A New Application of Tradable Performance Standards

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Key Points

- China's new national CO_2 trading program, scheduled to begin in late 2017, differs in key respects from most programs operating in the West.
- An important design difference is the use of intensity- or rate-based tradable performance standards (TPS). Because these standards fix average rather than total emissions, they differ from more familiar command-and-control or cap-and-trade mechanisms.
- This approach has obvious advantages in terms of adapting to economic changes, but it is also inherently more complex to administer.
- Critical implementation issues include allowance allocation, the division of responsibilities among different Chinese authorities, actual measurement and verification of emissions and output, and the setting/adjusting of sector-specific benchmarks.
- Given these challenges, and given China's decentralized environmental management framework and lack of a strong tradition of national data collection, it will be important to strengthen systems for third-party verification, include incentives for accurate reporting, and provide for periodic program review and the flexibility to make modifications.

Introduction

China's national CO_2 emissions trading program — scheduled to begin in late 2017 — differs in key respects from most programs operating in the West. Some of the design differences are clearly tied to reliance on administered rather than market prices in key sectors, the wide variation in incomes, and differences in the local economies across Chinese provinces.

This essay focuses on the tradable performance standard that drives China's new national program.[1] I begin with a short discussion of tradable performance standards (TPS), an intensity- or rate-based mechanism that fixes average emissions. I describe how these standards differ from both traditional regulation ("command and control") and from the more commonly

1 A broader set of issues associated with China's new national program is discussed in Goulder, et al. (2017). See also brief by Goulder in this volume.

used form of emissions trading, namely, cap and trade, which fixes total as opposed to average emissions. I then turn to some of the unique design characteristics of the Chinese program. Finally, I offer summary observations about the implementation of a TPS in China.

Tradable performance standard vs. cap and trade

Tradable performance standards combine elements of traditional regulation with market-oriented mechanisms. Just as under traditional regulation, tradable standards require the government to set a maximum amount of emissions allowed per unit of output for covered sources in the regulated sector (e.g., tons of emissions per kilowatt hour generated, in the case of the electricity sector). The standard may vary by the technology/fuel used (e.g., coal vs. natural gas), but need not do so. Instead of requiring each source to independently meet the requirement (as would be the case for a command-and-control approach), underperforming sources can purchase credits from those that outperform, such that the standard is achieved *on average* across the entire group.

A key attraction of issuing allowances based on the ratio of emissions to actual output is that the system can more easily adapt to economic changes. If the economy is booming (high output), the allowable level of emissions increases. Conversely, when the economy is in a slump (low output) fewer emissions are allowed. A disadvantage, as Fischer (2005) has shown, is that a TPS can generate an implicit subsidy to output, which may increase total emissions. Further, to assure program integrity, regulators charged with making compliance determinations in a TPS system face the challenge of obtaining reliable information on both emissions *and* output, not simply on emissions, as in a cap-and-trade system.

The canonical example of a TPS is the approach used by the U.S. Environmental Protection Agency (EPA) to phase out lead in gasoline in the mid-1980s, which also included provisions for emissions banking. A similar TPS mechanism was the preferred option under the EPA's 2016 Clean Power Plan to reduce CO_2 emissions from power plants.[2]

The lead phasedown program is widely seen as an effective and efficient means of reducing the lead content of gasoline. Retrospective analysis has shown that the market-based nature of the program, including the banking provisions, provided incentives for more efficient adoption of new lead-removing technology, relative to a uniform standard. In a review of the program, Newell and Rodgers (2006) explain that: "…expected permit sellers (i.e., low-cost refineries) significantly increased their likelihood of [technology] adoption relative to expected permit buyers (i.e., high-cost refineries)…compared to under individually binding performance standards."

2 This regulation is currently being revised by the Trump Administration.

Overall, Newell and Rodgers found that transaction costs were relatively modest, reducing the efficiency of the program by about 10 percent. At the same time, they concluded that the flexibility introduced by the TPS increased the likelihood of both intentional and unintentional violations, especially on the part of smaller refiners and fuel blenders. This placed additional administrative burdens on the EPA's monitoring and enforcement staffs. The most common violations involved the quantities of lead used and the volumes of gasoline produced and imported.

China's approach to tradable performance standards

China initially announced that large emitters in six major sectors would participate in the new national trading program. Subsequently, the number of sectors was reduced to three: electric power, aluminum, and cement. At this writing, there is discussion of further limiting the initial program to the electric power sector only.

Allowance allocation in the Chinese program occurs in two phases within each annual compliance period. At the beginning of the period, a covered firm receives a number of allowances equal to its output from the previous compliance period multiplied by the sector's benchmark emissions-output ratio, and adjusted by an initial allocation factor. As noted, for the electric sector, the benchmark emissions-output ratio is denoted in terms of tons per kilowatt hour. Although the actual benchmark emissions-output ratio(s) have not yet been announced, the initial allocation factor is expected to be about 60 percent.

At or near the end of the compliance period, a covered firm receives the additional allowances needed to bring the ratio of total allowances to end-of-period output in conformity with the mandated sector-specific benchmark emissions-output ratio. Depending on the firm's actual output for the year, there may be few additional allowances awarded at this later stage. In principle, firms could even be required to return some of their initially allocated allowances, although with the 60 percent ratio that seems unlikely. Firms that emit at a rate higher than the performance standard must abate emissions and/or purchase allowances, while companies that emit at a rate below the standard can sell their surplus allowances. Trading of allowances is allowed both within and across provinces, although there is concern that the latter may be limited for reasons of political economy.

As with the U.S. lead phasedown program, the compliance obligation in China's system is defined in terms of an emissions-output ratio, not the absolute level of emissions.[3] A distinguishing feature of China's program is the two-step, within-period allowance-allocation proce-

3 Recent discussions among the nationwide program designers indicate that, at a later point, when the system's coverage is expanded, a traditional cap-and-trade program (rather than a TPS) might apply to some of the added sectors. That is, the number of allowances awarded to companies in these sectors could be fixed in each compliance period rather than being tied to the level of output at the end of the compliance period.

dure, where the second step involves end-of-period updating.[4] The need to almost simultaneously assemble and verify information on both emissions and output may make it more difficult to determine compliance, a problem that may be magnified for sectors that produce multiple products or even for the electric sector if multiple benchmarks are used.

One of the key issues in implementing the program involves the division of responsibilities among different Chinese authorities. While the National Development and Reform Commission (NDRC) is tasked with determining sector-specific emission-output benchmark ratios and allocation methodologies, the provinces will be responsible for providing the necessary data to the NDRC and distributing allowances to firms based on the established methodologies.[5]

Another key issue involves the actual measurement of emissions and output. As in the lead phasedown program, reliable information on both metrics is critical to the integrity of the system. China aims to address the reliability issue by enlisting third-party verifiers to review company reports on emissions and output. However, at this writing, the verifier certification process is not fully established and the incentives for accurate reporting are in question. Even if these issues are resolved, it is not clear there will be a sufficient number of verifiers to review all covered companies' reports within the relatively short reporting window and at a reasonable cost.

In concert with provincial officials, the national government is working to further define program specifics. At this writing the open design issues include: 1) what level of ambition to apply in setting the sector-specific benchmark emissions-output ratios; 2) whether to offer unique benchmarks for different fuels and/or production processes; 3) how to adjust benchmarks over time and via what process; 4) what methodologies to use for sectors not readily amenable to benchmarks; 5) how to update allowance distributions to reflect actual production levels during the compliance period; and 6) whether provinces that expand coverage of the program will receive incremental allowances for the additional covered firms.

Conclusion

In establishing a national emissions trading system, China is clearly taking another "leap forward." Reliance on a TPS mechanism with emissions banking provisions has obvious advantages, especially the ability to adapt to economic changes. At the same time, the operation of such a system is inherently more complex. As the experience of the U.S. lead phasedown demonstrates, even in a more developed country with a well-developed legal and administrative system, the data requirements for implementing a TPS with banking impose additional

4 EPA's lead phasedown rules allowed a true-up period for firms to trade allowances.

5 Provincial governments will have the option of lowering benchmarks (i.e., reducing allocations) for specific sectors, but must receive approval from the NDRC to do so.

burdens on both regulators and industry, especially for the measurement, reporting, and verification of emissions and output. The highly decentralized nature of the Chinese environmental management system and the absence of a strong tradition of national data collection are specific issues of concern.

Going forward, China would be well advised to strengthen the system for third-party verification and assure there are strong incentives for the verifiers to report accurately. It is also important to provide for periodic review of the program and to build in the flexibility to make constructive modifications when new information reveals program weaknesses.

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Linking China's Cap-and-Trade System with Other Systems: Key Challenges

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Key Points

- China is introducing what will be the world's largest emissions trading system (ETS).
- This ETS will take the form of a tradable performance standard, a structure that is different from most other national or regional ETSs.
- Despite the structural difference, there is potential for mutually beneficial gains from introducing trades of China-sourced emissions allowances on the international market.
- Linking China's ETS with other ETSs would not be beneficial in the short term, however. Before the potential gains from linkage can be realized, it would be necessary to:
    - improve the reliability of the data on China's emissions reductions;
    - achieve greater compliance;
    - assure a level of policy stringency comparable to what is promoted in other countries.

China's forthcoming national ETS

China is embarking on the introduction of a nationwide CO_2 ETS. Once fully implemented, the national program will become the world's largest ETS, increasing by over 50 percent the global coverage of CO_2 under such programs. Initially covering the power, cement, and aluminum sectors, it will eventually expand to other sectors and embrace approximately 7,000 companies. Under current plans, the facilities covered by the program will eventually account for over half of China's GHG emissions. The program is expected to contribute significantly toward China's pledge under the Paris Agreement of a 60–65 percent reduction in CO_2 emissions by 2030.[1] The national ETS focuses exclusively on emissions associated with production by domestic firms. The emissions embodied in imported goods or services are not covered.

1 China's Nationally Determined Contribution is available at: http://www4.unfccc.int/Submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf.

China's ETS will take the form of a tradable emissions standard. Under this approach, which has previously been used, for example, in the U.S. Environmental Protection Agency's phase-down of leaded gasoline in the 1980s, allowances are allocated to firms based on sector benchmarks for maximum emissions-output ratios. If a firm's emissions would yield an emissions-output ratio in excess of its benchmark, it must purchase additional allowances to offset the excess; if a firm's emissions would give rise to a ratio below the benchmark, it can sell its excess allowances.[2]

Would international linkage be beneficial?

In principle, linking China's national ETS with ETSs or other types of emissions-reduction policies in other countries could yield social benefits to China and other countries. Linking China's ETS with other ETSs, in particular, would bring about international trades of emissions allowances among firms (sources), thereby causing emissions reductions to take place where they can be achieved at least cost. Purchasers would gain by obtaining allowances at a lower price than otherwise would be possible, while sellers would enjoy a new source of revenues above the cost of the additional required abatement implied by such sales. In theory, linkage can thereby reduce the global cost of achieving given global reductions in CO_2.

Notably, the structure of China's ETS — a tradeable performance standard — differs from that of most other national or regional ETSs. This structural difference does not prevent potential gains from linkage. In China and the nations to which the China system is linked, firms will wish to buy or sell allowances on the international market, and resulting trades would be mutually beneficial.

At the same time, aspects of China's ETS itself suggest that it might not reduce emissions in the most cost-effective way. The tradable performance standard implicitly gives a subsidy to output, since an increase in output helps meet the standard by lowering a firm's emissions-output ratio. This means that even if the prescribed emissions-output ratios (the benchmarks) are set optimally, the resulting costs per ton of emissions reduction will be higher than the costs of achieving the same reductions under a conventional cap-and-trade (or carbon tax) system. While this suggests a limitation in the cost-effectiveness of China's ETS, it does not deny the benefits of international linkage. Establishing linkage still lowers costs, and China and its trading partners would be better off with allowance trades than without them.

Steps needed to allow the benefits from linkage to materialize

The potential benefits from linkage would not materialize, however, until China overcomes some significant limitations in its current ETS program.

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2 For details on the nature of China's tradable performance standard, see Duan and Zhou (forthcoming) and Goulder, et al. (forthcoming). See also brief by Morgenstern in this volume.

Improve the reliability of information on emissions reductions

A needed step is to achieve strong MRV, enforcement, and compliance under China's ETS. Because of the intensity-based design of the ETS, the government will have to collect data on emissions and on the levels of industrial output (including inventories) and electricity consumption. In the country's pilot ETS programs (introduced in 2013), such data were apparently subject to manipulation by private firms (Lo 2016; Wang 2013) and local governments (Ghanem and Zhang 2014; Liu, et al. 2015). Under the national ETS, provincial governments will be responsible for MRV and compliance. But some of the provinces have limited resources for carrying out these functions.

Until the reliability of the emissions information is much improved, declared emissions reductions are likely to fall considerably short of actual reductions. This means that if entities in China were to sell allowances on an international market, the associated increases in foreign emissions would not be matched by actual reductions in China. Allowances would be traded at prices that do not reflect true marginal abatement costs, since less abatement would be carried out than appeared to be the case. Rather than equalize marginal abatement costs internationally, the true abatement costs in China would be higher than what the market suggested; hence, the potential for international trades to improve cost-effectiveness would be compromised — and possibly lost entirely. A precondition for effective linkage is overcoming weaknesses in MRV, compliance, and enforcement.

Assure a level of policy stringency comparable to that of other countries

Current plans call for relatively lax benchmarks in the early stages of China's national ETS. This, combined with lack of reliability in emissions-reduction data, suggests that initially the effective cap on allowances would be lax from an efficiency point of view. China's allowance prices could be quite low at the outset — lower than the prices in ETSs elsewhere. Under these conditions, if China were to link its system with other ETSs, it would become a major seller of allowances on the international market.

Difficulties would arise if China's program were far less stringent than that of other ETS programs. Differences in stringency *per se* do not eliminate the potential of linkage to bring about greater cost-effectiveness. However, such differences raise distributional issues and associated issues of fairness. If China's program were much less stringent, linkage would bring about a significant transfer of wealth from other nations to China, corresponding to the purchase of Chinese-sourced allowances. Although this would benefit China, interested parties in other countries might view this as inequitable because of both the magnitude of the wealth transfer and the fact that it implies much less abatement and correspondingly much more local pollution in the other countries. This issue applies even if the above-mentioned problem of phantom reductions were overcome.

Greater stringency of China's program can be brought about through a tightening of the benchmark emissions-output ratios or through implementation of an allowance price floor, with a floor price comparable to global allowance prices. Achieving beneficial results from international linkage would seem to require one of these adjustment as China's system evolves over time.

Conclusions

Linking China's ETS with the ETSs in other countries has the potential to confer significant benefits to China and to the jurisdictions with which China's system is linked. This is the case despite the very different structure of China's ETS relative to most other ETSs. However, before these benefits can be fully realized, some improvements to China's system must be achieved. These include improving the reliability of the data on China's emissions reductions, achieving greater compliance, and assuring a level of policy stringency comparable to what is promoted in other countries.

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Forming a Northeast Asian Carbon Market under the Paris Agreement

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Key Points

- To develop a Northeast Asian Carbon Market, leaders in the region must build strong political momentum for their national climate-change agendas. This is possible if the formation of a carbon market is seen as a policy vehicle for developing major low-carbon projects, such as a regional supergrid.
- In establishing a carbon market for Northeast Asia, it will be very important to consider and reflect on the development of Article 6 of the Paris Agreement, including the cooperative approaches of Article 6.2 and the Mechanism of Article 6.4.
- Domestic carbon markets in Northeast Asia are at different levels of development. Therefore, flexibility in terms of participating stakeholders, market structure, and accounting rules is necessary to develop a carbon market at the regional level, as long as the regional market is compatible with Article 6 of the Paris Agreement.

Article 6 of the Paris Agreement

The future of carbon markets will be shaped by the development of the Article 6 regime under the Paris Agreement. Current negotiations on Article 6 have left a number of issues unresolved, and there is still room for adjustment on several options regarding the forms these carbon markets might take. At this stage, the Paris Agreement envisions various types of offset mechanisms under Article 6.4. The scope of these offset mechanisms will expand from the Clean Development Mechanism (CDM) and Joint Implementation (Kyoto-Protocol mechanisms), and Japan's Joint Crediting Mechanism (JCM) to new types of mechanisms that are likely to emerge in the future. Article 6.2 focuses on the accounting rules that will govern issues related to the transfer of mitigation outcomes. Under the Paris Agreement, mitigation outcomes can be internationally transferred between or among different national or regional jurisdictions.

Article 6 does not directly deal with the linking of emission trading systems (ETSs), although Article 6.2 may partially address linkage issues in the context of accounting rules, sustainable development, and environment integrity. Emissions trading has been used as a mechanism to implement domestic climate policies, and existing systems are not necessarily designed to

facilitate transnational implementation of climate policies at this stage. The European Union (EU) ETS can be seen as a compliance mechanism for one Party/jurisdiction (the EU) under the UNFCCC. Thus, linking trading systems between the EU and Switzerland could be seen as a way of facilitating cooperation between different jurisdictions.

Status of carbon markets in Northeast Asia

Currently, carbon markets in Northeast Asia are in different stages of development in different jurisdictions.

Republic of Korea

The Republic of Korea, which launched its national ETS in 2015, has developed the most advanced form of carbon market at the national level in Northeast Asia. As of August 2017, Korea has completed the first phase of its national ETS and is about to start the implementation of its second phase. The first phase covered 525 large emitters, 68 percent of total emissions, and 23 sectors, including steel, cement, petro-chemicals, refineries, power generators, buildings, waste, and aviation. Under the country's new administration, the second phase is expected to focus more on the following issues, very likely leading to changes in the governance of the ETS:

- Low-carbon innovation and increased environmentally-friendly investment;
- Cost-effective and flexible measures to reduce GHGs;
- Achievement of the national GHG reduction target; and
- Active participation in global carbon markets.

Finally, it is important to note that the Republic of Korea's Nationally Determined Contribution (NDC) calls for reducing GHG emissions by 11.3 percent relative to business-as-usual in 2030.[1] This creates another policy driver for Korea's active participation in international carbon markets and other cooperative approaches under Article 6 of the Paris Agreement.

Japan

Japan has developed various market-based mechanisms, both domestically and internationally. Japan's Voluntary Emission Trading System has been in place since 2005. Japan has also promoted advanced technologies through its Advanced Technologies Promotion Subsidy Scheme with Emission Reduction Targets (ASSET) and J-Credit System.

1 Korea's NDC is at: http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Republic%20of%20Korea/1/INDC%20Submission%20by%20the%20Republic%20of%20Korea%20on%20June%2030.pdf.

At the municipal level, the Tokyo Metropolitan Government has launched a cap-and-trade system that covers emissions from approximately 1,400 large-scale facilities, including commercial and industrial buildings and factories. By implementing various domestic market mechanisms, Japan has developed capacities relevant for implementing MRV and trading registries.

One important component of Japanese climate-change policy is the JCM. The JCM is implemented bilaterally with 16 partner countries through a joint committee that includes representatives of relevant ministries and high-level officials from participating governments. JCM implementation has involved a variety of programs and projects, including those developed by government agencies as well as efforts undertaken by Japanese and foreign firms, and a variety of sectors, such as electricity production and distribution, transportation, industry, and waste management. As of 2016, 23 JCM methodologies in five sectors have been approved. Outcomes of JCM implementation can be shared between countries that develop registries and can be used toward Japan's or host countries' NDCs. To promote JCM, Japan has been active in the development of related rules as part of negotiations over Article 6.

China

China is expected to introduce its own nation-wide ETS later in 2017, building on ten years of experience with trading through the CDM and several sub-national ETS pilots covering five cities and two provinces. Each ETS pilot jurisdiction has implemented its own ETS, resulting in different levels of emission-reduction targets, emissions-compliance thresholds, cap coverage, baseline years, and other design features. Seven pilot ETSs have made progress in the MRV process largely due to the influence of China's National Development and Reform Commission and with external assistance, such as from the World Bank's Partnership for Market Readiness.

Once China introduces its nation-wide ETS, the size of its carbon market will be much greater than that of the EU, which is currently the largest in the world. The scale of China's trading system has the potential to reshape world carbon markets by influencing existing and future market mechanisms. However, China may not immediately pursue international cooperative initiatives by, for example, linking its national ETS with others (such as Korea's) or actively engaging in developing the rule book for Article 6. Rather, China is likely to spend several additional years preparing for participation in international markets by ensuring domestic ETS compliance, advancing its domestic MRV, ensuring appropriate ETS coverage, and aligning with other national climate policies.

Elements of developing a carbon market for Northeast Asia

Voluntary cooperation by three Northeast Asian countries to develop a regional carbon club (i.e., Northeast Asian Carbon Market) will surely contribute to global efforts to reduce GHG

emissions. Even though China, Japan, and Korea have developed individual market mechanisms, several important elements need to be addressed to establish a regional carbon market. These include building political momentum, creating shared interests, securing broad participation, and ensuring compatibility with the Paris Agreement.

Building Political Momentum: Northeast Asia is one of the most difficult regions in the world for developing regional cooperative institutions, due to its unique geopolitical situation. In the past, history, traditional security concerns, and other political issues have often prevented neighboring countries from developing regional mechanisms. To succeed, leaders in these countries will need to build enough political momentum to place the development of a regional carbon market at the top of their respective national agendas.

Creating Shared Interests: Carbon clubs can be created only when there exist shared interests among stakeholders. In Northeast Asia, the formation of a carbon market should be seen as a policy vehicle for developing and implementing region-wide low-carbon projects. For example, the carbon market must be designed to mobilize financial and technological resources to boost major renewable projects in the region so that participating countries and other stakeholders can achieve development while substantially reducing GHG emissions.

Securing Broad Participation: Membership in a Northeast Asian Carbon Market must be flexible. In addition to China, Japan, and Korea, other countries in the region, such as Mongolia and North Korea, could be candidates for participation. Other interested countries and international organizations, such as the World Bank and Global Green Growth Institute, could also be considered as future candidates.

Ensuring Compatibility with the Paris Agreement: A Northeast Asian Carbon Market will need to comply with rules under Article 6 of the Paris Agreement, including rules for common accounting (MRV) and other mechanism(s).

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Gilbert E. Metcalf is a Professor of Economics at Tufts University where he serves as the Graduate Program Director in the Department of Economics. In addition, he is a Research Associate at the National Bureau of Economic Research, an Associate Scholar in the Harvard Environmental Economics Program, and a University Fellow at Resources for the Future. Metcalf's primary research area is applied public finance with particular interests in taxation, energy, and environmental economics. His current research focuses on policy evaluation and design in the area of energy and climate change. Metcalf received a B.A. in Mathematics from Amherst College, an M.S. in Agricultural and Resource Economics from the University of Massachusetts Amherst, and a Ph.D. in Economics from Harvard University.

Axel Michaelowa is part-time researcher at the Institute of Political Science of the University of Zurich and managing director of the consultancy Perspectives, which he co-founded in 2003. He has worked on international climate policy instruments and the UNFCCC process since 1994. Within the IPCC, he was lead author for the chapter on policies and measures in the 4th and 5th Assessment Report. Between 2006–2013, Michaelowa served on the Clean Development Mechanism (CDM) Registration and Issuance Team of the CDM Executive Board. He has participated in UNFCCC negotiations since COP 1 in 1995. He has a Ph.D. in Economics.

Richard Morgenstern is a Senior Fellow at Resources for the Future and a former Senior Executive at the U.S. EPA, where he directed the Agency's Policy Office for more than a decade and acted in various presidential appointee positions, including as the Deputy Administrator. For 2016–2017, he is a Fulbright scholar at the University of Ottawa. His research focuses on the evaluation of the costs, benefits, and design of environmental policies in the United States, China, and other nations, especially economic incentive measures for addressing climate change. His current research looks back at the performance of federal regulations and evaluates options for limiting emissions leakage in carbon pricing programs.

Ian Parry is the Principal Environmental Fiscal Policy Expert in the Fiscal Affairs Department of the International Monetary Fund (IMF). Prior to joining the IMF in 2010, Parry held the Allen V. Kneese Chair in Environmental Economics at Resources for the Future. His research focuses on analytical and spreadsheet models to quantify for different countries the economic impacts and efficient levels of a wide range of environmental, energy, and transportation policies. His work emphasizes the critical role of fiscal instruments to address externalities and raise revenue. He has a Ph.D. in economics from the University of Chicago.

Annie Petsonk is International Counsel for the Environmental Defense Fund (EDF); she coordinates EDF's advocacy efforts on international environmental law, international agreements and institutions, and works to develop international laws that provide economic incentives for environmental protection. Prior to EDF, she served in the Executive Office of the President, the U.S. Department of Justice, the United Nations Environment Programme, and the private bar. As well as her current role, Petsonk also teaches at George Washington University Law School. She received her J.D. from Harvard Law School and her B.A. from The Colorado College.

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ers with responsibility for energy and environmental policy from 1989–1991. Schmalensee's recent work focuses on applications of industrial organization economics to energy and environmental policy.

Robert Stavins is the A.J. Meyer Professor of Energy & Economic Development, Harvard Kennedy School; Director, Harvard Environmental Economics Program; and Director, Harvard Project on Climate Agreements. He is a University Fellow, Resources for the Future; Research Associate, National Bureau of Economic Research; elected Fellow, Association of Environmental and Resource Economics; and Member, Board of Directors, Resources for the Future. He was Chairman, Environmental Economics Advisory Board, U.S. Environmental Protection Agency. He was a Lead Author, Second and Third Assessment Reports, Intergovernmental Panel on Climate Change; and Coordinating Lead Author, Fifth Assessment Report. His research has examined diverse areas of environmental economics and policy. He holds a B.A. in philosophy from Northwestern University, an M.S. in agricultural economics from Cornell, and a Ph.D. in economics from Harvard University.

James H. Stock is the Harold Hitchings Burbank Professor of Political Economy, Faculty of Arts and Sciences and member of the faculty at Harvard Kennedy School. He received a M.S. in statistics and a Ph.D. in economics from the University of California, Berkeley. His research includes applied macroeconomics, econometrics, and energy and environmental economics. He previously served as Chair of the Harvard Economics Department from 2007–2009 and as Co-Editor of *Econometrica* from 2009–2012. In 2013–2014, he was Member of President Obama's Council of Economic Advisers, where his portfolio included macroeconomics and energy and environmental policy. He is a Faculty Fellow at the Harvard Environmental Economics Program.

Robert Stowe is Executive Director of the Harvard Environmental Economics Program and Co-Director of the Harvard Project on Climate Agreements—both University-wide programs based in the Harvard Kennedy School (HKS). He is also an Adjunct Lecturer in Public Policy at HKS, teaching a course on international climate-change policy. Stowe has been engaged through the Harvard Project in the annual Conferences of the Parties of the U.N. Framework Convention on Climate Change since 2007. He was a Contributing Author to a chapter on international cooperation in the Intergovernmental Panel on Climate Change's Fifth Assessment Report. Stowe holds a Ph.D. in political science from the Massachusetts Institute of Technology and an A.B. in physics from Harvard College.

Michele Stua is a researcher and analyst focusing on Climate Policy and Climate Finance. He has worked for Sant'Anna School for Advanced Studies in Pisa, where he obtained his Ph.D. in 2011, developing an innovative research on the application of the Clean Development Mechanism (CDM) in China and SPRU-Science Policy Research Unit, University of Sussex. His major efforts concerned the study of carbon mechanisms aimed at facilitating the trade

of mitigation-related assets worldwide. His findings led to the definition of policy proposals introduced in different international contexts.

Charles Vinsonhaler is an MPP candidate at The George Washington University. His studies focus on climate regulations at the federal and state levels and policies that utilize market-based solutions to mitigate emissions. Charles received his B.A. from George Mason University, majoring in economics and history. He is currently interning at the Environmental Defense Fund where he supports the international climate team, specifically aviation emissions research.

Market Mechanisms and the Paris Agreement

A Research Workshop Sponsored by the Harvard Project on Climate Agreements

July 6, 2017

Harvard Kennedy School
Cambridge, Massachusetts

Agenda

Location of all sessions, including dinner:

Allison Dining Room
Taubman Building, Fifth Floor
Harvard Kennedy School

Wednesday, July 5

6:00 – 8:30 pm Dinner and reception

Thursday, July 6

9:00 – 9:15 am **Welcome and self-introductions**

Robert Stavins, Harvard University

9:15 – 9:35 am **Lessons Learned from Cap-and-Trade Experience**

Richard Schmalensee, MIT

9:35 – 9:40 am Response: *Emily Wimberger*, California Air Resources Board

9:40 – 10:15 am Discussion

10:15 – 10:30 am **Coffee Break**

10:30 – 10:50 am **China's National ETS: Status and Challenges**

Valerie Karplus, MIT

10:50 – 11:00 am Responses: *Jackson Ewing*, Asia Society Policy Institute

Richard Morgenstern, Resources for the Future

11:00 – 11:30 am Discussion

11:30 – 11:50 am	**Heterogeneous Linkage Consistent with the Paris Agreement**	
	Gilbert Metcalf, Tufts University	
11:50 am – 12:00 pm	Response: *Lawrence Goulder*, Stanford University	
12:00 – 12:30 pm	Discussion	
12:30 – 1:30 pm	**Lunch**	
1:30 – 1:50 pm	**Carbon Prices and Carbon Markets**	
	Joseph Aldy, Harvard University	
1:50 – 2:00 pm	Responses:	*James Stock*, Harvard University
		Ian Parry, International Monetary Fund
2:00 – 2:30 pm	Discussion	
2:30 – 2:50 pm	**Article 6: Structure, Interpretations, Status**	
	Andrei Marcu, International Centre for Trade and Sustainable Development	
2:50 – 3:05 pm	Responses:	*Annie Petsonk*, Environmental Defense Fund
		Brian Flannery, Resources for the Future
		Michele Stua, C+3C Sistemi e Strategie
3:05 – 3:30 pm	Discussion	
3:30 – 3:45 pm	**Coffee Break**	
3:45 – 4:05 pm	**6.2 and 6.4 Mechanisms: Complementarities and Tensions**	
	Axel Michaelowa, University of Zurich	
4:05 – 4:15 pm	Response:	*Sue Biniaz*, United Nations Foundation
		Alex Hanafi, Environmental Defense Fund
4:15 – 4:45 pm	Discussion	
4:45 – 5:00 pm	**Summary, Conclusions, and Next Steps**	

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Participants

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