



Institute for
New Economic Thinking
AT THE OXFORD MARTIN SCHOOL



Symposium for the High-Level Commission on Carbon Prices

*a symposium hosted by the Agence Française de Développement (AFD), the
Chair Energy & Prosperity and the Ecole Normale Supérieure, Paris*

Organized by Gaël Giraud, Cameron Hepburn, Linus
Mattauch, Nicholas Stern

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TABLE OF CONTENTS

<u>A WORD OF WELCOME FROM THE ORGANIZERS</u>	3
<u>WORDS OF WELCOME FROM PARTICIPATING INSTITUTIONS</u>	4
<u>PROGRAMME - MAY 17</u>	6
<u>TITLES AND ABSTRACTS OF CONTRIBUTIONS</u>	7
<u>GENERAL INFORMATION</u>	11

A WORD OF WELCOME FROM THE ORGANIZERS

Dear participants,

It is with great pleasure that we welcome you to our symposium for the High-level Commission on Carbon Prices.

After the Paris Agreement on climate change, the focus of climate change mitigation policy is on the implementation of national targets and on increasing their ambition. Putting a price on carbon is widely recognized as the most efficient way to achieve cuts in emissions and a necessary condition for deep decarbonisation of national economies. Joseph Stiglitz, Nobel Laureate in Economics, and Lord Nicholas Stern, have agreed to chair a High-Level Commission on Carbon Prices that will make recommendations on implementing the Paris Agreement. The Commission has been established as part of the Carbon Pricing Leadership Coalition with a secretariat at the World Bank. The Commission's purpose is to guide the design of carbon pricing instruments in order to deliver on increasing the ambition of climate change mitigation policy.

The objective of the academic symposium is to discuss the economic rationality, political feasibility and public acceptability of carbon pricing in the context of national economic objectives and fiscal policy. A special emphasis is put on the potential of revenue recycling and instrument design as possibilities for generating political support for carbon prices. The contributions focus on policy implications, but are also grounded in state-of-the-art economic theory or empirical analysis.

The expected outcome of the conference is a wide dissemination in academia of insights about designing politically acceptable carbon pricing schemes in parallel with the report of the Commission.

The format of the academic contributions is 15 minutes presentation followed by 15 minutes discussion each.

We are looking forward to meeting you during the symposium.

The organizers

WORDS OF WELCOME FROM PARTICIPATING INSTITUTIONS

A word of welcome from the World Bank

Dear participants,

It is my pleasure to welcome you to this symposium for the High-level Commission on Carbon Prices. I want to deeply thank its organizers -the Agence Française de Développement (AFD), the Chair Energy & Prosperity and the Ecole Normale Supérieure- for convening this event at such an opportune time.

Through the Paris Agreement, countries are implementing individual, nationally-driven commitments to contribute to the global goal of limiting temperature increase well below 2 degrees. While implementation of countries' pledges will rely on a range of policies and programs, there has never been so much global momentum and interest for using carbon pricing. As countries look at various options, they need support to assess, design, prepare, and implement these instruments.

We believe that the work of the Stern/Stiglitz Commission will be extremely important. It will explore explicit carbon pricing options and levels that would induce the change in behaviours, including investment in infrastructure, technology, plant and equipment, needed to deliver on the objectives of the Paris Agreement. We are delighted that this symposium, gathering key experts from academia, can usefully contribute to the work of the Commission. It will present concrete analyses on existing carbon pricing instruments and tackle complex issues related to the design and implementation of carbon pricing, such as use of revenues and the effectiveness of international transfers, which are also particularly relevant for many of the countries we work with.

The World Bank Group is honoured to support the work of this Commission, launched under the Carbon Pricing Leadership Coalition (CPLC). Through our various programs, we have been mobilizing political leadership and business support for carbon pricing and we offer knowledge, technical and advisory support services to build capacity and help countries implement carbon pricing. We also work on enabling connectivity between carbon markets and comparability of different climate mitigation actions. We are committed to supporting the implementation of the Paris Agreement, notably its article 6, and the development of carbon pricing initiatives and we look forward to continuing working on this important and pressing issues with all of you.

I wish you all very productive discussions.

Sincerely,
John

A word of welcome from Agence Française de Développement and Chair Energy and Prosperity.

Dear participants,

On behalf of the Agence Française de Développement (AFD) and Chair Energy and Prosperity, I am very pleased to welcome you to the symposium for the High Level Commission on Carbon Prices. AFD is a public financial institution that implements the development policy defined by the French Government. Its aim is to combat poverty and inequality (understood in a broad sense) throughout the world and promote sustainable development, including ecological issues. It has a dual financing and knowledge production mandate within the international community. The Energy and Prosperity academic Chair is hosted at the Ecole Normale Supérieure, Ecole Polytechnique and ENSAE, since 2015. Its aim is to link public and private actors to the frontier of academic research on energy transition.

Both institutions work hand-in-hand on the macro-economic impacts of the energy shift on national economies, issues raised by specific sectors (transportation, construction, etc.) and the corresponding financing challenges. As such, both institutions are deeply concerned with carbon pricing issues. We are thus very pleased to organize with our partners this academic symposium in order to present the background papers of the High Level Commission on Carbon Pricing.

With my best wishes,

Gaël Giraud

A word of welcome from INET Oxford

Dear participants,

We warmly welcome you to the symposium for the High Level Commission on Carbon Prices on behalf of the Institute for New Economic Thinking at the Oxford Martin School (INET Oxford). The research programmes at INET Oxford address the challenge of creating a new model of economic growth and prosperity that is more inclusive, sustainable, and resilient to shocks. Mitigating climate change, through the complete decarbonization of the economy in the coming decades, is a pivotal element of this research agenda. INET Oxford researchers – including economists, physicists, mathematicians, political scientists and sociologists – work closely with policymakers and leaders in business and civil society to bring new economic ideas and thinking into debates and practice in the public, private and non-profit sectors. We are thus delighted to be supporting this academic symposium for the High Level Commission on Carbon Prices.

With best wishes,

Cameron Hepburn and Linus Mattauch

PROGRAMME

09:00-09:30	Arrival and Registration, Coffee
09:30-09:45	Introduction by <i>Gaël Giraud and Cameron Hepburn</i>
09:50-10:20	Sweden's CO₂ Tax and Taxation Reform Experience <i>Thomas Sterner (University of Gothenburg)</i>
10:20-10:50	Making Carbon Pricing Work <i>David Klenert (MCC Berlin)</i>
Coffee Break	
11:10-11:40	Environmental Prices, Uncertainty and Learning <i>Samuel Fankhauser (LSE)</i>
11:40-12:10	The Strategic Dimension of Financing Global Public Goods <i>Ulrike Kornek (MCC Berlin)</i>
12:10-12:40	Accepting Market Failure in Experiments: Opposition to Environmental Policies <i>Stephan Kroll (Colorado State University)</i>
Lunch	
14:00-14:30	Emissions Containment in Response to Carbon Market Prices <i>Dallas Burtraw (Resources for the Future, RFF)</i>
14:30-15:00	Coping with the Collapse: A Stock-Flow Consistent Monetary Macrodynamics of Global Warming <i>Gaël Giraud (AFD)</i>
Coffee Break	
15:20-15:50	Assessing Carbon Mitigation Policies in EU Countries <i>Ian Parry (IMF) – presented by William Oman</i>
15:50-16:20	Impacts of Costs of Advanced Technologies on Carbon Tax Rates and Revenue <i>Gilbert Metcalf (Tufts University)</i>
16:20-16:50	Climate Economics for the Age of President Trump <i>Rick van der Ploeg (Oxford University)</i>
16:50-17:00	Closing Remarks by <i>Gaël Giraud and Nicholas Stern</i>
Cocktail	

TITLES AND ABSTRACTS OF CONTRIBUTIONS

D. Burtraw, K. Palmer, A. Paul, C. Holt, W. Shobe – Emissions Containment in Response to Carbon Market Prices

In every air emissions trading program, there has been downward pressure on allowance prices, and the prices that are ultimately realized have been below expected values. This has a number of implications:

- a) It erodes the payoff to early actors and clean energy investors, while also reducing the incentive for more substantial emissions reductions.
- b) It can undermine the intended emissions reductions from companion policies, such as renewable portfolio standards or energy efficiency programs.

This downward pressure has been driven largely by the speed with which emissions have been reduced—faster than expected—which has in turn been caused by a number of factors. These include innovation and new mitigation options, the implementation of companion policies promoting clean technology, and the voluntary actions of cities, states, and private entities to further reduce emissions. To illustrate: At least in the short term, the introduction of companion policies alongside an emissions trading program does not drive additional reductions. Instead, it leads to a reduction in allowance prices, making room under the cap for emissions from other sources. This phenomenon is the so-called “waterbed effect,” where pushing emissions down in one place just leads to emissions going up somewhere else, unless administrative action is taken to adjust the cap downwards.

This paper investigates an emissions containment reserve (ECR) that would institute one or a series of soft price steps (potentially above a hard price floor). Each price step would serve as a reserve price for a quantity of allowances that are distributed through auction into the trading program. If the auction clearing price falls below a price step, the associated quantity of allowances would not be sold. The ECR would not determine the market price, but when prices fall the ECR support the price by incrementally constraining the supply of allowances.

The paper brings three approaches to an investigation of this new market design. The paper provides an analytical investigation of price formation in a carbon market when one or multiple price steps are introduced. The paper also exercises a highly parameterized electricity sector model to investigate the performance of the carbon market and the effect on the electricity market under various approaches to the ECR, such as one or multiple price steps, or a continuous price ramp. This model is calibrated to represent the implementation of the Regional Greenhouse Gas Initiative (RGGI), a carbon trading program covering the power sector in nine northeastern US states. The ECR is a mechanism for automatically adapting the program to account for unanticipated changes in the carbon market or the electricity market, and is currently being considered as part of RGGI’s second scheduled program review. The simulation model provides a way to examine its performance under variations in natural gas prices, demand and other uncertain market parameters. Finally, the paper explores the ECR in an experimental setting using students as subjects in a simulated electricity market where price discovery, market equilibrium and welfare are measured.

T.L. Cherry, S. Kallbekken, S. Kroll – Accepting Market Failure in Experiments: Opposition to Environmental Policies

To explore whether and why people sometimes reject environmental policies that improve individual and collective outcomes, we create an experimental market in which transactions generate a negative externality. Market participants endogenously determine whether to implement corrective policies. Previous studies had identified several factors that impact acceptance of these policies (e.g., earmarking revenues, timing of policy's benefits, framing). In this study we consider three policy instruments (Pigouvian taxes and subsidies, and quantity regulation) and two levels of policy efficiency (full and half). We then explore how individual cultural worldviews might contribute to the rejection of policies that correct the market failure. The results show significant opposition to policies, even when the policy improves individual earnings and market efficiency. Results show that worldviews explain much of the variation in policy aversion, and interesting connections emerge between individual worldviews and specific policy instruments.

G. Giraud, F. Mc Isaac, E. Bovari, E. Zatssepina – Coping with Collapse: A Stock-Flow Consistent Monetary Macrodynamics of Global Warming

This paper presents a macroeconomic model of endogenous growth that takes into consideration the economic impact of climate change, the pivotal role of private debt and income distribution. Using a Goodwin-Keen approach, based on the Lotka-Volterra logic, we couple its nonlinear monetary dynamics of underemployment and income distribution with abatement costs. Various damage functions à la Nordhaus, Dietz-Stern, and Burke et al. reflect the loss in final production, stock of capital, and labor productivity due to the rise in temperature. An empirical calibration of our model at the world-scale enables us to simulate plausible trajectories for a planetary business-as-usual scenario. Our main finding is that, even though the short-run impact of climate change on economic fundamentals may seem *prima facie* rather minor, its long-run dynamic consequences may lead to an extreme downside. Under plausible circumstances, global warming forces the private sector to leverage in order to compensate for output and capital losses; the private debt overhang may eventually induce a global financial collapse, even before climate change could cause serious damage to the production sector. Under more severe conditions, the interplay between global warming and debt may lead to a secular stagnation followed by a collapse towards the end of this century. However, it turns out that increasing the wage share, fostering employment, or reducing the private-debt-to-output ratio makes it easier to avoid a collapse. The paper concludes by examining the conditions under which the +1.5°C and +2°C targets, adopted by the Paris Agreement (2015), could be reached thanks to an adequate carbon price trajectory.

S. Dietz and S. Fankhauser – Environmental prices, uncertainty and learning

There is an increasing demand for putting a shadow price on the environment to guide public policy and incentivise private behaviour. In practice, setting that price can be extremely difficult as uncertainties abound. There is often uncertainty not just about

individual parameters but about the structure of the problem and how to model it. A further complication is the second-best nature of real environmental policy making. In this paper, we propose some practical steps for setting prices in the face of these difficulties, drawing on the example of climate change. We consider how to determine the overall target for environmental protection, how to set shadow prices to deliver that target, and how we can learn from the performance of policies to revise targets and prices. Perhaps most significantly, we suggest that estimates of the marginal cost of environmental protection, rather than the marginal benefit, will often provide the more consistent and robust prices for achieving targets.

H. Hammar, T. Sterner and S. Åkerfeldt – Sweden's CO2 tax and taxation reform experience

This contribution outlines the basics of the CO2 tax introduced in Sweden in 1991 as an important part of a major reform of the national taxation system. The Swedish carbon tax, as part of a major tax reform, did not increase the size of government: in fact the total tax share of GDP has actually fallen. Carbon tax levels have gradually increased and are now considerably higher than those in most other countries and considerably higher than current carbon trading schemes prices. The Swedish experience can be summarized by increased tax levels over time and steps taken towards a more uniform national price on fossil CO2. Thus far, the CO2 tax base has been only moderately elastic to price changes of petrol and diesel, implying stable revenues.

D. Klenert, L. Mattauch, E. Combet, C. Hepburn, N. Stern – Making carbon pricing work

This presentation focuses on the question of how to make carbon pricing work through the allocation of the revenue. We synthesize findings regarding the optimal use of carbon pricing revenue from several unrelated literature strands such as behavioral economics, optimal taxation theory, general equilibrium modeling and political science. We then compare real-world carbon pricing regimes with theoretical recommendations. We find that the political acceptability of the carbon pricing hinges to a large extent on behavioral effects, which are heavily influenced by the use of the revenue rather than on equity and efficiency outcomes

U. Kornek and O. Edenhofer – The strategic dimension of financing global public goods

Countries have frequently employed international transfers from compensation funds to foster cooperation and address adverse incentives when providing public goods. Effective implementation of transfers however remains a challenge. This study analyzes the design of transfer payments when free-riding incentives exists because countries are sovereign both in choosing (i) their contribution to the public good and (ii) whether to participate in the fund. We show that when transfers increase with the individual contribution, the total level of public good provision increases in equilibrium. Donor countries may have an incentive to participate in the

compensation fund if the other countries increase their provision of the public good, which is determined by how marginal transfers change when the donor joins. We present a specific design of transfers based on differences in costs of public good provision, with which the social optimum is the equilibrium when countries are symmetric. Our results are important for analyzing the effectiveness of international transfers when individual actors voluntarily provide a public good.

I. Parry and V. Mylonas – Assessing Carbon Mitigation Policies in EU Countries

This paper develops a flexible spreadsheet tool (incorporating fuel projections for energy sectors and assumptions about fuel price responsiveness) for evaluating, for EU member countries, a range of carbon mitigation policies (emissions trading systems, carbon taxes, taxes on electricity and individual fuels, incentives for renewables and energy efficiency) across a range of metrics (climate, domestic environmental, fiscal, and economic welfare impacts and, in some cases, distributional incidence across firms and households). Along with complementary modelling efforts, this information helps policymakers choose among instruments or instrument combinations; design policy specifics, including accompanying measures (e.g., broader fiscal reform from recycling of carbon pricing revenues, compensation for vulnerable households and firms); and to communicate the case for reform. And cross-country estimates of explicit (or implicit) carbon prices implied by Paris emissions pledges provide a sense of the need for additional price coordination measures (beyond the EU trading system).

A. Rezai and R. van der Ploeg – Climate Economics for the Age of President Trump

With the election of President Trump, climate deniers moved from the fringes to the center of global policy making and needs to be addressed in policy-making. An agnostic approach to policy, based on Pascal's wager where a key role is given to subjective prior probability beliefs about whether climate deniers are right, finds that policy makers that assign a 10% chance of climate deniers being correct set the global tax on carbon to \$13.3 per ton of emitted CO₂. Given that a non-denialist scientist sets the tax at \$14.7/tCO₂, agnostics' reflection of remaining scientific uncertainty leaves climate policy essentially unchanged. The difference reduces if policy makers are averse to fundamental climate model uncertainty or follow the classical max-min principle. Taxing carbon is the robust response under rising climate skepticism. Hence, allowing for the view of climate deniers, hardly alters science-based climate policy if included in an agnostic policy framework.

M. Yuan, G. Metcalf, J. Reilly, M. Paltsev – Impacts of costs of advanced technologies on carbon tax rates and revenue

A primary reason for implementing a carbon or greenhouse gas tax is to reduce emissions. In recent years, however, there has been increased interest in a carbon tax's revenue potential. In the United States context, this revenue could be used, among other uses, for federal deficit reduction, to help finance income tax reform, or support new spending priorities. Carbon revenue for new initiatives might net out

some funding for temporary transitional assistance or to address concerns about impacts on low-income households. But even after some set-aside, there could be considerable revenue for other uses in the federal budget. Given the environmental goal of ultimately reducing emissions to very low levels, programs that become dependent on the revenue may face funding challenges when and if carbon revenue begins to decline. To date, the revenue potential of a carbon tax has not been studied in detail. This study focuses on how much carbon tax revenue can be collected and at what point the tax revenue peaks and starts to decline. In other words, we explore the carbon “Laffer Curve” relationship that postulates the trade-off between the carbon tax rate and revenue. We calculate the revenue maximizing carbon tax rate both for the carbon tax in isolation and for the Federal tax system as a whole. That latter calculation takes into account changes in corporate and personal income tax and payroll tax collections due to reduced economic activity in response to high carbon tax rates. To carry out this analysis, we employ the MIT U.S. Regional Energy Policy (USREP) model, a dynamic computable general equilibrium model for the U.S. economy, for the numerical investigation of this question. We consider scenarios with different carbon prices and emissions reductions goals to explore how that may affect whether and at what tax rate revenues peak. We hypothesize that whether and when revenues peak will depend on the cost of low carbon technology alternatives. To examine emissions and revenue responsiveness to the carbon tax, we bring in a range of cost estimates of the abatement technologies. Our preliminary results suggest that higher rate of abatement technology deployment makes emissions more responsive to the tax rate and thus the revenue maximizing tax rate falls in level and appears earlier in time.

GENERAL INFORMATION

The symposium will take place in Ecole Normale Supérieure (ENS)
ENS- 45 rue d’Ulm -75005 Paris (Salle Dussane).