



Minutes of the Conference “Economic stakes of the 2015 Paris Climate Conference”

October 14, 2015 – Paris Dauphine University

As the Paris Climate conference in December 2015 approaches, the Climate Economics Chair (CEC) and Toulouse School of Economics (TSE) launched a common approach for mobilizing economists to emphasize the role of economic instruments and carbon pricing in any international agreement.

The conference of 14 October 2015, organized with the Center for European Policy Studies (CEPS), is part of this initiative. This conference brought together international economists, chief executive officers, and representatives of public authorities to discuss the role of economic and financial instruments in the implementation of an international climate agreement.

Presentation of the conference

by Christian Gollier (TSE) and Christian de Perthuis (CEC)

While most of the technical solutions to cut CO₂ emissions already exist, the main barriers to achieve mitigation are economic, because the challenge is to match short-term economic decisions with long-term issues. The CEC-TSE partnership is in line with this approach. This is why these two institutions launched a “call for an ambitious and credible agreement in Paris”, which has already gathered the signature of over 200 economists.

The state of COP 21-negotiation

by Laurence Tubiana, French Climate Ambassador

Pricing carbon is unescapable to move towards a low-carbon economy. There exist two main options to price carbon but only one is conceivable and desirable in the context of the COP-21.

The first option consists in imposing, at the beginning of the negotiations, the principle of a common commitment in terms of carbon price. This approach was at the root of the Kyoto’s cap and trade scheme, before failing during the implementation stage because of two main reasons: a unique carbon price is not fair and would require the complete abolition of inequalities of development among countries (or a massive transfer of revenues); existing public policies create

market distortions which cause a gap between the private cost (carbon price) and the social cost (marginal cost associated to the constraint) of carbon.

The second option rather consists in making easier the introduction of a carbon price with intended nationally determined contributions (INDC). Countries that emit the most (China, United-States, European Union, India) do not behave as free-rider. For these countries, decisions in terms of carbon pricing result from the balance between a geopolitical vision and the way the energy transition is able to tackle one national issue or another. This makes the interest of INDC through which each State clarifies changes in emissions paths that are considered to be in line with its own vision of development and its constraints due to internal policies.

At present, more than 150 countries (representing more than 85% of worldwide GES emissions, *versus* currently 15% for Kyoto) have already communicated their INDC. According to the different existing studies, it makes us on the track towards +3°C. This is better than the estimations of +4°C, +5°C or +6°C without these INDC, but this is not enough with regard to the objective of +2°C.

COP21 is thus challenging, and has to:

- 1- ensure the enlargement of commitments (MRV, transparency, finance, ...);
- 2- encourage Presidents, Ministers and firms to work for implementing a carbon price (cf. “Carbon Pricing Leadership Coalition”);
- 3- favor the creation of clubs with common rules (pricing rules, markets, ...);
- 4- make easier the implementation of innovative funding mechanisms of INDC, which consistency would be based on a guiding carbon price which could reach high levels more quickly than a carbon price (cf. statement of LCS-Rnet);
- 5- encourage countries to adopt a long term strategy.

IMPLEMENTING A CLIMATE AGREEMENT: ECONOMISTS' DIALOGUES

What price for carbon? Benchmarks for negotiation

Chairman: Larry Goulder, Stanford University

Behind practical and theoretical controversies over the relative merits of economic instruments to price carbon emissions (cap-and-trade, tax, etc.) lies the overarching question of the adequate carbon price level. A high carbon price provides much more of an incentive to abate emissions than a low price, but is generally less politically palatable. What price (prices?), therefore, could be both conducive to a 2°C-consistent emissions pathway and broadly agreed upon and endorsed by political leaders?

Long-term perspectives for carbon pricing

by Christian Gollier (TSE)

The underlying question behind carbon pricing is that of intergenerational equity and responsibility. Supposing future generations will be richer than we are, how much are we willing

to forego today so as to reduce emissions and damages tomorrow? Then, how should we compare present and future (very distant) damages? This comes down to the choice of the discount rate: a lower discount rate puts relatively more weight on the future and hence implies more present responsibility. For instance, Nordhaus recommends a price of 10\$/tCO₂ with a 5% discount rate, whereas Stern suggests an indicative price of 100\$/tCO₂ with a discount rate of 1.5%.

In this modelling exercise, the long-run risk on growth matters. At the individual level, the presence of uncertainty leads to relatively more precautionary savings. Collectively, this would translate into a lowering of the discount rate. A standard calibration of Consumption-based capital asset pricing model (CCAPM) for long-term growth assumes a Brownian motion with a trend of 2% and a standard deviation of 1%. In the distant future, however, uncertainty also surrounds the level of the long-term growth trend. Assuming an unknown trend, the risk-free rate (resp. risk premium) decreases (resp. increases) in the temporal horizon considered. From Monte-Carlo simulations using the DICE model, Pr. Gollier's own estimation of the climate beta is one. This implies a discount rate of 4%, associated with a carbon price of ~€30/tCO₂.

Carbon price scenarios in the latest IPCC report

by Carlo Carraro (University of Venice)

Markets seem unable to deliver an adequate carbon price signal that is long-term, credible and effective; plus, time is needed to expand and link up markets and taxes are not viable in many countries. There is thus a need for both additional investment and redirection of existing investment in low-carbon technology (see IPCC AR5-WG3-Ch.16). An effective and acceptable price level hinges upon technology availability, timing of actions, distributional implications and the architecture of the agreement.

Pr. Carraro then reviews results from two integrated assessment modeling (IAM) comparison studies for different possible scenarios in two cases: high ambition (HA); low ambition (LA). In the first-best scenario (one global ETS), price levels and uncertainty across models are higher under HA than under LA. In the fragmented scenario (coexisting but separated regional ETSSs), price levels are lower in the short term to medium term under HA than under LA but prices soar under HA in the long term as compared to LA. Fragmentation hence appears as a short-term solution but global pricing would be regressive without transfers – climate benefits should compensate for lower-income countries paying more than industrialized countries due to higher carbon intensity and terms of trade.

How to apply the principle of “common but differentiated responsibilities”?

Chairman: Patrice Geoffron (Paris-Dauphine University)

The equity criteria to be accounted for

by Lucas Bretschger (ETH Zurich)

The talk explained from an economic perspective how the general principle of “common but differentiated responsibilities” can be implemented in current climate policy by using equity

principles. Lucas Bretschger explained that what is needed to make the principles operational in climate negotiations is a plausible mechanism for transforming abstract theorems into effective rules for international burden sharing. He presented a general approach analyzing fairness and ambition of the different “intended nationally determined contributions” (INDCs). The equity-based approach to burden sharing combines four principles: ability to pay, merit, cost sharing, and technical opportunities.

The synthesis allows Lucas Bretschger to eventually concentrate on a single variable, emissions per capita, and two parameters, the start of the responsibility period and the degree of historic responsibility. This equity-based proposal was then compared to the alternative solutions, which are equal access to carbon space or a carbon tax with tax revenue remaining in each country. Lucas Bretschger concludes that the equity-based proposal constitutes a compromise between these more extreme solutions, reflecting the aim of equal access to sustainable development. For practical use, the recently developed ETH climate calculator is presented.

The introduction of an international carbon Price/Rebate mechanisms

by Pierre-André Jouvét (Paris Lumières University)

Whether we levy a global carbon tax or allocate tradable permits (freely or by auction), there is no escaping the issue of how countries share responsibility and reward. Proceeds from the international carbon tax or the emissions permit auction should be redistributed in such a way that encourages reticent countries to join a universal climate accord and could finance all or part of the \$100 billion pledged at Copenhagen. A plausible option could be a hybrid system combining emerging carbon markets and an international “carbon price and rebate” system.

Under the price and rebate system, each nation would face the same CO₂eq price, whether through a carbon tax or emissions trading scheme. Proceeds from the tax or emissions trading system would go to a global fund, and each nation would receive back from this fund an amount proportional to its population per capita emissions. This combination of price and rebate promotes both efficiency and fairness. It promotes efficiency since every nation faces the same incentives at the margin to reduce emissions. It promotes fairness because the rebate received will be larger, the lower are a nation’s per-capita emissions. A price of \$1 per ton of CO₂eq would create a very powerful incentive to build a common MRV system by 2020. At \$7 per ton, this would finance the \$100 billion.

How to price carbon?

Chairman: Thierry Bréchet, CORE, UC Louvain

Once this is commonly agreed that a carbon price is needed, the next step consists in deciding how to price carbon. The two main options are the carbon tax (control is placed on the price of CO₂) and the cap and trade scheme (control is placed on quantities of emissions).

Merits of the cap-and-trade

by Roger Guesnerie (Collège de France)

As the goal is to obtain a CO₂ emissions profile that is in line with the objective of keeping under 2°C the rise in global temperature, the key issue is to control the quantity. Thus the cap and trade scheme appears to be the best option. The way of distributing permits among countries (e.g. on a flat-rate basis, proportionally with the population, and so on) raises other issues, notably in terms of equity. Perfect information is however claimed to offer the possibility to achieve a Pareto-improving situation. Besides, enlarging the scope of negotiations – by integrating trade policies in particular (for instance with constraints in terms of CO₂ emissions underlying free trade) is recommended by cap and trade scheme partisans. Besides, within a worldwide cap and trade system, implementing national carbon taxes is not excluded. Quite the reverse, it would generate revenues and also limit the needs to purchase permits.

Merits of global carbon pricing

Steven Stoft (Berkley)

Global carbon pricing is a new approach favored by Joseph Stiglitz, William Nordhaus and Martin Weitzman, among others. It is based on the science of cooperation in the absence of a global government, and relies on concepts researched by Elinor Ostrom and behavioral economics. It was motivated by the observation that a common commitment based on emission quantities has been, and will be, impossible to agree on. Instead, countries should agree on a common price, and each country should implement that price with fossil taxes, cap-and-trade or some other forms of carbon pricing.

Global pricing is superior to global capping for four reasons. Firstly, pricing solves the free rider problem because it uses a common price commitment. Secondly, a global cap does not require countries to price carbon, and behavior under Kyoto's cap-and-trade indicates they will not. Thirdly, global cap-and-trade imposes enormous trading risks on countries. For example, if China had joined the Kyoto agreement, it could have suffered an unexpected cost of \$1 trillion, mostly paid to foreign countries. Finally, a global cap makes altruistic abatement useless because the cap determines total emissions.

Morning conclusions

by Andreas Löschel (Münster University)

Carbon pricing is at the core of the debate. The discussed carbon prices will exist provided that all countries are involved, mitigation actions are deployed efficiently and rapidly, clean technologies are available and the carbon price is unique. Then, we could reach the 2°C-target at relatively moderate cost. However, all these assumptions are very unlikely. Especially, the distribution of costs cannot easily be detached from the efficient carbon pricing. The first roundtable discussed about politics and how to share the burden and what would be the consequences. Equity is essential. But it has to be kept in mind that equity arguments are also often used serving own economic interests. Moreover, there is no consensus about the right equity definition among negotiators as a survey showed. The burden sharing is likely a combination of different normative concepts and an acceptable concept differs among countries.

The second roundtable was about how to introduce a carbon price. It is essential that we have to provide for a solid foundation for MRV and, moreover, understand the implied stringency of the commitments. We hence need to have a more detailed evaluation of the Intended Nationally Determined Contributions (INDC). This is difficult as policy instruments are diverse and overlapping, there is no commonly accepted metric and a neutral assessment body would be required.

Allocution of Jean-Louis Bianco

Special advisor (French Minister for Ecology, Sustainable Development and Energy)

Carbon pricing has long been recognized by economists and is no more a taboo subject for firms, which begin to introduce a carbon price in their investment calculation. Furthermore, the law on the energetic transition for a green growth has introduced a trajectory for the carbon price in France via a carbon tax which will reach the amount of 56€/tCO₂ in 2020 and 100€/tCO₂ in 2030. Paradoxically, carbon pricing is absent from international negotiations. It is therefore urgent to reintroduce the debate around carbon pricing in the COP21 arenas. It would consist of a corridor of carbon prices.

IMPLEMENTING A CLIMATE AGREEMENT: ECONOMISTS AND COMPANIES DIALOGUES

Why the economists-companies dialogue matters?

by Edmond Alphandéry (CEPS)

This conference presents the debate in its true dimension, which is economic. Obviously, international negotiations have a strong political dimension but the problem of climate change is mainly economic. Indeed, every day, thousands of decisions are taken by households and firms on economic criteria, and particularly on energetic issues. Energy demand will continue to grow, to enable a part of humanity to get out of poverty. It is thus necessary to use the substitution effect. The only way is to price carbon

Roundtable 1: Carbon pricing and innovation

Chairman: Jonathan Wiener (Duke University)

Innovation is a key-issue for the climate change mitigation. As this question interacts strongly with the carbon taxation, in this roundtable we will discuss how carbon pricing affects the innovations already realized, but also how carbon pricing policies could favor low-carbon innovations.

Carbon pricing and investment strategies

by Patrick Pouyanné (Total)

Total calls for carbon pricing, which may seem contradictory as it is a leading oil company. In reality, the enterprise does not see the energetic transition only as a challenge, but also as an

opportunity: in June 2015, the company called with five other oil companies for an international taxation of emissions. They believe pricing carbon will permit to direct R&D investments to low-carbon technologies. In order to realize the transition, Total has decided to act at three levels: firstly by expanding the gas business compared to the oil one, as gas consumption is less polluting than oil. Secondly, by becoming a key player in renewable energies, especially in the solar energy and biomass. Lastly, by improving the efficiency of oil transformation along its value chain. But, to realize these important investments, the industry needs a long term signal for carbon pricing; designing a corridor of price for the European allowances could be a good solution to achieve that goal.

Economic fundamentals

by Jean Tirole (TSE)

The free rider problem is central to the climate change issue. It is also a critical point when we come to talk about innovation. There are two kinds of innovation: private innovation mostly realized in the R&D departments of private companies and protected by intellectual property; public innovation, funded by states and realized in public research centers and universities.

On the one hand, companies face two issues concerning the profitability of low-carbon innovations. Firstly, further issues of permits or non-fulfilled pledges to a high carbon tax could lower the carbon price ex-post, making themselves less competitive. There are ways of reconciling the necessary adaptation to uncertainty and the need for commitment to sufficient carbon pricing. Then, developing countries will need these low-carbon innovations to develop a clean economy. They may impose compulsory licensing, which is a disincentive to private investments in low-carbon R&D. These issues create uncertainty on clean technologies profitability, and measures need to be taken to reduce this uncertainty and then to stimulate private investments. Hence the importance of transferring money to poor countries in a lump sum fashion.

On the other hand, public innovation policies (should) target the very long-term, which is difficult to manage as breakthrough innovations come from various scientific fields. A good way to keep flexibility and efficiency in public research is to constitute committees of independent experts to review periodically projects and decide if they should keep going on and to make sure that the funding goes where the talent is.

The role of “carbon removals”

by Graciela Chichilnisky (Columbia University and Stanford University)

To avert climate change, the International Panel on Climate Change states that we now need carbon negative technologies that remove the carbon that is already in the atmosphere. Global Thermostat is commercializing a proven "carbon negative" technology that captures CO₂ directly from the atmosphere, to sell profitably for enhanced oil recovery, clean synthetic fuels, fertilizers, cement, plastics, graphene, dry ice, foods and beverages. It requires no transportation producing low cost CO₂ anywhere, and scales from thousand to millions of tons of CO₂ per year. It has remarkably low cost using residual heat (80C) as source of energy, and can transform fossil fuel power plants (which originate 45% of emissions) into carbon negative "sinks", while making solar power plants more efficient and carbon negative. It allows to co-generate

electricity with the production of CO₂. Legal limits on CO₂ emissions are needed at the global and national levels as is the flexibility of the EU ETS Carbon Market – both features of the Kyoto Protocol. Legal emission limits can be agreed by all nations with a new concept where poor nations pledge emission limits that are restricted to those reductions they can achieve by building carbon negative power plants, plants that produce energy while cleaning the atmosphere, with funding from the Clean Development Mechanism of the Carbon Market. A Green Power Fund can provide US\$200Bn/year funding from the Carbon Market and its CDM for 15-20 years and resolve climate change if the funding is used to build carbon negative power plants in Latin America, Africa and Small Island States. This can resolve the global climate crisis while providing clean energy to overcome poverty in low income nations and enhancing job creation and exports from OECD nations

Carbon pricing and energy markets

by Gerard Mestrallet (Engie)

Business leaders are becoming increasingly more concerned about climate change: this is a radical change for the Paris conference compared to the COP15 in Copenhagen. Today, both personal and economical convictions converge in order to avoid an ecologic disaster. In practice, it translated this year into several business summits in Paris and New York, gathering industrial companies, finance actors and governments to address the climate change issue. For instance, in Europe, the eleven biggest electricity producers, representing one third of European emissions, have called for a reform of the EU cap-and-trade system to raise the carbon price.

Innovations in the electrical system are very important, but we should not underestimate the realized innovations in the field of heat, which is a key-sector to mitigate climate change. Industrial companies call for a carbon price because they need visibility in the future, to reduce uncertainty on low-carbon innovations. If they mainly advocate for a cap and trade system, the failures of this system make it less reliable than a tax.

Roundtable 2: The perspective of carbon markets' integration

Chairman: Jean-Michel Glachant, Florence School of Regulation

Which industries' strategies in a context of flourishing carbon markets?

by Jean-Pierre Clamadiou (Solvay)

Solvay's commitment in the fight against climate change has two aspects. The first one concerns emissions reduction inside the company itself with the establishment of an internal carbon price. The latter is used as a sensitivity test for internal investments to analyze their profitability in case the carbon price would be higher than its current level. The second component is the development and commercialization of green technologies for Solvay's clients. Solvay notably works with automotive and aerospace manufacturers to reduce the weight of their cars / planes and hence their energy consumption and the resulting CO₂ emissions. Carbon pricing through emissions trading schemes is an efficient way to incentivize companies to reduce their emissions in a flexible way and to direct their investments to low carbon technologies.

Carbon emissions in China: Features and compliance of pilots and their transition to a nationwide scheme

by ZhongXiang Zhang (Tianjin University)

China launched seven pilot carbon trading schemes from 2013 to 2015. They were deliberately implemented either on industrial regions or in municipalities and covered emissions from enterprises. These schemes have features in common, but vary considerably in their design, implementation and compliance aspects. One key lesson derived from these pilots is that educating the covered entities, strictly enforcing compliance rules, and ascribing allowances as financial assets and defining the duration of their validity are crucial to enabling active participation in carbon emissions trading.

Now China is going to establish a national carbon market and two ways are foreseen to move in this direction. The first way consists in establishing a nationwide ETS by linking those existing pilot ETS that meet all the qualification conditions to be integrated into a national linked system. The second option lies in establishing a national ETS based on experience and lessons learned in the pilots. China initially plans to include six sectors in its national ETS, and covers about 10,000 entities with an estimated market size of two to three billion tons of CO₂-eq. The management of the national ETS will take place at two levels. The central government should be in charge of setting national rules. In the meantime, provincial governments should be assigned to take responsibility for implementation and enforcement of the rules, but they should be allowed to set even stricter rules than the national rules. To authorize emission trading at the national level, a national ETS legislation needs to be established. The provisions governing emissions trading across regions in the form of interim measures are needed to be elevated to a level of greater legal strength, ideally to national law but at least be elevated to State Council's regulation. This is essential because disputes could become more intensive and frequent as the carbon market expands beyond the institutional jurisdiction of administrative regions.

The case for carbon market clubs

by Frank Convery (Environmental Defense Fund)

According to economic theory, a global carbon price has to be implemented. Many academic works have been conducted to study this first best solution. However, few studies have been developed on second and third best solutions. Indeed, carbon tax failure in France and also in Ireland shows that there are constraints to achieve the first best of a global carbon price. In California, the authorities have chosen regulation and trading instead of a carbon tax. Consequently, clubs could be an intermediary solution to achieve economic efficiency: since China, the United States and European Union contribute to more than 50% of global emissions, creating a club of these major emitters could be seen as a path towards rapid emissions reductions and potentially could hugely reduce transaction costs. So there is a need to launch evidence based research addressed to the economics of clubs in general, but specifically in the context of global climate change.

Towards a transcontinental carbon market?

by Christian de Perthuis (CEC)

The cap and trade system for Governments did not work. When a company does not comply with EU-ETS, it pays a fine but when a Government doesn't comply with Kyoto commitments, it negotiates and/or leaves the scheme. Consequently another system is needed to enlarge the participation of Governments (see the "Carbon price & rebate/Bonus-malus" scheme). For firms, the major risk concerning a cap and trade system is the problem of inefficient linking. When the first generation of cap and trade (RGGI, Kyoto Protocol, EU-ETS) were put in place the risk of high carbon price has been initially regularly overestimated and finally resulted in complexity of the rules and lack of ambition. Consequently, linking markets in this context could increase both the complexity of the rules and the pressure to less ambition. Hence, the conditions to promote a "transcontinental carbon market" are the following: defining harmonized rules to prepare future integration and mutualize emission targets and reaching agreements on allocation rules.

