How to make progress post-Kyoto ?
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Capping emissions and costs

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1 THE ANALYTICAL FRAMEWORK

1.1 The origins: environmental regulation through quantities or/and prices

The safety valve, price cap or trigger price concept derives from the early works of Baumol & Oates (1971, 1978), Weizman (1974) and Roberts & Spence (1976):

- Baumol & Oates (1971) introduced the control of environmental damages through quantity *and* prices with the "Standard and Charges" approach. It allows to manage uncertainty in damages and abatement costs estimates, both in static and in dynamic perspectives. In the static perspective the approach allows setting a social environmental target and then to account for the willingness to limit abatement costs. In the dynamic perspective, the management of uncertainty stems from the possibility of adjusting either the environmental standard or the level of the penalty over time, when more information is gained on damage and abatement costs.
- Weizman showed that, when abatement costs are uncertain, the choice between quantity instruments and price instruments rests on the relative slopes of marginal cost and benefit curves.
- Roberts & Spence showed that hybrid instruments, associating a quantity, a price cap and a price floor, always perform better than either pure instruments.

Pizer (1997, 2002) and Newell & Pizer (2000) applied Weitzman's analytical framework to the case of climate change, using Nordhaus' DICE model. They concluded that control through prices is probably more adapted for Greenhouse Gas control policies:

- Quantity instruments deliver certain emission reductions at uncertain costs, while price instruments keep marginal costs under control but do not provide certainty on emission levels. As climate change is indeed a stock externality the benefits from climate mitigating policies are linked to slow changes in GHG concentrations, while costs are linked to instantaneous emissions, although the analysis should take into account the dynamics over time of induced technological changes.
- The "price versus quantity" analytical framework thus suggests a strong superiority of price instruments over quantity instruments in GHG abatement policies. Price instruments spontaneously adjust to actual costs. Conversely, quantity instruments entail the risk of paying, at the margin, excessive costs for small marginal benefits.

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- Quantity targets would be justified on the same economic grounds only if they implied drastic reductions in GHG emissions, according to the Newell & Pizer's estimates. A sensitivity analysis suggests that a minimum of 40% cut would be needed to justify quantitative short-term targets. This would essentially allow for stabilisation of CO2 concentration at its current level.

1.2 Economic benefits, political advantages and environmental performance

However, the economic benefits from using a hybrid instrument, combining quantified targets with a price cap, over a pure price instrument may be real but limited. The very reason to prefer the "cap on emissions and on costs" approach may lay in the international political dimension of Climate Change negotiation:

- To reach global cost-effectiveness in a pure price policy, the GHG tax should be equal everywhere, while compensations or side-payments may allow to deal with international equity issues.
- On the contrary, quantity instruments oblige to account for acceptability conditions by the different Parties in the negotiation process itself.
- The major feature is undoubtedly that emissions trading – the possibility of which is conditioned by the existence of emission targets or endowments – allows for the richer countries to buy emission reductions in poor countries and in that way finance the development of clean technologies there.

As emission trading, the price cap has usually been advocated on mere grounds of economic efficiency or political acceptability. But while the price cap indeed caps the costs, it may also make easier the adoption of strong environmental targets:

- In Pizer's and Newell & Pizer's work, the target would be the same with and without a price cap – set on the "best-guess" point: where marginal cost and benefits curves cross. This is what should be done if there were a price floor as well as a price cap, as in Roberts & Spence's model.
- In the absence of a price floor, one must define a more stringent target with a price cap to get the same expected benefits without it. This would still entail lower expected costs.
- Making the target more stringent again would augment the expected benefits – and this is possible up to the point where expected costs with the price cap (and the more stringent target) would equal the expected costs without it (and a less stringent target) (IEA, 2002).
- There surely would exist an optimum … if only the climate damages could be precisely estimated. If this is not the case, the target could be set somewhat more stringent than it would have been without a price cap… and depending on the agreed level of the cap price. This is how the price cap approach, instead of putting environmental integrity at risk may help adopt stronger targets and get more abatement.

It has also to be noted that the price cap should be set in the upper range of cost expectations. As a result, while more adverse cost outcomes are avoided, if the price cap is used, more abatement will be undertaken than the optimum would have been.

1.3 Price cap and concentration levels

Given the state of the art in climate and associated economic models, uncertainties on both costs and benefits of climate policies do not allow determining an optimum level for greenhouse gas concentrations that would fulfil the ultimate objective of the convention.

Abatement costs must be part of any decision on these levels, and the discussion on what may be "dangerous levels" cannot be disconnected from the abatement cost issue. If it were not the case, one would simply decide to return to pre-industrial levels, since there is no guarantee that even current levels are not "dangerous". Climate change is already occurring and already detrimental for some species and human populations.

However, the inertia in climate systems implies early action, while the inertia in the technical systems constrains it. In that context, how to be sure to engage sufficient action if the objective remains undetermined? One way out of this dilemma might be to aim at low levels of emission profile, while making full achievement conditioned by actual costs (IEA, 2002). Indeed, price caps allow doing this:

- Short-term stringent targets are adopted, but might be exceeded if too costly to fully achieve.
- Similarly, one could adopt indicative long-term objectives, subject to periodic revisions.
- If price caps have been used and short-term targets are not reached, revisions would either augment the long-term objective to take into account higher abatement costs, or maintain it and augment the level of price caps – depending on the scientific knowledge at the time.

The process proposed above is exactly the one described in Baumol and Oates' papers as a reasonable, practical and effective way to manage uncertainty in environmental policies.

2 DESIGN AND IMPLEMENTATION ISSUES

2.1 From early proposals to new international commitment schemes

Economic and political advantages were clearly considered in the first proposals for the implementation of "emission caps and safety valve" in the US. Two consistent proposals have been formulated by Resources for the Future in 1999 and 2000:

- The first one (Kopp et al., 1999) introduced the concept of a "credible early action" in the US in order to prepare before the First Commitment Period of the Kyoto Protocol with a safety valve starting at 25$/tC in 2002 and then escalating at 7 %/yr unto 2007.
- The second one proposed an international safety valve in order to "limit cost, assure effort and encourage ratification" (Kopp et al., 2000). This safety valve was supposed to be set at 50 $/tC by the end of the First Commitment Period of the Kyoto Protocol (i.e. a doubling from the initial domestic safety valve proposed for 2002, or exactly the result of a 7 %/yr increase in ten years).

These simple, consistent and practical proposals have not been adopted for domestic policies in the US and neither explicitly discussed among key parties in the international negotiation forums before, during and of course after COP-6 in the Hague. Nevertheless, the concept has been further explored – and usually considered positively – by various authors, including Aldy et al (2001), Jacoby & Ellerman (2002) and the IEA (2002).

Does this means that they are now fully out of the scope of current and future negotiations? Indeed many questions remain open: that of the value to be chosen for the safety valve or compliance payment, that of the implementation details incorporated in the two RFF proposals (upstream control in domestic policies, international auction system for recycling the revenues of the safety valve) and of course that of possible post-Kyoto targets.

In this perspective, work concerning international endowment schemes for the post-Kyoto period is going on and many proposals are under study, in particular in Europe. They generally aim at identifying endowments schemes that may be judged as acceptable in non-Annex I countries' view. Such schemes encompass the Multi-Stage approaches, as analysed by den Elzen (2002), or the "Soft Landing" profiles, which implies a progressive reduction in the growth of developing countries' emission entitlements, as proposed by Blanchard et al. (2003).

Philibert (2000) also suggested that emissions trading, contrary to conventional wisdom does not need the adoption of binding commitment by all participating entities. In particular, developing countries that do not want to put their economic development at risk with binding targets on their GHG emissions could still be given an incentive to participate in emissions trading and allow the global community to take advantage of their low-cost emission reduction opportunities. This concept might be thought of as one particular version of the price cap concept – a zero price cap.

Even if some may think that times have changed and are no more favourable to that type of solution, we consider that they still deserve further research and transatlantic debate. This is simply because

the fundamentals of these proposals are still valid, due to the fact that the rationale for a control of both quantities and prices are permanent aspects in the design of environmental policies.

Last but not least, a price cap system may provide one of the rare way-out to the current US-European divide on climate policies: this system indeed combines the key features of the European approach, which lays in the identification of quantitative emission targets, and of the US one, which emphasises the necessity of a cost-effective policy that should not entail excessive short term costs.

2.2 Implementation issues still to be explored

If the merits of this type of solution were to be considered in the international negotiations, then many issues would still need to be explored.

Indeed using price caps in an international emissions trading regime raises a number of issues, including for domestic policies. Price cap would take the form of supplementary permits sold at an agreed price. There are two possibilities: countries buy these permits from an international body, according to the global result of their domestic policy; or, economic agents within countries buy these permits internationally or from their government. In the latter case, it would be necessary to cover all agents with a comprehensive tradable permit scheme, or to complement a trading regime with a carbon tax set at the price cap level.

Many issues also remain to be explored in the international perspective and in particular the post-Kyoto one that surely will have to integrate developing countries in the climate regime.

The study of the conditions and consequences of the combination of such endowment schemes with an international compliance payment system will have to encompass the following issues:

- Should the international compliance payment be set at a unique value or might it be differentiated, between Annex I and non-Annex I countries, or even among Annex I and non-Annex I countries, respectively? Surely the answer to this type of question is highly dependent on choices in the endowment scheme and trade-offs may appear to that respect.
- In the case of a multiple compliance payment system what should be the conditions in the access to trading of the different parties, according to the level of compliance payment they have implemented?
- How should the possible revenues from the price cap be spent?

- *Unique or multiple price caps?*

It has been argued (Mueller et al., 2002) that agreeing among industrialised countries on a single price for a price cap would be « a nightmare ». However, a price cap is not a tax. Nor does it represent the marginal cost of emission abatement. It only caps it. Countries can have different levels of efforts, and appropriately differentiated assigned amounts under a single price cap system.

Moreover, expectations of high costs are often associated with beliefs of low benefits, and vice-versa. Thus, a well-chosen level of price-cap may appear as low and potentially effective for parties expecting high costs (and low benefits) and in the same time as high and not potentially effective for parties expecting low abatement costs (and high benefits). This feature may probably facilitate agreement, at least in the early stages.

However, given the huge differences in economic conditions and in order to encourage non-Annex I countries' participation, one may envisage, for example, a structure with non-binding targets for low income developing countries, a low price cap for the advanced developing countries and most economies in transition, and a higher price cap for the other industrialised countries.

- *Multiple price-caps and emission trading*

Using different price levels would however necessitate trading restrictions to ensure that the lowest price cap does not dominate the trading regime. It must in particular be ensured that no country sells supplementary permits.

Non-binding targets can be made compatible with emissions trading by different means. The most appealing is probably the "responsibility limited to units sold": if a country exceeds its allowed emissions after having sold emission rights, it must buy them back; but once this is done, its emissions are still not constrained. The commitment period reserve may help alleviating the risk that a country oversells – and then cannot, or refuse to, buy back the overselling. Other possibilities include turning the non-binding into binding targets once trading occurs, allowing only ex-post trading, and using two different targets, one binding and the other non-binding (as further developed by Kim & Baumert, 2002)

Trading between zones with different levels of price cap would necessitate the same kind of restrictions, to ensure that a country with a low price cap only sells real reductions below its assigned amount to countries with a higher price caps – and not "supplementary permits" from the using the price cap.

Will the use of price caps set at different levels entail losses of efficiency? Let us consider one case: a country with a low cap price cannot fulfil its obligation and makes use of the price cap; there remain, however, abatement options at a cost higher than the lower price cap, but lower than the higher price cap. They will likely be neglected, while costlier options in the country with the higher price cap may be used. Thus, multiplying the number of levels of price cap may create efficiency losses.

For the same reasons, one cannot be sure that developing countries with non-binding targets will effectively enter trading and allow the international community (including themselves) to benefit from their low-cost abatement options. It is unlikely, however, that most developing countries would enter trading soon with fixed and binding targets. The option of non-binding targets can only accelerate mitigation and reduce eventual concentration levels.

- *Does the money really matter?*

There has been a number of ideas on how to use the money from the price cap. It could be used either in an auctioning system to provide some additional abatement actions, or in the financing of technology development and transfer programmes, or for adaptation in less developed regions. Hopefully, however, there will be no such money, abatement costs will remain below expectations, targets will be reached and the price cap will – like an insurance police – not been used.

Conclusion

Novelty and innovative ideas are surely needed in research on the possible architectures for international climate change policies. However, sensible and practical approaches that address the basic challenges of environmental regulation – such as the emission quantitative targets and price cap concepts – shouldn't be abandoned when they still seem to present important advantages..

The price cap concept – and its "non-binding" version for low-income developing countries – would help countries in adopting relatively more stringent targets. It might facilitate any agreement on indicative long-term concentration levels fulfilling the ultimate objective of the Convention that would help negotiate future country targets. With or without such an agreement, it would provide important long-term price signals to all economic actors, be they governments, entities, companies or consumers.

Combining the study of the progressive introduction of developing countries in an international emission endowment scheme and a consistent price cap system is still a highly relevant issue. It has in our view to be kept high in the research agenda, as well as in collaborative efforts to make progress in a post-Kyoto perspective.

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