DOCUMENTS DE TRAVAIL / WORKING PAPERS

N° 2017-59

Revisiting the Carbon Pricing Challenge after COP21 and COP22

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Mars 2017

After the Paris Agreement a fresh look is needed about the role of carbon pricing in climate policies. Paragraph 136 of the Decision notes its importance but only applies to "non-party entities" and is not binding upon Parties to the Convention. Carbon prices will thus stay country-specific as one of the possible component of the INDCs to which the Paris Agreement gives a pivotal role.

This is in contrast with the idea that carbon prices should represent the social costs of climate change (SCC) and be equated throughout countries and sectors modulo compensating transfers. Their level will be constrained by the pace at which each country can embed them into reforms of its fiscal system and its public policies. This pace will likely not be consistent with the urgency of the climate challenge and leave unsolved how to meet the Article 2 of the Agreement i.e. *"making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development »*.

The usual response to this ***carbon price gap*** is found in complementary non price measures. But, these measures entail the ***risk of political arbitrariness*** and ***economic inefficiencies***. The way out is to ***anchor them on 'the social, economic, and environmental value of mitigation activities and their co-benefits to adaptation, health, and sustainable development"*** (hereafter SVMA) which is recognized in the paragraph 108 of the Decision of the Paris Agreement. This notion results from a political process[1] triggered after the Cancun's call (2010) for *"building a low carbon society … that ensures … **equitable access to sustainable development"***[2].

This note aims clarifying a few basic principles about the links between the Social Cost of Carbon, the Carbon Prices and the SVMA in view of a reflection, conducted in two companion notes about the pricing schemes apt to bridge the carbon price gap and, ultimately, the 'climate finance gap'.

1 Social costs of carbon versus shadow prices of carbon

The common parlance often confuses the concept of ***social cost of carbon*** (SCC) with the ***Social Cost of Climate Change Damages (SCCC)*** per ton which is the discounted value of incremental climate change damages of emitting one more ton along a given scenario. The SCCC gives no ground for setting a carbon price because there are as many damages as climate warming scenarios, hypotheses on the feedbacks on the ecosystems and views about the adaptive capacities of impacted societies.

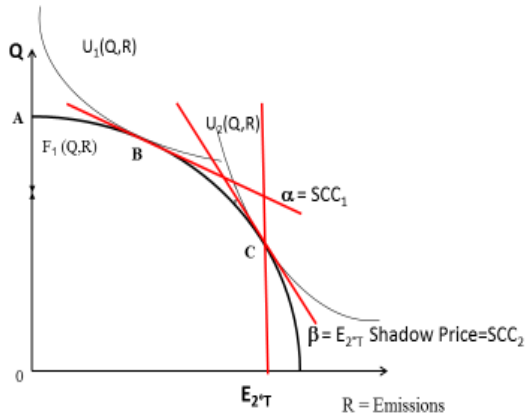
The notion of SCC provides such a ground (Nordhaus (1994). This is the trajectory of the costs, at each point in time, of avoiding one ton of emission along an optimal response pathway which equates the SCCC and the discounted value of the marginal abatement costs. Be the reference pathway optimal (in 'Ramsey'-like models) or not does not make any difference as long as the latter is assumed to be the 'best reachable one because of the transaction costs of reform packages.

[1] Decisions adopted by the Conference of the Parties : https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf

[2] See the Obama-Roussef declaration on June 30th 2015 and the LCS-Rnet Declaration June 2015 http://lcs-rnet.org/lcsrnet_meetings/2015/10/1489

In this case the link between the SCC and carbon prices is straightforward: it is pictured in graph 1 with an economy on a production frontier $F_1(Q,R)$ (i. e. the set of maximum production of a composite good *Q* for a given amount of emissions reduction *R)*. Point *A*, with no emission reductions, represents the case of 'climate skeptics' for which the SCC is zero. If the social welfare function is $U_1(Q,R)$ then point *B* maximizes social welfare. At this point, marginal abatement costs (the slope of $F_1(Q,R)$ is equal to marginal utility losses due to the climate damage triggered by on more emitted ton (the slope of $U_1(Q,R)$. Both slopes are equal to α which represents the SCC, i.e. the loss of production and consumption of *Q* to abate one additional ton of GHGs.

SCC vs Shadow Price: implicit vs explicit valuation of Climate Change Damages?



Q, Consumption of Composite goods
$E_{2°T}$, Emissions budget to meet the 2°C target

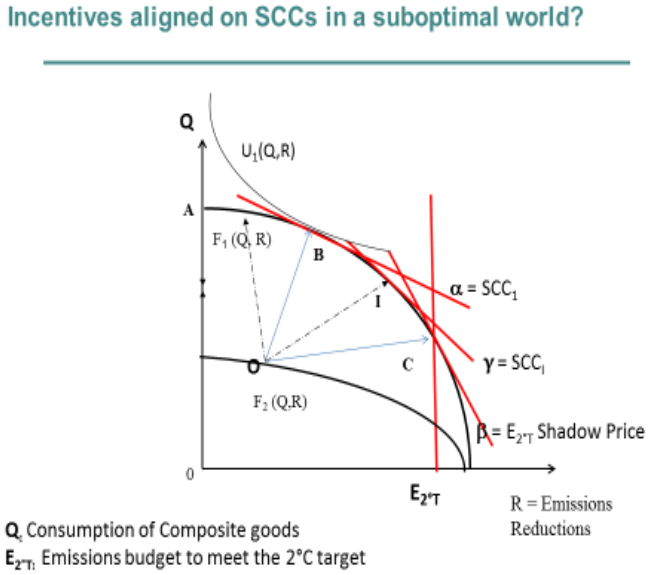
The difficulties around the assessment of the SCC have been extensively discussed around the Stern report (2007). Its value is function of parameters such as the economic growth rate, the pure time preference, the future costs of low carbon techniques, the shape of the c vdamage curve in function of the temperature levels and of the vulnerability of impacted societies, the asymmetry between the utility of a gain and of a loss (Ambrosi et al. 2009), the intragenerational equity of individuals and the forms of inter-generational solidarity (Lecocq and Hourcade, 2012).

Because all these parameters can generate infinite regresses of scientific and ethical controversies one option is to adopt a ***cost efficiency analysis*** and to calculate the ***shadow price of carbon*** associated with a climate objective treated as a political constraint. In graph 1, this is the slope β of $F_1(Q,R)$ at its crossing point *B* with the line $E_{2°T}$ (the 2°C objective). In a 1st best context a world carbon price should be equal to this value that represents the willingness to pay for $E_{2°T}$ (and can be interpreted as the SCC of a country with a social welfare function U_2).

2. The equality between SCC and carbon prices: the limits of a useful lemmas

Since Lipsey and Lancaster we know that the recepies valid in a 1st best world might not hold in a 2nd best one. This applies to the relation between the SCC and carbon prices. The imperative ***of 'equitable access to low carbon development'*** forces indeed to start from an economy standing at point *O* on $F_2(Q,R)$ below its possibility frontier and to assume the possibility of approaching it through reform policies and to generate a new production fronteer, a new possibilities space. Without this hypothesis, there are only trade-offs between climate and development.

One way of framing the problem is to start from a given possibilities space $F_1(Q,R)$ and to conduct climate centric reforms leading the economy to *A, B* or *I* which all three deliver both a better climate and a better development. Although it is possible to calculate 'on paper' the SCCs and related carbon prices for these three points, this approach drives to an impasse when negotiating international policies to help an economy to reach the point *C* which is its desired contribution to the 2°C objective. The ***SCCs*** are indeed ***ex-post measurement*** applied on a baseline resulting from policy packages adopted for a mix of climate and non-climate objectives. They ***do not provide ex-ante guidance*** about how to incite a country to reveal its intention to locate itself on *I* (closer to *O*). Its best interest is not to put forward INDCs leading to *I* because it would then negotiate compensations for the loss of composite good I – C only whereas, announcing INDCs leading it to the less ambitious point B it could ask compensation for B – C . To put it in another way, claiming the necessary equality between carbon prices and the SCCs leaves unadressed the question of the policy packages leading a low carbon 'states of the world' and to detect the means of reaping the possible benefits of cooperating towards this state of the world.



To detect these means, it is necessary to start recognizing that the ***possibilities spaces are not given ex-ante***, that we generate continuously new ones and that ***the Paris Agreement is simply a reasonable prophecy to make low carbon states of the world possible. The issue is how to make this prophecy self-fulfilling and to avoid bifurcations towards non climate friendly possibilies spaces.*** This necessitates a profound redirection of the world growth engine and the Social Value of Mitigation Action is the measure of both the climate and development benefits of the redirection.

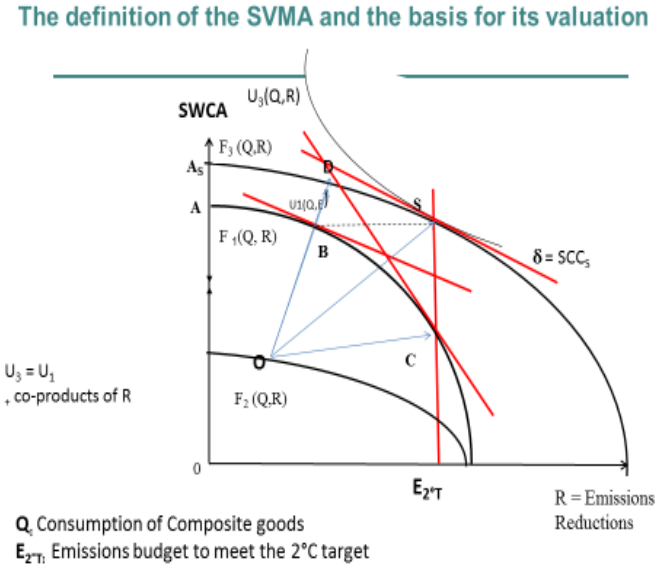
3. The SVMA, carbon pricing and the reshaping of 'possibilities spaces'

The notion of 'co-benefits' commonly encompasses three categories:

- the ***direct joint products*** of avoided GHGs emissions: a) lower adverse consequences of local air pollution on health and on agricultural productivity, b) countries' energy security and lower vulnerability of their trade-balance to the volatility of oil prices and c) world security through the decrease of energy tensions and of climate induced migration.
- the ***acceleration of technical change*** when early investments in low carbon technologies deliver learning – by – doing effects (Bramoullé, et al.;Vogt-Schilb et al.) and help triggering a new

production frontier through a "Schumpeterian" innovation wave (Stern, 2015). Stricto sensu, this is a net co-benefit only if the low carbon biais in technical change results into higher overall factor productivity than the business as usual one, and a faster and more inclusive development.

- the ***indirect short and medium term macroeconomic and development benefits*** of a well conducted low carbon transition: a) narrowing the gap between the propensity to save and the propensity to invest through redirecting financial flows towards productive investments b) strengthening the industrial fabric of each country through investing in low carbon technologies and local resources c) alleviating poverty through higher growth, higher employment and higher furniture of basic energy, transport and housing infrastructures.



The first category is easy to picture, in Graph 3, by using the social welfare function $U_3(Q,R)$ which incorporates the joint products of mitigation action and attaches to it a greater value than $U_1(Q,R)$. The two other components are captured in the production fronteer $F_3(Q,R)$ which both is higher than F_1 and F_2 and incorporates a carbon saving bias. With $F_3(Q,R)$ and $U_3(Q,R)$ the social optimum is now situated on point *S* which represents a level of social welfare higher than both *O* and *B.* The associated SCC is δ. It represents the carbon price to be applied if the transition towards *S* succeeds. The SVMA is the distance, in social welfare units (given $U_3(Q,R)$) between S and O. This distance is a function of the slope of OS (growth variation associated with one ton of avoided emission) and of the transformation of the marginal utility of Q and R when passing from O and S (in function of the level of income and of the joint products of decarbonization).

Dividing this distance by the amount of avoided emissions ($E_{2°T} - E_o$) gives a SVMA per ton, a SVAT (Social Value of Avoided Ton of emission). The SVAT looks like a price of carbon 'augmented' by the incorporation of the co-benefits of mitigation. However interpreted this way, the SVAT does not change the nature of the carbon pricing problem since it would be a price higher than when considering the SCC only. Instead, the *SVAT* gives the magnitude of the signal to be launched immediately to make credible and successful a 'prophecy' towards the end point S. It can then provide an anchor for any mechanism helping to materialize, ex-ante, the synergies between development and climate policies. Carbon prices are part of these mechanims since they reward, ex-post, low carbon decisions every year. But other pricing mechanisms are needed ex-ante to both give an early signal higher than politically acceptable carbon prices and put some rationale in the non price policies.

In such a framing the SVMA helps detecting the gains of cooperation. Indeed, countries will not argue that their baseline will be located in *B* for example in the absence of cooperation to meet $E_{2°T}$. Would they do so, they would receive less support for a ton of avoided emission since the additional value of mitigation action (indicated by the slope of BS) is lower than if they accept to take O as a starting point (slope of OS > solpe of BS).

Concluding remarks: towards positive pricing mechanisms

We have seen why the notion of Social Value of Mitigation Action is needed to better frame the carbon pricing issue in a new paradigm where the objective is no longer to minimize the welfare losses of climate policies deployed at the margin of a given development path but to redirected the world growth engine in order to open new possibility spaces.

The SVMA encompasses the climate and development benefits of avoiding the emission of GHGs. The pending issue is how to use it as a reference value to:

- anchor ***early and high pricing signals*** to prevent bifurcating towards carbon intensive development paths despite the fact that the gap between its value per ton of avoided emission and implementable explicit carbon prices cannot be reduced overnight (implicit carbon pricing, prices of real estates, interest rates)

- ***accelerate the emergence of explicit carbon prices*** in all countries and their progressive convergence over the long term in order to respond the concerns about distortions in international competition amongst exposed and energy intensive industry, which constitute a political obstacle to a full deployment of ambition climate policies.

Ultimately, the challenge after COP21 is to organize, around the SVMA, ***positive pricing*** arrangements and devices (Sirkis et al. 2015), thanks to which pricing the carbon externality is percieved a way of opening the possibility space we need for a better development and a better climate.

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