Social Value of Mitigation Action, an anchor for new forms of carbon pricing?

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After the Paris Agreement a fresh look is needed about the role of carbon prices in climate policies. Paragraph 136 of the Decision which notes the importance of carbon pricing, only applies to "non-party entities" and is not binding upon Parties to the Convention. Carbon prices will thus stay country-specific. This is in contrast with the idea that, in a "first-best" world, carbon prices should represent the social costs of climate change (SCC) and be equated throughout countries and sectors modulo compensating transfers for the losers.

De facto, the Paris Agreement gives a pivotal role to INDCs for aligning the +2°C objective and the sustainable development goals (SDGs). Carbon prices will be one of the possible tools of their deployment but 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 lies in complementary non price signals. But, these tools entail the ***risk of political arbitrariness*** and ***economic inefficiencies*** leading to political distrust of climate policies. The way out is to ***ground complements to carbon prices on the legitimacy of the paragraph 108 of the Decision of the Paris Agreement*** which *"recognizes the social, economic, and environmental value of mitigation activities and their co-benefits to adaptation, health, and sustainable development"* (hereafter SVMA).

The notion of SVMA results from a political process triggered after the Cancun's call (2010) for *"building a low carbon society … that ensures …* ***equitable access to sustainable development"***[1]. This paradigm shift from climate-centric analysis forces economists to pay more attention to second-best situations and to the co-benefits/costs of climate mitigation (Hourcade and Shukla, 2015). It more specifically re-opens the discussion about pricing policies apt to align climate policies and SDGs: carbon taxes, prices from carbon markets, internal carbon prices of private entities, notional prices in sectorial public policies and prices other than carbon prices (real estates, land, interest rates, currency exchange rates).

However, there is no general theory of second-best situations (Lipsey and Landcaster, 1956) and the SVMA is not a well-established concept in economic analysis. This is why this paper tries and defines it while clarifying its links with well-established concepts like the social cost of carbon, the shadow prices of carbon, notional and market carbon prices.

1. Social costs of carbon versus shadow prices of carbon

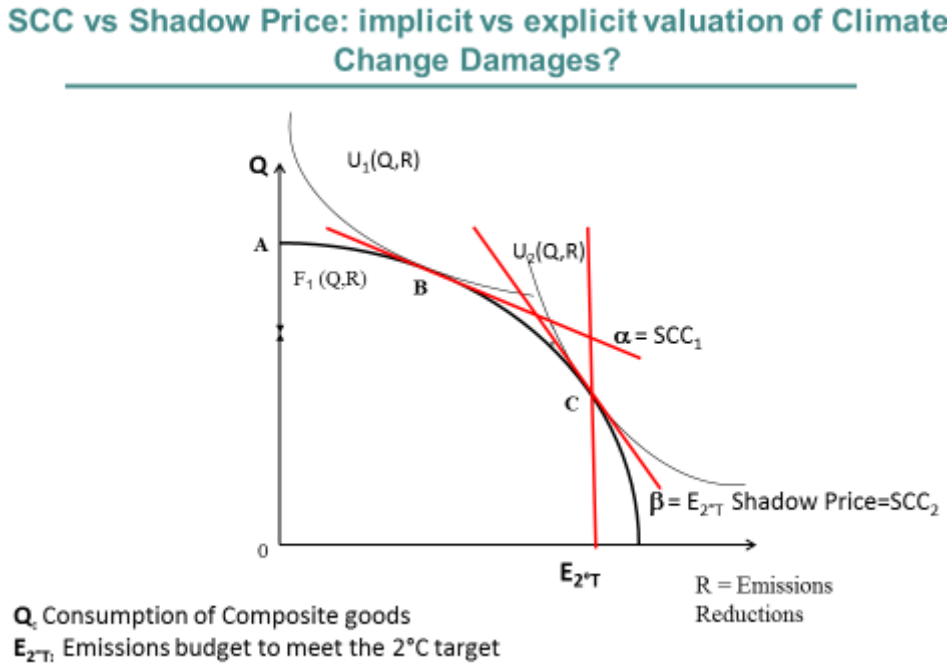
In economic policy debates confusion is sometimes created by the fact that some well-established concepts in economics have other connotations in the policy arena.This might be the case for the concept of ***social cost of carbon*** (SCC). In the common parlance, it evokes the

[1]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

social and economic damages of emitting one ton of carbon. But this gives no ground for mitigation policies (for example 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. To avoid confusion, it would be better to make a distinction between the ***Social Cost of Climate Change (SCCC)*** which is the discounting value of climate change damages along a given emissions scenario and the SCC.

The SCC, in the IAM since Nordhaus (1994), is the time series of the cost, at each point in time, of avoiding the emission of one more ton along an optimal response pathway which ultimately equates the SCCC and the discounted value of the SCCs. The reference pathway is optimal in 'Ramsey'-like models (maximization of a social utility function over a given time period) but not necessarily in recursive models ('Solow'-like or not). This does not make a difference for discussing the SCCs if the reference path in recursive models is assumed to be 'not modifiable' or the 'best reachable one' because of the transaction costs of reform packages.

In this case the link between the SCC and carbon prices is straightforward: let us thus picture, in graph 1, 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 damages (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* caused by one additional emission reduction.



Difficulties around the value of the SCC have been extensively discussed around the Stern report (2007). This value is function of parameters like the expected economic growth rate, the pure time preference, the rate of technical progress in low carbon techniques, the shape of the damage function in function of the temperature levels and of the vulnerability of impacted societies. Other parameters, less present in the debate, also matter: the asymmetry between the utility of a gain and of a loss of income (Ambrosi et al. 2009), the

intragenerational ponderation of individuals in the social welfare function and the forms of inter-generational solidarity (Lecocq and Hourcade, 2012).

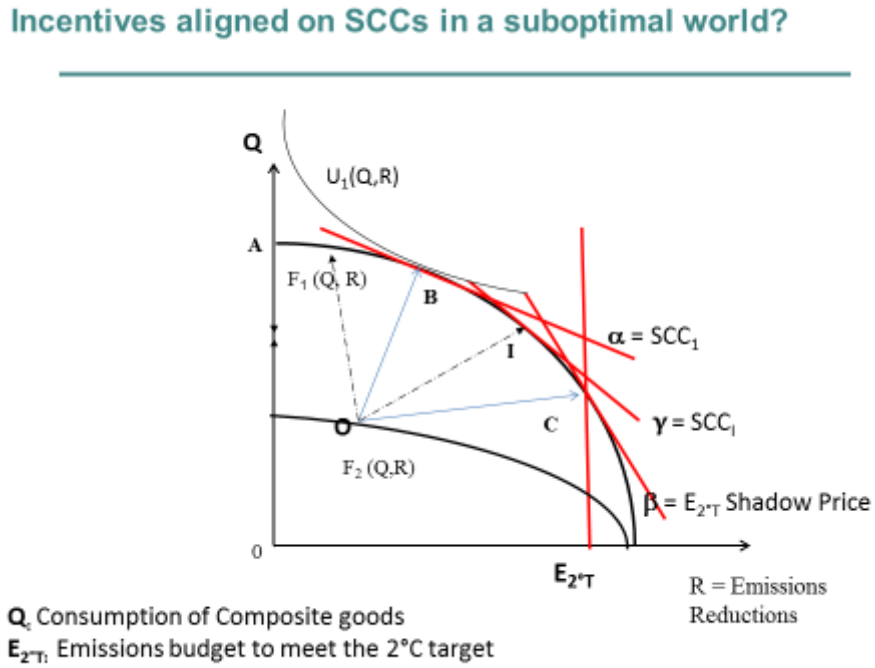
Because all these parameters can lead to infinite regresses of scientific and ethical controversies (Espagne et al., 2015), one alternative option is to adopt a ***cost efficiency analysis***. This comes to calculate the ***shadow price of carbon (ShPC)*** associated with a climate objective treated 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 $E_{2^\circ T}$ (the 2°C objective). This slope can also interpreted as the SCC for a country with a social welfare function $U_2(Q,R)$. Contrary to a cost-efficiency analysis where the implicit damage caused by the emission of one additional to of carbon approaches infinity, β can be interpreted of as the willingness to pay for $E_{2^\circ T}$ and allows for "overshoot scenarios" (Ambrosi et al 2003). Whatever the interpretation of β as a SCC or a SPC, however,policy makers should implement a carbon price equal to this value.

2. SCC in a '2nd best world': a useful indicator, an incomplete guide for action

Let us now assume, in graph 2, that a) the economy stands at point *O* on $F_2(Q,R)$ strictly below the potential technical possiblity frontier $F_1(Q,R)$, b) this real production fronteer is 'movable' through reform policies which can lead the economy to *A, B* or *I,* and that *C* is the point to be reached to comply with its contribution to the Paris Agreement's objectives.

It is possible to calculate the SCCs for *A, B* or *I.* But these SCCs are ***ex-post measurement*** of the welfare losses of decreasing emissions from a baseline resulting from policy packages adopted for a mix of climate and non-climate objectives (Kok et al., 2008). They ***do not provide ex-ante guidance*** about the set of policy signals inciting the economy to locate itself on *I* (closer to *O*) for example. More precisely, thinking that the policy signal to bring the economy from *B* to *I* is a carbon price equal to the difference $\alpha - \gamma$ of the SCCs associated with these two points, comes to ignore the existence of interplays between mitigation and development policies and that bifurcations towards carbon intensive development patterns can make more costly the return to low carbon pathways.

In this framework it is difficult to organize a negotiation process around the gains of cooperation helping the economy to reach the point *C*. The best interest of each country is indeed not to reveal the INDCs leading it from *O* to *I* because it would then negotiate compensations for the loss of composite good I – C wheras, starting from less ambitious INDCs leading it to B it could negotiate for a loss B – C . The higher the announced INDCs, the lesser compensations the country will be legitimate to ask.



3. The SVMA a suitable concept for 2nd best economies

Beyond legitimate caveats against the idea of policies yielding both a climate and a development dividend, it matters to underline that, without this hypothesis, there is no room for discussing 'equitable access to low carbon development'. The very notion of development implies a change in the pace and direction of the growth engine (the upward move of the production frontier and the shape of this move). In this context, the notion of 'co-benefits' commonly denotes the non-climate related dividends of GHGs mitigation. It encompasses three distinct 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 (IPCC WGIII, 2014) and of climate induced migration. Graph 3 uses the social welfare function $U_3(Q,R)$ instead of $U_1(Q,R)$ which attaches a greater value to mitigation actions by incorporating their joint products.

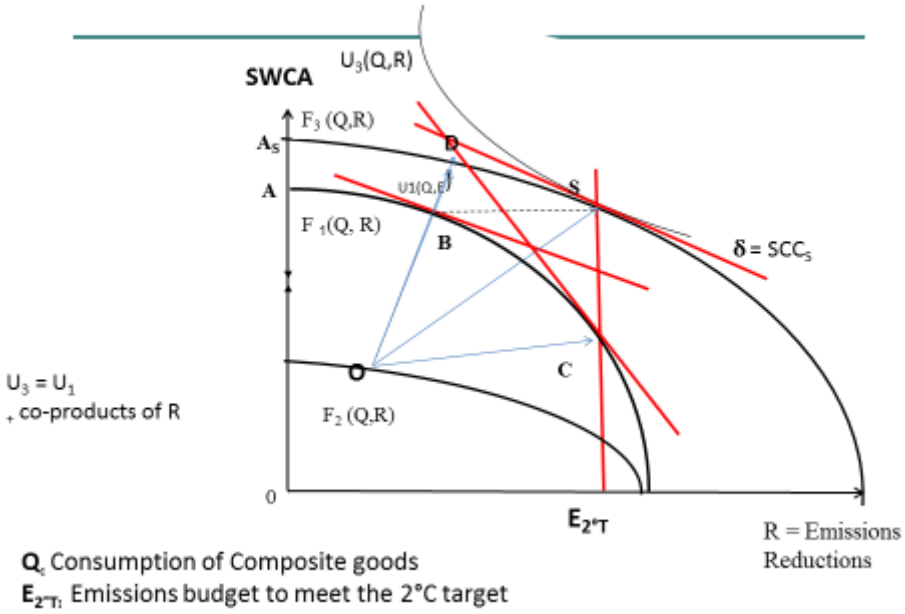
- the ***acceleration of technical change*** in such a way that a new production frontier $F_3(Q,R)$ is generated by a "Schumpeterian" innovation wave (Stern, 2015). Stricto sensu, this is a net co-benefit if the ***low carbon biais*** in technical change yields higher dividends than the business as usual one, in terms of long term economic growth and inclusive development (local resources efficiency, spatial distribution of human settlements, access to basic energy, transport and housing infrastructures, less energy and material intensive demand patterns).

- the ***indirect short and medium term macroeconomic and development benefits*** of well conducted low carbon transition: a) benefits of 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 need

With $F_3(Q,R)$ and $U_3(Q,R)$ the optimum is now situated on point *S* which represent a level of social welfare not only higher than *O* but higher than the initial objective *B.* The associated SCC is δ. But again δ represents the optimal carbon price to be applied if the transition towards *S* succeeds. The 'if' reminds that ***the Paris Agreement is a reasonable prophecy of the future and that the issue is how to make it self-fulfilling***. Here comes the SVMA.

The global 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 between O and S (in function of the level of income and of the joint products of decarbonization).

The definition of the SVMA and the basis for its valuation



If we divide the global SVMA by the amount of avoided emissions ($E_{2°T} - E_o$) we obtain a SVMA per ton. This looks like a price of carbon 'augmented' by the incorporation of the co-benefits of mitigation. This is important but does not change the nature of the carbon pricing problem if it comes to say that carbon prices should be higher than when considering the climate externality only. This would only result in widening the 'carbon price gap'.

To overcome this problem, it matters to come back to the fact that the end point S is unknown ex ante because of a large set of uncertainties (technical change, growth impact of a new innovation wave, governmental judgments on development priorities and on the political acceptability of various policy tools). Actually, to trigger a credible self-fulfilling prophecy, the *SVMA* per ton of avoided emission should provide an anchor to funding mechanisms helping to materialize, ex-ante, the synergies between development and climate policies, while the carbon prices (augmented or not) come to reward, ex-post, low carbon decisions every year.

Understood this way, the SVMA overcomes the baseline issue in the negotiation process. Indeed, countries will not argue that their baseline will be located in *B* 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 about the 'good use' of the SVMA

The remaining question is whether the notion of SVMA should remain a rethorical reference leading to pinpoint the carbon price gap or can provide an anchor to help climate policies and development policies working synergistically and to set pull-back forces to help reorienting soon infrastructure investments and avoiding bifurcations towards a high carbon intensive development pathway. Complementary to carbon prices its specific contribution should be:

- To support ***institutional cooperative arrangements*** apt to reduce transition costs and transaction costs of climate policies and maximize their complementarity with other SDGs, including through positive effects of reducing income inequalities and poverty

- To ***hedge against the fragmentation of non pricing policies and climate finance initiatives*** launched by such arrangements and their potential arbitrariness and inefficiency

- ***to reach high levels over the short term*** and to facilitate the narrowing of its gap with implementable carbon prices.

- to support the emergence and widespread use **of *financial devices to de-risk low carbon investments,*** specifically on infrastructure, ***and to build a new class of low-carbon assets*** to attract many categories of savers (by backing financial products)

- to be ***more easily negotiable*** that carbon prices because financial devices incorporating this value will ***bridge the funding gap*** which penalizes the deployment of infrastructures in developing economies and their retroffiting in developped countries.

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