A NOTE ON THE IMPOSSIBILITY OF DERIVING A SCIENTIFICALLY VALID, ETHICALLY SOUND OR POLICY-USEFUL ESTIMATE OF THE SOCIAL COST OF CARBON

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The Social Cost of Carbon

The principal greenhouse gas and cause of anthropogenic climate change is carbon dioxide. The Social Cost of Carbon (SCC) is the name given to the cost of emitting 1 tonne (t) of carbon (as carbon dioxide) today, because of its contribution to climate change. SCC is expressed as a net present value (NPV, i.e. using a discount rate) of the impact over the indefinite future of this 1t of carbon emitted today.

The calculation of SCC requires an estimate of both the physical impacts of climate change, and an attribution of a monetary value to these impacts.

This Note relates to the papers recently commissioned by the Department for Environment, Food and Rural Affairs (DEFRA), referenced here as Downing et al. 2005 (TD05 for short) and Watkiss et al. 2005 (PW05 for short), to explore what the value of SCC might be, and how it might be used in relation to Government policy.

The Scientific Validity of SCC

Physical Impacts of Climate Change

No-one knows what all the impacts of climate change might be. They have been estimated to include sea level rise and more extreme weather events (e.g. floods, storms, and droughts). The policy concern with climate change is driven by the fact that it is possible that these events could be both economically very costly and catastrophic in human terms (including perhaps the necessary relocation of coastal cites, huge population movements, widespread famine and large-scale loss of life). After an exhaustive review of the literature, TD05 concludes: “An upper benchmark of the SCC for global policy contexts is more difficult to deduce from the present state-of-the-art, but the risk of higher values for the social cost of carbon is significant.” (p.56) In plain English, this appears to be saying that no-one knows how high the damages from climate change might be, but there is a significant risk that they could be high.

Lack of knowledge about future outcomes may be expressed in a number of different ways:

- Risk, where both the possible outcomes and their probability are known.
- Uncertainty, where the possible outcomes are known, but their probability is not.
- Ignorance, where neither the full range of possible outcomes nor their probability are known.
- Indeterminacy, which adds to the ignorance a profound uncertainty as to how societies would react to extreme outcomes (such as large-scale population movements).

It is clear from TD05 that the current state of the art of climate change science includes both ignorance and indeterminacy (impacts with this latter characteristic are called ‘socially contingent’ in TD05 and PW05), as defined above. There is no scientifically valid way of assigning monetary numbers to outcomes of this kind.

The Non-Marginal Nature of Climate Change

SCC is what economists call a 'marginal' concept. Marginal analysis works best when a small change in one variable, for example emissions (e.g. 1t of carbon), produces a relatively small change in impact. It works least well, and is generally thought to be inappropriate, when large-scale impacts and whole-system changes are involved, especially when these might be triggered by crossing thresholds related to the variable concerned. Yet, as TD05 (p.64) reports, in respect of climate change "Large scale impacts, such as migration, can be triggered by relatively modest climate changes in vulnerable regions." However, these climate changes cannot at present be reliably related to emissions. What this means is that the SCC may seem quite small until some level when the climate changes start to occur, after which further emissions start to trigger 'large scale impacts', when SCC would suddenly become very large. The use of a marginal concept like SCC in such circumstances of discontinuity is simply inappropriate.

The Valuation of the Impacts of Climate Change

Current estimates of the impacts of climate change suggest that it could lead to large-scale loss of life (for example, heat stress in the hot summer in Europe in 2003, which is thought likely to become more frequent with climate change, caused several thousand deaths). The calculation of SCC requires that this loss of life, and all the other human miseries that might accompany catastrophes and 'socially contingent' events, be given a money value.

One of the characteristics of the techniques of monetary valuation is that effects on poor people are valued less than effects on rich people (because the valuations tend to be based on willingness-and-ability to pay). Thus such valuations give a lower value to, for example, the lives of poor people than the lives of rich people. This can be remedied by another technique called 'equity weighting' (discussed in both TD05 and PW05), but there is no consensus on the weights to be applied, and often it is not carried out, although it is taken into account in the model used in PW05.

The efforts of those economists who believe in these techniques to convince others (especially those who find that the techniques give their lives relatively low value) that the techniques have a sound scientific basis have so far been generally unsuccessful. Not infrequently, those who reject the scientific basis of the use of these techniques in such circumstances also question the ethical assumptions which they imply.

The Ethical Soundness of SCC

Justice is a very important component of policy making, and is an especially important issue in relation to climate change, with its enormous differential impacts within and between nations (some small-island nations seem likely to disappear altogether) and between generations (later generations will bear a great majority of the costs). Calculations of SCC are not just an intellectual exercise. If the valuations are believed and acted on by policymakers, they will lead to more or less mitigation of climate change (and therefore lower or higher climate change costs for future generations), and to adaptation efforts that seek the maximum benefit from adaptation per unit of expenditure on it (a calculation which may suggest that real estate in London or New York should be preferentially protected to land and lives in Bangladesh).

As applied to calculations of SCC, 'equity weighting', which is based on the notion of diminishing marginal utility of income, has nothing to do with justice. The whole SCC concept is an extreme application of utilitarian thinking. It positively obscures the key justice questions related to climate change: who is responsible for anthropogenic climate change? who has benefited most from it? who will suffer most from it? if the beneficiaries from and victims of climate change differ (as seems to be the case), what kind of compensation should be paid between the two, not to achieve economic efficiency or to maximise the utility of the world as whole, but in recognition of the injustice that has been committed?

These issues are absolutely critical in the politics of climate change, but they are totally obscured by the utilitarian calculus of SCC. It is for this reason that use of SCC in climate change policy is ethically unsound.

The Usefulness of SCC to Policy

The policy usefulness of a number like SCC depends on the degree to which it captures the key effects which are of concern to policy makers and the general public, and the credibility of the number, or numerical range, which emerges from the SCC calculations. The performance of SCC on the first criterion is not encouraging. In fact, PW05 notes that, in respect of the studies of climate change which seek to estimate SCC "None cover socially contingent effects, or the potential for longer-term effects and catastrophic events" (p.ii). This may not be surprising given the indeterminacy of such events, but a calculation which does not cover precisely the issues of most concern for policy makers and the public seems to have very little relevance to policy.

With respect to the actual numbers produced by SCC calculations, TD05's review of the science makes clear that the range of values which can plausibly be considered for SCC is very great, (£0-1000+/tC, p.vi, 56ff.). Moreover, this range has neither a robust central estimate nor a well-defined upper bound (pp.64ff.,72ff.). It is further much influenced by decisions about the discount rate and equity weighting, about neither of which is there definitive scientific guidance, so that decisions about both of them are likely to prove contentious. The policy usefulness of a concept with such characteristics is effectively zero.

In order to sidestep these inconvenient characteristics of SCC, PW05 suggests that one could make use of the completely different concept of marginal abatement costs (MAC), which is the cost of reducing carbon emissions by 1t. PW05 describes attempts to use this concept to derive an upper bound and central estimate for SCC, which, as has been noted, the science of climate change cannot produce. Because MAC and SCC are completely different concepts, and will not be numerically equal to each other except under unknowable policy circumstances, such attempts simply confuse the issue and provide further evidence of bad science being used in climate change policy

Luckily, there is an alternative policy approach to the use of SCC, which is based on a precautionary determination to avoid dangerous climate change by reducing greenhouse gas emissions, coupled with cost-effective policies (those that seek to achieve this at least cost). The current Government policy to reduce emissions by 60% from their 1990 level by 2050 exhibits the first characteristic of such a policy. Its embrace of the EU Emission Trading Scheme, which may be expected to equalise the marginal abatement costs across the nearly 50% of UK emissions to which it applies, goes some way to giving effect to the second. Invoking the SCC at this stage can only confuse those who do not understand the arcane considerations underlying its calculation, or invite opposition from those who have understood them well enough to reject the invalid science and unsound ethics on which they are based. Neither reaction will help climate change policy to be more effective.

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References

Downing, T. et al. 2005 'Social Cost of Carbon: A Closer Look at Uncertainty', Final Project Report, March, DEFRA, London

Watkiss, P. et al. 2005 'Methodological approaches for using scc estimates in policy assessment', Final Report, December, DEFRA, London

COMMENTS

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"The notion of a ‘social cost of carbon’ (SCC) in terms of providing a single number or a bounded range as a monetary estimate of the global long-run costs of climate change is both scientifically and ethically invalid.

The SCC should be used to indicate society's view of the costs determined by a political and judicial process assessing the uncertainties and risks. Something on these lines was done in the process leading to the UK's 60% target as embodied in the 2003 Energy White Paper. A better way of obtaining such a number, or a range, for government cost-benefit calculations would be to calculate the overall shadow price of carbon required to achieve such a target, but determined at a global level with explicit assumptions that the value of human life is equal everywhere and over time.

The basic problem is the monetisation of damage, such as loss of ecosystems (e.g. coral reefs), and the monetisation of risk, such as that of human extinction. This damage or this risk cannot be assessed by a single number, unless its range is unbounded in which case it becomes meaningless.

The essential conclusion of the review was that the risks are such that the costs do not have an upper bound."