Thoughts on "The Social Cost of Carbon: Trends, Outliers and Catastrophes"

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The updated meta-analysis of estimates of the social cost of carbon (SCC) offered by Tol (2007) is a welcome addition to the conversations about "What is new?" and "What should we do with so much uncertainty?" It offers five conclusions with diminishing persuasion; but perhaps its largest contribution is its differentiating list of the 211 estimates that can now be found in the literature. Simply compiling, segregating, and referencing this list is worthy of commendation for those who try to bring the social cost of carbon to bear on issues of climate policy. That point made, though, it is important to respond to his remaining four conclusions:

1. the estimate offered by the *Stern Review* (Stern, et al., 2006) is an outlier – or at least on the very high end of a distribution of estimates of the social cost of carbon even amoung those derived from a combination of low discount rates and significant equity weighting;

2. the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) reported that economics estimates (of impacts) have become (actually "will become") more pessimistic, but this claim is unfounded;

3. as argued in Tol (2003), Yohe (2003), Tol and Yohe (2007), and Weitzman (2007) among other places, economic and scientific fixation on central tendencies in the middle of probability distributions (of impacts and costs) is misguided, since much of the action occurs in tails that cannot be dismissed; and

4. many of the estimates of the social cost of carbon, if set equal to a carbon tax as suggested by cost-benefit analysis, would bankrupt many societies and nations around the world.

In between the third and fourth conclusion, Tol (2007) also reports risk premia across the SCC sample as an indication of the level of scientific uncertainty that they reflect. We now take each conclusion, in turn.

It is not a surprise that the estimate offered by Stern, et al. (2006) is an outlier. It was suspected during final stages of the Fourth Assessment Report (AR4) of the IPCC (2007), because it was certainly true in comparison to the 100 or so estimates available

through the summer of 2006. That said, that the authors of AR4 were in error when they concluded that

> "There is some evidence that initial new market benefits from climate change peak at a lower magnitude and sooner than was assumed for the TAR (the Third Assessment Report), and it is likely that there *will be* (my emphasis) higher damages for larger magnitudes of global mean temperature increases than was estimated in the TAR" (Schneider, et al., 2007).

The first part of this conclusion is the result of assessments of new literature that became available after the IPCC (2001) was published wherein the first version of the "burning embers" was unveiled. The second conclusion hinges on one operative word – "*will*". It is not clear that the estimates surveyed by Tol incorporated the new knowledge noted in the Fourth Assessment Report; but when they do, all other things being equal, estimates of the social cost of carbon should increase. This is, of course, most likely to be true for future estimates of the social cost of carbon that are most sensitive to lower turning points; i.e., estimates based on high discount rates and/or no equity weighting. The conclusion from AR4 may "not be supported by the data presented" in Tol (2007), but that does not mean that it is wrong.

The Weitzman-esque conclusion that important and perhaps dominating impacts are captured in the tails is well founded; and the range of estimates of the SCC reported by Tol offers some evidence to support this claim. That the high end estimates would bankrupt some countries if they were the basis of a carbon tax is, however, not convincing in this regard. This conclusion, portrayed in Tol's Figure 2, assumes that carbon taxes (even extremely high carbon taxes) would not reduce carbon emissions. But of course they would. And what would these economies do with the revenue? Meanwhile, Weitzman (2007) speaks more to catastrophes and damages in the thick tails that economic analyses fail to recognize adequately. While the conclusion (that the tails are important and perhaps dominantly important), the argument about catastrophic climate policy falls flat.

So, too, does the calculation of risk premia. These calculations are appropriate economic measures of the cost of uncertainty for specific utility functions, but the sources of uncertainty reflected in their calculations should include true sources of uncertainty from the natural system (e.g., climate sensitivity) or the socio-economic system (e.g., the baseline scenario of greenhouse gas emissions). They should not include decisions made by policy makers based on their own perspectives on discounting (societal impatience) and/or equity weighting. These value decisions surely contribute to the range of estimates, but they are not sources of uncertainty across which risk premia should be calculated. That they confirm the Weitzman hypothesis that climate policy analysis can be dominated by a thick tail of the SCC distribution is right, but the argument is not convincing.

What is the appropriate role for estimates of the social cost of carbon if not to calibrate near-term carbon prices? They can certainly be used to calibrate benefits for programs that, as a matter of course, inspire lower carbon emissions. Whether ancillary benefits should be calibrated to reduced impacts distributed around the world or confined to improvements anticipated within specific regional boundaries is an open question (another policy-maker decision), but understanding the construction of SCC can be informative in either case.

The SCC estimates reported by Tol are also clear indications that some efforts to reduce greenhouse gas emissions should be supported, especially by those who value equity. As soon as that conclusion is reached, of course, then there is an economic reason to act sooner rather than later even while recognizing that it is impossible to write climate policy in 2007 that will be valid for the entire century (see Yohe, et al., 2007). Coping with thresholds and uncertainty over the long term will require adopting an adaptive risk management approach in which a series of medium-term policy decisions will be informed by the evolution of long-term objectives. Designing such a program will be difficult, because it will need to give clear signals of intention over the medium-term even as it maintains flexibility so that it can respond to

- changes in scientific understanding,
- changes in social valuations of impacts, and
- changes in our expectations of how the policies are working.

In every case, however, this flexibility must somehow be immune to political and/or economic manipulation, and so designing such a mechanism will require a considerable amount of political leadership.

In the short term, the goal should be designing a portfolio of policies that will discourage long-term investments in energy, transportation, and construction that would otherwise lock in high carbon intensities for decades to come. As suggested in Yohe, et al. (2007), accomplishing this task would be consistent with long-term programs designed to diminish climate risks over the long term (however our understanding of it evolves) and with the minimization of long-term economic costs of the policies.

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