

Summary and major comments

This paper uses the PAGE09 IAM to examine the effects on the social cost of carbon of alternative probability density functions for (i) the climate sensitivity and (ii) the damage-function exponent. In particular, as the title suggests, the authors consider probability distributions with different tail properties, including the thin-tailed normal and fat-tailed Pareto distributions. As one would expect, the mean social cost of carbon increases significantly when (i) and (ii) are Pareto distributed, though, interestingly enough, it also increases when (i) and (ii) are normally distributed, as opposed to the default triangular distributions in PAGE09 (which have finite support).

Overall I think that, while the paper is not terribly insightful on concepts, it is a useful contribution to an emerging body of literature on the social cost of carbon, when the possibility of extreme climate outcomes is taken into account. There is still an insufficient number of such studies, so that meta-analyses such as those of Richard Tol, while correctly done, arguably underestimate the social cost of carbon by being based primarily on studies taking little or no account of extremes.

The pdfs inputted for (i) and (ii) are rather idiosyncratic, insofar as the left-hand tail of the distribution is set to replicate the PAGE09 defaults, while in fact it is only the right-hand tail that is normally or Pareto (or log-normally) distributed. This is all due to the fact that (i) is not a free parameter in PAGE09. However, the probability mass presumably still adds up to one, so the pdfs are odd, but not wrong, and since the action is in the upper 50% of probability, the effect on the results is probably small. A useful robustness check would nevertheless be to use a full normal/Pareto/log-normal distribution for (ii) and compare it with the hybrid used.

One thing I missed from the paper was explicit mention of the values taken by the pure rate of time preference and the elasticity of marginal utility. These are crucial parameters in estimating the social cost of carbon, so one needs to know what values they took in the analysis. Moreover it would be very interesting to see how sensitive the social cost of carbon is to (i) and (ii) under low values for the pure rate of time preference. Intuitively, one would expect a larger effect, since extreme climate outcomes are in the far-off future.

Minor comments

- The section numbering has gone wrong.
- Page 2 and elsewhere: Dietz et al (in Climatic Change) is just single-authored

by Dietz.

- Page 2, bottom: “In principle, it summarizes...in a single dimension...all...impacts in all world regions, all future time periods AND ALL FUTURE CONTINGENCIES”.
- Page 3, top: as well as a guide for the level of a Pigouvian carbon tax, the SCCO₂ can be used to guide the setting of a cap in a cap-and-trade scheme.
- Page 4, first paragraph in section on background and literature: this paragraph could be made clearer. There are three problems. First, Weitzman’s point has generally been that IAM results are NOT robust, because of tail probabilities of catastrophe, so it is unclear in what sense the authors are using the term “robustness”. Second, non-expert readers may confuse extreme climate/damage outcomes with extreme weather (i.e. variance around the mean trend). Third, it is unclear whether this paragraph is discussing climate or economic extremes or both.
- Next paragraph: evaluation generally implies taking value judgements (see e.g. Partha Dasgupta’s book on wellbeing and resources), whereas I think the point here is about estimation (i.e. valuation) of damages, before discounting and such like.
- Page 7, final paragraph: I suppose what is meant here is that the enumerative method of damage estimation may be inappropriate, and/or that, even if general-equilibrium effects are taken into account, it is unclear how to extrapolate from 1-3C to 5C and beyond. In any case, this passage could also be made clearer.
- Page 14, penultimate paragraph: it isn’t clear in theory what effect an increase in the elasticity of marginal utility has on the SCCO₂, since it increases intertemporal consumption smoothing, risk aversion and inequality aversion, so the overall effect depends on how damages are distributed through time, space and across the state space, and on baseline growth assumptions.