Referee report on the paper by Tomas Kögel

Review of manuscript MS778

The paper offers a good and exhaustive review of the main contributions on the rate of change of the social cost of carbon. Such a synthesis was probably necessary and should prove to be extremely useful to many researchers.

The paper also extends the benchmark model to integrate a non-linear relation between the polluting resource and its released pollution content.

I have one concern regarding this extension. The author emphasizes the special case where this relation is one-to-one (hence proportional). What matters as a special case to be compared with the commonly-made linearity assumption, is that the relation between the two variables is proportional, not that it is one-to-one. The one-to-one case is easily obtained by a normalization which does not imply any loss of generality.

Furthermore, given the paper's objective, the most interesting insights that could be brought about by this extension should be delivered in the non-stationary or the non-linear case. In this respect, it is also surprising that the reasons for why the relation may not be linear are not discussed. According to footnote 12, one of these reasons might be that the relation should take into account voluntary efforts to abate pollution. To my view, another related one may be that the relation eveolves over time as technical improvements go on. The problem is that these two pictures result from economic decisions to be endogenous, while the paper treat the form of the relation as exogenous.

Another approximation is related to the what the author calls the social discount rate, sometimes identified in the paper with the rate of interest. Partial-equilibrium analysis implies the utility concept to be cardinal, measured in terms of the numeraire. In general equilibrium analysis, it is not so and a social discount rate should be interpreted as a weighting device applied to utility measures. Interpretations made in partial-equilibrium models should not lead to such confusions in general-equilibrium approaches.