Commentary

Beyond the Stern Review: Lessons from a risky venture at the limits of the cost–benefit analysis ☆

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A B S T R A C T

This paper argues that debates amongst economists triggered by the Stern Review are partly relevant, focusing on key parameters translating real ethical issues, and partly misplaced in that they do not consider enough other determinants of climate change damages: i) the specifications of the utility function used for the assessments (preference for the environment, preference for smooth growth paths), ii) the interplay between uncertainty and the sequentiality of the decision, and iii) whether the growth engines behind the integrated assessment models can account for transient disequilibrium and sub-optimality. We derive some suggestions for any future research agenda in integrated assessment modelling, whatever the position of the analysts about the relevance of the intertemporal optimisation framework and the Bayesian approach to uncertainty in the climate affair.

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1. Introduction

Undoubtedly, the media success of the Stern Review (Stern, 2006), in addition to its richness, is due to an alarming assessment of climate change damages, calling for "strong and early action", being delivered by a former Chief Economist of the World Bank and not by an ecologist activist. It was both praised[3] and harshly criticized[4] by the different

leanings of the economic profession which concentrated on two controversial parameters of critical importance for a cost–benefit analysis (CBA), i.e. the pure time preference (PTP) and the curvature of the function linking consumption to its utility.

It is remarkable that this debate developed essentially amongst the tenants of the conventional CBA framework and did not mobilize so much those who, reluctant to monetizing damages and sceptical about applying intertemporal optimisation over one century, experienced alternative frameworks such as the Tolerable Windows or the Safe Corridor Approach (Petschel-Held et al., 1999; Toth, 2003) with more complex and multi-disciplinary models but an explicit acceptance of normative targets not grounded in an economic framework. From their perspective, the Stern report is a risky and desperate venture to expand conventional CBA beyond its scope of relevance.

The bottom line of this paper is to start from an internal appraisal of the dispute, i.e. accepting the discounted utility criterion as an appropriate framework in the climate affair. This appraisal will be used to spell out a set of methodological issues to be tackled by new generations of integrated assessment of climate policies. These issues

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[3] A selection of comments to the Stern review can be accessed http://www.hm-treasury.gov.uk/media/1/2/20061028_Quotes-7.pdf.
[4] See for instance, Dasgupta (2006), Mendelsohn (2006), Nordhaus (2006), Tol and Yohe (2006), Weitzman (2007a), to name only a few.

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concern all analysts including the sceptics about the conventional economic toolbox. The Ariadne's thread of this appraisal is made up with two diagnoses:

– the gap between Stern's detailed description of climate change impacts and the methodology used for their aggregate valuation. He casts serious doubts about the chief assumption behind low estimates of climate damages (Mendelsohn et al., 2000; Tol, 2002), namely that societies can adapt to an evolving climate with no significant transition costs. However his toolbox fails to incorporate the key element of this diagnosis, namely the disequilibrium dynamics possibly triggered by the interplays between social and environmental changes;

– the fact that, perhaps driven by a professional reflex of using very stylised models whose analytical control is possible, and attracted by the revival of a familiar dispute, many economists did not focus the discussion on this gap. They rather conducted controversies on the discount rate and to a lesser extent on the elasticity of the marginal utility of consumption, at the risk of overshadowing the assessment of climate damages by the debates around a couple of very fragile parameters.

We first show that the value of the PTP is not the only component of the preference system that matters for the trade-off between the short term and the long term. We then show that this parameter is less critical in a sequential decision-making approach because of the importance of the value of information and of its many determinants. In a third step, we question the vision of the economic growth engine and of intragenerational equity that underpins conventional CBA.

2. Trade-offs between the short and long terms: the role of the preference systems

The harshest debates about the Stern Review relate to the selection of a very low pure time preference (PTP) to assess climate change damages and climate policies[5]. They in fact repeat an old dispute (Ramsey vs. Koopmans), which is likely not to come to an end because it intrinsically incorporates a positive dimension (how people do really behave) and a normative one (how we should behave) (Arrow, 1996). This dispute is indeed framed around the Ramsey equation ($r = \rho + \eta \cdot g$) which is a catchy way to capture the interactions between critical aspects of preferences (ρ as the PTP and η as the elasticity of the marginal utility of consumption) and technical change (r as the marginal productivity of capital and g the resulting growth of consumption) along an optimal growth pathway.

To align the social discount rate on the economic growth rate is no longer controversial amongst economists specialized in this field: if future generations are richer, it is ethically legitimate to consider that the same burden (a mitigation cost or a damage cost) will affect less their welfare than that of current generations. There is no contention as well against retaining discount rates corresponding to the most pessimistic assumptions in a context of uncertainty about economic growth (Newell and Pizer, 2001; Weitzman, 1998): in a stochastic framework, the least value of the discount rate tends to dominate in the far distant future and drives the results of the analysis. Along the same line hold the arguments of Heal (2005) and Dasgupta et al. (1999) that, if environmental disruption slows down economic growth, the discount rates should be lower.

The value of ρ, that governs the gap between the discount rate and the economic growth rate, is more contentious because of its inevitable ethical consequences. The difficulty is that it makes sense in a formula stemming from what R. Hahn called a "ramseyification of

the Solow's model"[6]: it is used for normative analysis but, to inform public policy, it pretends to describe a reasonable state of the world. Over a one century time horizon, this does not mean a likely or best guess prediction but, at least, to secure that a given scenario, resulting from a specific worldview about the world future generations will experience, does not contain an intrinsic inconsistency. This imposes that ρ cannot be selected totally independently from the other parameters of the projection.

Let us admit, like Stern, that the uncertainty about the existence of generations yet to be born is the only ethical justification for discounting utility and that this justifies a 0.01% PTP[7]. The calibration of the model should make this value consistent with values of η, r, and g leading to plausible and consistent projections of future economies. Selecting an arbitrary PTP all other parameters equal and without such a consistency check has indeed profound ethical consequences. The most important one was well perceived in the early attempts to use à la Ramsey models for economic planning in the fifties a non-null prevents the social planner from sacrificing the current generation in the name of a brighter future (Stoleru, 1968)[8] by preventing important capital accumulation today to maximize consumption in the long term. Actually the magnitude of this 'sacrifice' is ultimately depending upon assumptions regarding capital deepening and capital productivity, which determine the links between savings and future consumption flows.

The same consistency check should also apply on any alternative proposal for weighting current and future generations to compensate for the role of the PTP in discounting on long-term horizons. One of these proposals has been to adjust the elasticity of the marginal utility of income. The Stern assumption ($\eta = 1$) has been contested by Gollier (2006) and Weitzman who suggest $\eta = 2$ to reflect risk-aversion in a consistent way with the risk premium revealed on insurance markets. Given that the Stern Review deals with uncertainties about climate change damages through a Monte-Carlo technique picking 1000 possible scenarios and selecting $\eta = 2$ instead of $\eta = 1$ would indeed lead to a higher expected disutility of climate change damages.

However, this comes to mix up the *marginal utility of income* along a growth pathway under certainty with the *marginal utility of a gain/loss* in a lottery (the Von Neumann–Morgenstern utility function). Actually, the Stern's assumption of $\eta = 1$ is consistent with empirical estimates in growth models (Fellner 1967, Pearce and Ulph 1994)[9]. The confusion comes from the fact that the curvature of the utility function works as a risk-aversion coefficient, giving a higher weight to lower income outcomes: if, one conjectures that there is a fifty–fifty probability that the per capita income will be either 150 or 180 at a given date (compared to 100, as of today) then the certainty equivalent of this conjecture is 164.3 (below the 175 average value) assuming a natural logarithm utility function. But this mechanical result from the decreasing marginal utility of income says nothing about what trade-off a society would accept between a risky growth pathway leading to a 180 expected value for

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[6] Franck Hahn used this expression in a collection of essays to celebrate Bob Solow (Hahn, 1990), noting that adding perfect foresight to the Solow model '*is its proper consummation*'. The reason is that it endogenises the savings function, the core of the model, which leads to a model that '*may « fit » some time series*' but '*does not aid understanding*' (p. 27). The oversight of this type of caveat may be one reason why the use (and criticisms) of « ramseyified Solow models » in the climate affair triggered a permanent mix of normative judgments and positive analyses of the real world.
[7] Here a 0.95 probability they will exist in 2100. This argument joins the positions of Ramsey, Sen or Solow.
[8] A similar interpretation of discounting can be found in Chichilnisky et al. (1995) who proposes a formula to protect the last generation without sacrificing the current ones.
[9] Note that Hope (2008) showed that this revision of the value of h does not change drastically the results because the effect of the discount rate outweighs the uncertainty effect in the PAGE model.