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Are the economic costs of (non-)stabilizing the atmosphere prohibitive? A response to Gerlagh and Papyrakis

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There is a widespread impression that the cost of climate policies could be so high that they would jeopardize our current standard of living, and would prevent countries in the South from developing. For instance, Lindsey (2001), President Bush's assistant on economic policy, stated that "the Kyoto protocol could damage our collective prosperity and, in so doing, actually put our long-term environmental health at risk".

In a recent paper in *Ecological Economics* (Azar and Schneider, 2002), we put that view in doubt. We show that the cost to achieve ambitious climate targets tend to be minor compared with overall economic development—even if top down energy-economy modelling approaches are used (which tend to neglect a variety of factors that would lower costs). In such models, the net present value of the cost to stabilize the atmospheric concentration of CO_2 below 450 ppm may count in trillions of dollars.

But in comparison with the overall growth in world income, even net present value costs of tens of trillions would "only" amount to a few years delay in achieving an already impressive growth in income. In our paper, we estimated that global GDP will be ten times greater in April the year 2102 (with climate policies) rather than in the year 2100 (without climate policies, and assuming that there will be no impacts from the resulting climate change).

This does not mean, as we said in our paper, that the costs of stabilizing atmospheric CO_2 concentrations are negligible or unimportant, or that it will be easy to meet the climate targets—particularly in the short-term. The key point is simply that the cost estimates have to be put in context. Our hope was, and still is, that a more balanced picture of the costs involved would lead to a more balanced debate and decision making process.

In a comment to our paper, Gerlagh and Papyrakis (2003) seem not to disagree with our observations and conclusions. Rather they take the opportunity to venture a related point that also deserves attention. They point to the fact that the same kind of argument as we made regarding the cost of abatement could also be made for the cost of the expected climatic changes. But there are serious additional factors that make estimates of the costs of climate change not equivalent to the mitigation costs.

There are a few estimates of the global GDP loss from climate change, and these typically suggest that a doubling of atmospheric CO_2 equivalent

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concentrations would cost a few percent of global GDP (at the time when the damage takes place), see IPCC (2001) (chapter 19). In the words of Gerlagh and Papyrakis: "The costs of unconstrained climate change do not seem to threaten future economic development and welfare. Unconstrained climate change leads to a welfare loss equivalent to only a 1 year delay of economic growth over a period of 100 years".

But is it really possible to copy our cost-abatement argument and use it analogously when it comes to the cost of climate damages? We think not.

There are several reasons for that. First, there are huge difficulties in actually estimating the value of environmental amenities and ecosystems services. Second, there are equally large difficulties in estimating the value of health and lives as a consequence of climatic changes. Third, there are problems associated with the choice of discount rate, in particular since the impacts of the next few generations are expected to cause damage—including irreversible ecological losses—on far future generations. It is not all that clear that the way our current generation makes trade-offs for our own consumption, should imply that the damage we cause for future generations should be valued substantially less than the actual impact simple because future generations live in the future (for more on the problems of discounting, valuation and uncertainty in the context of cost benefit analysis of climate change, see Azar, 1998).

Some would say that these problems are manageable and that research on economic decision making and valuation would ultimately resolve these problems. Others (including ourselves) would argue that the difficulties stem from more fundamental problems with valuing ecosystems, health and human life in the same metric as we value TVs, cars and other gadgets, fun to play with, but inessential when it comes to basic human needs and human and ecosystems existence. Monetary estimates of the cost of climate change provide only an incomplete picture of damages climate change might cause. It is even likely that aggregating all costs and expressing them in monetary terms could obscure rather than enlighten the decision making process. For that reason, other metrics or numeraires are needed when assessing the impacts of climate change (see table 1 from Schneider et al., 2000).

Gerlagh and Papyrakis express this lack of comparability or fungibility as poor substitutability, and conclude: "When poor substitutability prevails in the long run, that is, when the compensation for the loss of environmental amenities by providing more man made goods, cannot go on perpetually, then the choice for an abatement level cannot be based on a cost-benefit analysis that treats both costs and benefits on an equal footing". The key aim of the paper by Gerlagh and Papyrakis seems to be to spell out this view. There is no disagreement between us on this point.

So one may wonder if there really is any disagreement? Gerlagh and Papyrakis again: "When long-term perfect substitutability holds, it is unconvincing to downplay the cost of abatement measures, since costs of unconstrained climate change can be downplayed as well". Here we disagree.

For them, it seems as if it is only the question of substitutability that matters. One key problem with this argument is that it does not consider the distribution of damages. A caricature of a neoclassical economist would argue that the level of abatement of CO_2 emissions should increase from zero, but only until the marginal cost of abatement is lower than the marginal cost of the emissions. But what if damages from the emissions would affect primarily poor countries such as Mali and Bangladesh? The caricature economist would then argue that by not abating we would save enough money so that we can compensate the poor.

It is our view that such compensation is difficult to carry out, both in practice and in theory. What we in practice would end up with is, in this scenario, that rich countries emit, poor countries get hurt and economics suggest that this is optimal since the rich has the potential to compensate the poor. It would be unfortunate if economics would be the tool that some use to justify, without closer scrutiny, such an outcome. Instead, the distribution of impacts is a key concern when it comes to the climate change debate, and economics must consider that as well, as suggested on Table 1.

Uncertainty in the estimates of climate change and climate impacts is very large, and is at least as important a reason to avoid equivalences of fairly constrained cost estimates with a very wide range of possible benefits. Nordhaus (1994) conducted a decision analytic survey in which the respondents elicited damage estimates ranging from a small GDP gain from climate change to a dramatic loss of tens of a percent (see figure 1 from Roughgarden and Schneider, 1999, based on the data of Nordhaus, 1994). If above median damages on figure 1 would materialize, then climatic changes would fundamentally disrupt human societies—to say nothing about natural systems—rather than adding only minor deviations to a smooth development path.

Of course, there is also some probability that aggressive near-term climate abatement policies would be disruptive for our societies, in particular if the rate of emission abatement is very fast. It could lead to inflation, unemployment, social protests by coal miners and truck drivers etc. But if we start to abate now, we will learn about how to be fairer and more cost effective in climate policies. An orderly transition to decarbonized energy systems at, say, 1 or 2% reductions of CO_2 emissions per year, could put us on a track to avoid serious climatic effects without serious social effects.

If on the other hand, we do not take the risk of climate change seriously and are unlucky and end up on the wrong half of the damage curves, then rapid and potentially irreversible climatic impacts could well become unavoidable. Thus, we do not see costs and benefits in a symmetrical cost-benefit logic, but rather as an equity problem and a risk management dilemma.

Table 1
The "Five Numeraires"

The five numeraires* (vulnerabilities to climate changes)	
• Market impacts	($ per ton c)
• Human lives lost	(Persons per ton C)
• Biodiversity loss	(Species per ton C)
• Distributional impacts	(Income redistribution per ton C)
• Quality of life	(Loss of heritage sites; forced migration; disturbed cultural amenities; etc per ton C)

*Disaggregate by value differences—provide traceable account of re-aggregations to make value differences transparent. It is essential for analysis of costs of climate change impacts or mitigation strategies to consider explicitly alternative numeraires and to be as clear as possible which are being used and what is omitted. Moreover, before any aggregation is attempted, e.g. cost-benefit optimization strategies authors should first disaggregate costs and benefits into several numeraires and then provide a "traceable account" (see Moss and Schneider, 2000) of how they were re-aggregated. Such transparency is essential given the normative nature of the valuation of various consequences characterized by the five numeraires.

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