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The economics of climate change: a post-stern perspective

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Abstract What have we learned from the outpouring of literature as a result of the Stern Review of the Economics of Climate Change? A lot. We have explored the model space and the parameter space much more thoroughly. The Stern Review has catalyzed a fundamental rethinking of the economic case for action on climate change. We are in a position to give some conditions that are sufficient to provide a case for strong action on climate change, but we need more work before we have a fully satisfactory account of the relevant economics. In particular, we need to understand better how climate change affects natural capital—the natural environment and the ecosystems comprising it—and how this in turn affects human welfare.

1 Introduction

In November 2006 the U.K. government published *The Economics of Climate Change: The Stern Review*, written by a team led by Nicholas Stern (2006). The publication of the Stern Review provoked an unprecedented outpouring of papers on the same topic, including an entire issue of *The Economists' Voice* and large collections in the *Review of Environmental Economics and Policy* and in *World Economics*. And many of them were by very distinguished colleagues, so the Stern Review provoked not only quantity but quality too. What have we learned from all of this? Are there any emerging conclusions? In particular, what do we have to assume to make an economic case for prompt and significant action to reduce greenhouse gas emissions? This, it seems to me, is the really controversial issue,

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and the one that matters from a policy perspective. There is an amazing disjunction between economists and natural scientists on this issue: most natural scientists take it as completely self-evident that the consequences of climate change justify significant actions to mitigate the buildup of greenhouse gases, whereas there is a range of opinions on this matter among economists, with the conventional wisdom being until quite recently very different from that in the scientific community. Who is missing something important here—the economists or the scientists?

What we have learned from the recent debate, and what it takes to make a case for action on climate change, are the issues on which I focus. The recent debate has clarified many important issues, and we are in a position to give conditions that are sufficient to provide a case for strong action on climate change, but we need more work before we have a fully satisfactory account of the relevant economics. In particular, we need to understand better how climate change affects natural capital—the natural environment and the ecosystems comprising it—and how this in turn affects human welfare. I take some first steps in this direction.

2 Welfare economics and climate change

Let me begin with the basic economic theory of climate change. The first topic I want to spend time on is the discount rate, but before that there is a simple, important and interesting point that Duncan Foley has recently emphasized (2007). The emission of greenhouse gases is a massive negative external effect—the Stern Review refers to it as possibly the greatest market failure in history. Foley's point is that with such a large uninternalized externality, the business as usual scenario with no action on climate change obviously cannot be Pareto efficient, so if we move to correct the externality it must in principle be possible to make a Pareto improving (or "win–win") change to the world economy. If we do this then there is in aggregate no net cost to correcting climate change: the gains must outweigh the costs so that the gainers could compensate the losers and still gain. We can all come out ahead—whether we do is a matter of institutional design, on which many people are now working. The numbers in the Stern Review support this point, indicating that the gains from action on climate change greatly outweigh the costs, but the point would be valid whatever the numbers.

3 Discount rates and the environment

Now to discount rates. As anyone who has spent even a short time on this issue must be aware, one of the controversial issues is the choice of a discount rate. By this we mean the pure rate of time preference (PRTP), to be distinguished clearly from the consumption discount rate (CDR). The PRTP is the δ in the expression $\int_0^\infty u(c_t)e^{-\delta t}dt$ where c_t is aggregate consumption at time t, u is a utility function showing strictly diminishing returns to consumption and we are summing discounted utility over all remaining time. The other discount rate concept, the CDR, is the rate of change of the present value of the marginal utility of consumption, that is, the rate of change of $\frac{e^{-\delta t}du(c_t)}{dc_t}$. For the case of a single consumption good—and we will turn to the case of multiple goods later—it follows from well-known arguments going