



ECONOMICS  
FOR EQUITY &  
ENVIRONMENT

## ***The Stern Review vs. its Critics: Which Side is Less Wrong?***

Frank Ackerman

Stockholm Environment Institute-US Center, Tufts University  
*for Economics for Equity and the Environment Network*<sup>1</sup>

*April 2009*

- A reasonable economic analysis of climate change requires a low discount rate, a broad treatment of uncertainty, and a rigorous examination of expected damages.
- Sir Nicholas Stern's use of these three assumptions lends authority to the Stern Review's call for prompt and vigorous action on climate change.

In the Stern Review, released in late 2006, a team headed by Sir Nicholas Stern reviewed the economics of climate change, at the request of the British government.<sup>2</sup> Stern and his colleagues expressed alarm at the impending climate damages that will result from business as usual, and presented economic arguments endorsing prompt and vigorous action. In Stern's view, inaction on climate change would lead to damages worth at least 5% of world output per year, and, depending on how the damages are calculated, perhaps as much as 20%. Most of these damages could be prevented, according to Stern, by spending 1% of world output annually on mitigation.

Other economists were quick to respond, often quite critically. Conventional economic analysis typically recommends doing much less, and more slowly, in order to avoid dampening the prospects for economic growth. This brief evaluates the economists' debate over the Stern Review.<sup>3</sup> While neither side has a credible answer in every respect, a review of the debate shows that on at least three crucial questions, Stern is "much less wrong" than his critics in academia.

**1. The discount rate** is central to the economics of climate change. When costs are incurred to reduce emissions today, the benefits of reduced climate change will occur decades or centuries later. How much less valuable are those benefits, because they will

---

<sup>1</sup> Economics for Equity and the Environment Network (E3) is a nationwide network of economists developing arguments for environmental protection with a social equity focus. For more information, please contact Kristen Sheeran, Director, at [ksheeran@e3network.org](mailto:ksheeran@e3network.org). E3 is a program of Ecotrust.

<sup>2</sup> The Stern Review is available online, with background and other related documents, at [http://www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm).

<sup>3</sup> This brief is based on a more extensive report for Friends of the Earth-U.K. The issues discussed here are presented in more detail in my book, *Can We Afford the Future? The Economics of a Warming World* (Zed Books, 2009).



ECONOMICS  
FOR EQUITY &  
ENVIRONMENT

happen in the future? At a discount rate near zero, future benefits are almost as valuable as if they occurred today, implying that it is “worth it” to take action now to secure those future benefits. At a high discount rate, future values fade rapidly into insignificance, implying that very little climate mitigation is “justified” by its (heavily discounted) benefits in generations to come.

Economic theory distinguishes between two components of the discount rate: the “rate of pure time preference” that would apply if all generations had equal incomes; and a growth-related rate, assuming that if the future will be richer than the present, then there is less need to make investments on their behalf today.

Stern endorses the philosophical argument that present and future generations are of equal ethical standing, implying that pure time preference should be zero. Your granddaughter is no less important than your daughter simply because she will be born a generation later. Other economists frequently object that people display impatience and short time horizons at a level incompatible with zero pure time preference. Moreover, a rate of precisely zero causes technical problems in some economic theories. Perhaps to avoid this technical issue, Stern introduces a miniscule rate of pure time preference, 0.1% per year, based on an arbitrary estimate of the annual probability that the human race will not survive.

Like other economists, Stern includes a second part of the discount rate, tied to economic growth. His discount rate thus becomes the rate of growth of per capita consumption, plus 0.1%. Since economic growth averages 1.3% in his model, his discount rate averages 1.4%. Other economists assume both a more substantial rate of pure time preference, and a larger growth-related component, yielding discount rates as high as 6%. The difference this makes is enormous: \$100 of benefits 100 years from now would be worth \$25 today at a discount rate of 1.4%, versus \$0.25 at 6%. In short, economic analysis can “see” much more of the future at a discount rate as low as Stern’s, but becomes myopic at a rate as high as 6%.

**2. Uncertainty** is also crucial to understanding climate change – both because of what we don’t know, and also because of what we do know. Temperature, rainfall, and other climate impacts are becoming more variable; floods, droughts, and storms are getting worse, although they are not predictable in detail. As temperatures rise, so does the risk of an irreversible catastrophe, such as the loss of a big ice sheet in Greenland or Antarctica, even though the probability of such catastrophes is not precisely known in advance. Most economic models, nonetheless, rely on best guesses about future climate impacts, treating those guesses as established facts.



ECONOMICS  
FOR EQUITY &  
ENVIRONMENT

The Stern Review explicitly includes uncertainty, using what is called “Monte Carlo analysis.” Many critical features of climate science and economics are assumed to be uncertain; each time the model is run, the computer effectively rolls the dice and picks a different value for the uncertain features. In this case the model was run 1000 times, and the results were averaged to produce the final estimates of climate damages. In some runs the impact of climate change is milder than the average expected value, and in some runs it is more severe. The effect of this treatment of uncertainty is quite large; replacing the Monte Carlo analysis with fixed, best guesses, as in most other models, would have the same bottom-line effect as doubling the discount rate.<sup>4</sup>

The Stern approach shows the effect of assuming a broad, but somewhat arbitrary, range of uncertainty in climate analysis. It is impossible to believe that the Stern team knew the exact extent of uncertainty about the dozens of features that are allowed to vary in their model. Indeed, they likely assumed far too little uncertainty on some key points, as suggested below.

**3. Costs and benefits** of reducing carbon emissions are an additional source of contention, with many economists claiming that Stern set the costs too low, and/or the benefits too high. Some of Stern’s critics in this area, including Bjorn Lomborg, and a team of prominent British critics, echo the claims of the “climate skeptics” who want the world to stop worrying about climate change. In fact, the Stern Review and its well-researched background papers are consistent with IPCC and other reports. There is no hard evidence that Stern has exaggerated the extent of crisis.

If there is a problem, it is in the opposite direction: on some important questions, Stern relied too heavily on existing economic research and models, including an analysis that gives low estimates of the probability and costs of catastrophic changes.<sup>5</sup> While the text and diagrams of the Stern Review suggest that the risk of losing the Greenland ice sheet is noticeable at 2° of warming, and severe by 3°, the Stern economic model assumes no risk of catastrophic damages below a threshold that varies from 2° to 8°, with 5° the most common value.<sup>6</sup> A model that took seriously the warnings about catastrophe in Stern’s text would reach even stronger conclusions about the need for immediate action to reduce emissions.

**Summary:** A reasonable economic analysis of climate change requires a discount rate roughly as low as Stern’s, in order to “see” the future; a broad treatment of uncertainty,

---

<sup>4</sup> See the sensitivity analyses in Simon Dietz et al. (the Stern team’s response to critics), in *World Economics* vol. 8 no. 1. Using the modal value for each Monte Carlo parameter has about the same effect as adding 1.4 percentage points to the pure rate of time preference (i.e., raising the average discount rate from 1.4% to 2.8%).

<sup>5</sup> See Frank Ackerman et al., “Did the Stern Review Underestimate U.S. and Global Damages?”, *Energy Policy*, forthcoming 2009, <http://dx.doi.org/10.1016/j.enpol.2009.03.011>.

<sup>6</sup> See Paul Baer, “The Worth of an Ice Sheet.”



ECONOMICS  
FOR EQUITY &  
ENVIRONMENT

something like Stern's, to reflect current scientific knowledge of the problem; and rigorous examination of expected damages, which are likely to be even greater than Stern suggested. While no one is exactly right on every question, Stern is "much less wrong" than most of his critics.

Stern remains a very active participant in the climate economics debate, which is increasingly focusing on proposals for a post-Kyoto global agreement. For my review of Nicholas Stern's latest book, *A Blueprint for a Safer Planet* (2009), see *Nature Reports: Climate Change*, at

<http://www.nature.com/climate/2009/0905/full/climate.2009.34.html>.