

## The case for mitigating greenhouse gas emissions

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Last fall, the United Kingdom issued a major government report on global climate change directed by Sir Nicholas Stern, a top-flight economist. The Stern Review Report on the Economics of Climate Change amounts to a call to action: it argues that huge future costs of global warming can be avoided by incurring relatively modest cost today.

Critics of the Stern Review don't think serious action to limit CO<sub>2</sub> emissions is justified, because there remains substantial uncertainty about the extent of the costs of global climate change, and because these costs will be incurred far in the future. However, I believe that Stern's fundamental conclusion is justified: we are much better off reducing CO<sub>2</sub> emissions substantially than risking the consequences of failing to act, even if, unlike Stern, one heavily discounts uncertainty and the future.

Two factors differentiate global climate change from other environmental problems. First, whereas most environmental insults – for example, water pollution, acid rain, or sulfur dioxide emissions – are mitigated promptly or in fairly short order when the source is cleaned up, emissions of CO<sub>2</sub> and other trace gases remain in the atmosphere for centuries. So reducing emissions today is very valuable to humanity in the distant future.

Second, the externality is truly global in scale, because greenhouse gases travel around the world in a few days. As a result, the nation-state and its subsidiaries, the typical loci for internalizing externalities, are limited in their remedial capacity. (However, since the United States contributes about 25% of the world's CO<sub>2</sub> emissions, its own policy could make a large difference.)

Thus, global climate change is a public good (bad) par excellence. Cost-benefit analysis is a principal tool for deciding whether altering it through mitigation policy is warranted. Two aspects of that calculation are critical. First, it has to be assumed that individuals prefer to avoid risk. That is, an uncertain outcome is worth less than the average of the outcomes. Because the possible outcomes of global warming in the absence of mitigation are very uncertain, though surely bad, the uncertain losses should be evaluated as being equivalent to a single loss greater than the expected loss.

The second critical aspect is how one treats future outcomes relative to current ones – an issue that has aroused much attention among philosophers as well as economists. At what rate should future impacts – particularly losses of future consumption – be discounted to the present?

The consumption discount rate should account for the possibility that, as consumption grows, the marginal unit of consumption may be considered to have less social value. This is analogous to the idea of diminishing marginal private utility of private consumption, and is relatively uncontroversial, although researchers disagree on its magnitude.

There is greater disagreement about how much to discount the future simply because it is the future, even if future generations are no better off than us. Whereas the Stern Review

follows a tradition among British economists and many philosophers against discounting for pure futurity, most economists take pure time preference as obvious.

However, the case for intervention to keep CO<sub>2</sub> levels within bounds (say, aiming to stabilize them at about 550 ppm) is sufficiently strong to be insensitive to this dispute. Consider some numbers from the Stern Review concerning the future benefits of preventing greenhouse gas concentrations from exceeding 550 ppm, as well as the costs of accomplishing this.

The benefits are the avoided damages, including both market damages and non-market damages that account for health and ecological impacts. Following a “business as usual” policy, by 2200, the losses in GNP have an expected value of 13.8%, but with a degree of uncertainty that makes the expected loss equivalent to a certain loss of about 20%. Since the base rate of economic growth (before calculating the climate change effect) was taken to be 1.3% per year, a loss of 20% in the year 2200 amounts to reducing the annual growth rate to 1.2%. In other words, the benefit of mitigating greenhouse gas emissions can be represented as the increase in the annual growth rate from today to 2200 from 1.2% to 1.3%.

As for the cost of stabilization, estimates in the Stern Review range from 3.4% of GNP to -3.9% (since saving energy reduces energy costs, the latter estimate is not as startling as it appears). Let’s assume that costs to prevent additional accumulation of CO<sub>2</sub> (and equivalents) come to 1% of GNP every year forever, and, in accordance with a fair amount of empirical evidence, that the component of the discount rate attributable to the declining marginal utility of consumption is equal to twice the rate of growth of consumption.

A straightforward calculation shows that mitigation is better than business as usual – that is, the present value of the benefits exceeds the present value of the costs – for any social rate of time preference less than 8.5%. No estimate of the pure rate of time preference, even by those who believe in relatively strong discounting of the future, has ever approached 8.5%.

These calculations indicate that, even with higher discounting, the Stern Review’s estimates of future benefits and costs imply that mitigation makes economic sense. These calculations rely on the report’s projected time profiles for benefits and its estimate of annual costs, about which there is much disagreement. Still, I believe there can be little serious argument about the importance of a policy aimed at avoiding major further increases in CO<sub>2</sub> emissions.

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