

Hot air

Are models that show the economic effects of climate change useless?



Models simplify. They are supposed to. It is a feature, not a bug. Their formulae may be complex but models deliberately omit some things in order to focus on others. They also leave out factors that cannot be modelled satisfactorily. That is understandable, but what if the factors that cannot be modelled make a huge difference to the outcome? And what if the things that are excluded tend to produce a systematic bias in the results?

That is precisely the situation facing those who model the economic impact of climate change, argue two new studies (see sources below). Nicholas Stern, the author of an influential 2007 review of the economics of climate change, says the models minimise environmental damage. Robert Pindyck of the MIT Sloan School of Management goes further, saying the inputs economists use are so arbitrary that their models say almost nothing useful.

Both think climate models play down or leave out “tipping-point” risks that may not affect the climate yet but could do one day. Examples of such risks include crop yields—which could decline gradually in response to global warming, and then lurch over a cliff—and the possibility that swathes of Siberia might warm, releasing huge stocks of methane that lie locked up in the permafrost. Since methane is a greenhouse gas, that could produce a vicious cycle of more warming and more gas emissions. A recent study in *Nature* reckoned that if the methane in the Arctic were ever to escape, it could (the authors guessed) do \$60 trillion of damage—although there is no sign that this is happening.

Economic models—known as Integrated Assessment Models (IAMs)—borrow the limitations of climate models and add problems of their own. Lord Stern argues that they tend to underestimate environmental damage, and wrongly assume that long-term economic-growth rates will continue unaffected even if the climate changes profoundly (see article). Mr Pindyck objects that the basic assumptions economists make about things such as discount rates and the response of temperatures to rising carbon concentrations are so arbitrary that, as he puts it, “these models can be used to obtain almost any result.”

Economic models typically incorporate losses or damage (from recessions as well as from climate change) by lowering the value of a flow of output rather than reducing the value of the stock of capital, land or labour. Usually, this makes sense. But climate damage may be different. If, say, sea levels were to rise, which they did by almost 20cm in the last century, they could inundate coastal cities and destroy large amounts of productive capital and land (to say nothing of damage to life and limb). That would affect not only current but also future output.

The models also tend to underestimate damage from climate change because, as William Nordhaus of Yale University has noted, they are extraordinarily poor at extrapolating beyond a warming of more than 3°C. One of Mr Nordhaus's own models assumes that a rise of 19°C would be associated with a loss of half of world output. Warming on that scale would more probably be associated with the extinction of human life on Earth. Many models imply the world would be better off despite higher concentrations of carbon dioxide of up to 650 parts per million (compared with 400ppm now). To most climate scientists, 650ppm looks like a Mad Max scenario. Mr Pindyck calls the models' assumptions about climate damage "completely made up".

Lord Stern argues that their treatment of growth is not much better. Most models assume there is an underlying "exogenous" growth rate (ie, one that keeps chugging along regardless of what else is going on in the model). Even when this rate is fairly low—growth of 1% a year, say—the magic of compounding means that after 100 years, output will have almost trebled (see chart, column 2). If the growth rate were 3%, output would rise almost 20-fold.

Now combine those results with the models' tendency to underestimate climate damage. Even if the loss in economic output were reckoned at 50% (ie, the loss associated with a life-obliterating 19°C rise in temperatures), the models still say future generations would be better off (see chart, column 4). At a growth rate of 1% a year, for example, it would take an output loss of two-thirds to make people worse off in 2100. These results are incredible. The problem is not that climate change will certainly leave people worse off in future. Rather, it is that it could do so if things got bad enough. But the models almost rule that possibility out. As Lord Stern says, they "come close to assuming that the impacts and costs [of global warming] will be modest, and close to excluding the possibility of catastrophic outcomes."

Not useless, just plain wrong

The question is whether it is nevertheless useful to have some guide to the future cost of climate change, however inexact. Mr Pindyck's answer is radical: forget the models. He calls them "close to useless as tools for policy analysis...their use suggests a level of knowledge and precision that is simply illusory."

Lord Stern is a little more hopeful. He points out that scientists are producing a new generation of climate models and urges economists to do the same. But to work, he says they require sweeping changes to incorporate the idea that global warming can damage capital stock, productivity and growth. They would also, he says, need low or even negative discount rates, to reflect the possibility that future generations will be worse off than the current one. That is controversial: the use of a low discount rate in the "Stern review", the 2007 study that used some of the models he now complains of, was heavily criticised. But as John Maynard Keynes is supposed to have said, it is better to be roughly right than precisely wrong—or not to make any estimate at all.

Too sunny
Global economic output, 2000=100

Assumed annual growth rate, 2000-2100	Output in 2100	With GDP loss of:	
		5%	50%
1%	270	256	135
2%	724	688	362
3%	1,922	1,826	961

Source: "The Structure of Economic Modeling of the Potential Impacts of Climate Change" by N. Stern, 2013

Fonte: The Economist, London, v. 409, n. 8856, p. 78, 5 a 11 Oct. 2013.