Costing the Earth: A Numbers Game or a Moral Imperative?

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ABSTRACT

It is a simple truism that public policy must be guided by an objective analysis of the physical and economic consequences of climate change. It is equally true that policy making is an inherently value-laden endeavor. While these two threads are interconnected, the relative weight given to each depends on the certainty that the technical analyses can deliver. For climate change, the envelope of uncertainty is best understood at the global scale, and there are some well known and formidable challenges to reducing it. This uncertainty must in turn be compounded with much more poorly constrained uncertainties in regional climate, climate impacts, and future economic costs. The case can be made that technical analyses have reached the point of diminishing returns. Should meaningful action on climate change await greater analytical certainty? This paper argues that policy makers should give greater weight to moral arguments, in no small part because that is where the heart of the debate really lies.

1. The Humpty Dumpty challenge

A recent U.S. interagency assessment of the social cost of carbon (the monetized damages associated with an incremental increase in carbon emissions in a given year) arrived at a central value in 2015 of $38 per tonne of emitted carbon dioxide (tCO_2^{-1}), but a range of $12–$109 tCO_2^{-1} (Interagency Working Group on Social Cost Carbon 2013). The last report of the Intergovernmental Panel on Climate Change (IPCC; Yohe et al. 2007) based its evaluation on a review of more than a 100 studies (Tol 2005), which gave a median value of $12 tCO_2^{-1} but a 90% confidence range extending from −$10 (i.e., a net benefit) to $350 tCO_2^{-1} (i.e., a crippling burden). Tol (2011) collates yet more studies and finds an equally daunting variance. What to make of these more than order-of-magnitude ranges, and what guidance does it offer policy makers?

The cause of this disconcertingly large uncertainty is that the dollar quantification of the global costs and benefits of climate change lies at the end of a long chain of analyses, a chain in which each link is beset with its own uncertainty.

First, though some warming is certain, the degree of warming is not. The likely range (meaning a 2-in-3 chance) of equilibrium climate sensitivity—the long-term change in global mean temperature for a doubling of CO_2—is 2°–4.5°C. A very likely range (9 in 10) is hard to give because of the scientific challenges in constraining the upper bound (e.g., Knutti and Hegerl 2008). However, since these upper bound temperatures would take many centuries to materialize, it is the transient climate response that has far greater relevance for policy makers. Very roughly, for any given pathway of future radiative forcing the global mean temperature response has about a factor of 2 uncertainty at one standard deviation (1σ), and a factor of 3 uncertainty at 2σ. For example, continued development with a reliance on fossil fuels is projected to lead to 3°–6°C warming by century's end at 1σ (e.g., Meehl et al. 2007).

This global picture is also accompanied by uncertainty in the local consequences of climate change, on which an assessment of the impacts depends: among climate models, global climate sensitivity is a poor predictor of local climate change (Fig. 1). It is important to be clear—all the models are warming (almost everywhere), but the degree of local warming varies considerably.

In the next link, the myriad impacts of climate change on human and natural systems must be gauged, and economists must then cost them out. Many mainstream economics models then amalgamate all these individual systems into a single damage function: the change in globally averaged consumption as a function of the change in globally averaged temperature (Nordhaus

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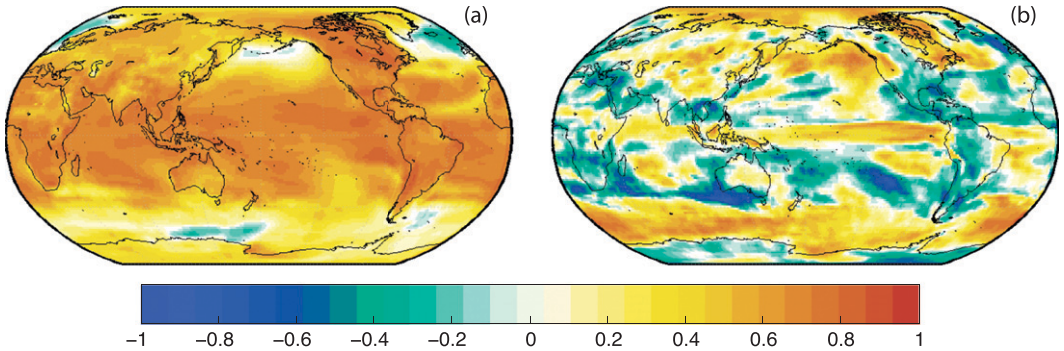

FIG. 1. How well does global climate sensitivity predict local climate changes by century's end? The figure shows the correlation, r, between global climate sensitivity and (a) annual-mean temperature changes and (b) annual-mean precipitation changes, in 2090–99 based on 17 comprehensive coupled ocean–atmosphere climate models, the A1B emissions scenario from the IPCC 2007 report, and against a baseline of 2000–10 (Meehl et al. 2007). The normalized prediction error is $\sqrt{1-r^2}$.

2008; Ackerman and Stanton 2011; Newbold et al. 2012). An objective quantification of the uncertainties involved is likely intractable.

Emissions today affect human welfare in the future. Our willingness to pay now to avoid future damages therefore necessitates economic predictions. Economic analyses of the future are hostage to the discount rate—the exponential factor by which future consumption is discounted by present decision makers. Since nothing else in the problem varies exponentially, the analyses are acutely sensitive to this choice. The premise is reasonable and valid: future, richer generations will be better able to afford the fixes or survive the damages. However, the value of the exponent must be picked based on a combination of predicted future economic growth rates, and ethical choices about income disparities and our level of concern for our descendants. Values in the literature range from near zero to upward of 10% yr^{-1} (e.g., Tol 2005). But with what confidence can we exponentiate the consequences of our actions into the future? If the vicissitudes of Mother Nature are hard enough to predict, then those of human nature are surely harder still. Gordon Moore made a famously successful prediction for the doubling time of the number of transistors on a computer chip. His lesser-known corollary—that "no exponential is forever"—comes to mind here.

Each of these manifold pieces must be quantified in turn, but with all their attendant uncertainties it is the ultimate "Humpty Dumpty" challenge in science and economics—with what confidence can we put the pieces together again? The range of answers given above suggests that current confidence is not high. Nor is there a clear path forward to reducing all this compounding uncertainty. At the global scale, progress on reducing uncertainty in climate projections has been slow at best (constraining past or current radiative forcing would be the biggest help for narrowing global climate projections; e.g., Roe 2010, and references therein). At a regional scale, we lack even a framework for formally bounding the possible changes. Furthermore, the philosophical and moral elements in choosing a discount factor preclude there being, even in principal, a correct answer to be found in the economic analyses (e.g., Dasgupta 2004).

Quantified analyses are absolutely essential—they provide scenarios from which enormously valuable insight can be derived. However, the magnitude of the uncertainties involved, and the realistic prospects for reducing them, must be made abundantly clear and must be confronted by policy makers. Moreover, embracing the uncertainty can be viewed as liberating. Instead of the "paralysis of analysis" created by requiring the correct costs be known in advance, we are freed to act right away using our best estimates while fully recognizing the practical reality that we will have to learn and adjust—perhaps substantially—as we go.

2. A moral issue as well as a quantitative issue

In the end then, what does it mean when, as is arguably the case for the comprehensive and global costing of climate-change damages, the answer cannot be meaningfully quantified or at best can only be bracketed within wide bounds? In the framing of any policy, there are quantitative analyses and there are moral arguments. Both must necessarily coexist. But when the quantitative analyses are uncertain, it raises the relative importance of the moral arguments. These moral arguments must be debated by society as a whole,

and they must be informed by objective scientific knowledge.

The balance between quantitative analyses and moral arguments is an important one to strike, as it goes to the true nature of the underlying debate. A clear example of this is the public debate about the death penalty. It is just about possible for reasonable people to disagree on the issue, and both sides frequently trot out quantitative arguments (for instance, ''it costs more to try a death penalty case than life incarceration'' on one side, or ''the deterrent effect reduces crime, and saves money'' on the other). Whatever one's stance on the death penalty, I would argue that no one really believes that these factoids are rigorous or defensible. It is understood that they are cherry-picked by partisans, and that they act as rhetorical stun grenades that temporarily distract from what is, at heart, a profoundly moral issue. In the extreme, some issues are obviously exclusively moral and are now universally agreed to be so: the economic costs of abolishing slavery are irrelevant, for instance.

A planet that, in several centuries' time, is hotter by 5°C or more is a very different world and, in the opinion of many, would be a dismal legacy of economic and human progress that would also engender a hideous disruption to other life on Earth. Powerful emotions recoil against the prospect of bequeathing such a world to our descendants, but economic arguments that factor in conventional long-term growth rates are blind to such feelings. Through the lens of future generations, one can easily imagine that their increased consumption will not be the only measure by which they judge us.

If morality, as much as a costing of damages, is at the heart of the policy debate, then should it not be made more prominent and explicit? Moral arguments appeal to moral premises and seek to guide ethical choices. Such arguments can be philosophical: By what natural authority do we accrue the right to materially reengineer the only planet in the vast immensities of the universe known to harbor life? The arguments can be practical: Is there a subset of outcomes (e.g., threats to human life, losses of species, habitat, or water rights) whose likelihoods can be quantified and, despite being hard to rate in terms of global gross domestic product (GDP), can nonetheless be agreed on as unacceptable? Or the arguments can be nakedly emotional: Great-Granddad, what is a polar bear? Of course, arguments that have the opposite moral complexion can also be readily constructed, and they should be.

For me personally, the debates that these kinds of questions provoke have tremendous power. The political will to take action and the public opinion that fuels it are driven by the outcomes of such debates, and much less so by the formal (and uncertain) policy analyses.

The earth is a messy and highly complex system, and the societal and economic impacts of global warming will always be shrouded in uncertainty. But uncertainty is not ignorance, and nor does it justify inaction: global warming is incontrovertible; we are responsible for it; and it is beyond rational dispute that temperatures will continue to increase. It is equally true that science says nothing about what is right or wrong to do about it. A reliance of policy makers on scientific and economic analyses to deliver more certainty on how to optimize our future consumption acts to mask the moral issues at stake, and it may be placing more weight on those analyses than they should be reasonably asked to bear.

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