Comments on Simon Dietz and Nicholas Stern's *Why Economic Analysis Supports Strong Action on Climate Change: A Response to the Stern Review's Critics*

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The science of economics has made a number of important contributions to understanding greenhouse gases and their optimal control. From basic economic theory, economists have pointed out the need to minimize the sum of mitigation costs and climate damages (Nordhaus 1992). From this simple insight, society can derive an elegant solution to greenhouse gases. The optimal policy for society should balance marginal mitigation costs with marginal damages. Economics also provides an important perspective on time. Time is valuable and cannot be ignored. This is especially critical for a problem that has a very long time horizon. Costs borne in the present are more burdensome than costs born in the future. Finally, economics has much to offer in quantifying both the costs of mitigating greenhouse gas emissions (Weyant 2008) and the damages that climate change will cause to society (Pearce et al. 1996; Tol 2002; Mendelsohn et al. 2006).

Stern (2007) and Dietz and Stern (2008) largely reject all of these contributions by economics. They argue that "minimizing the present value of costs of climate change and costs of abatement is both misleading and dangerous." They argue that treating future costs as though they are worth less than current costs is "unethical." They reject the empirical analysis of actual impacts arguing that the impacts are unknowable. They reject the economic estimates of mitigation costs in favor of the free-lunch estimates of technologists.

Dietz and Stern argue that "strong and urgent action is in fact good economics." To make this case, they assume that the discount rate is effectively zero, that climate change poses "severe risks" far beyond any we can measure, and that the mitigation costs will be lower than the most optimistic scenario. Even then, they suggest a formal weighing of costs and damages is unacceptable and that instead society should turn to ethical principles to guide greenhouse gas policy. They invoke an "ethics of responsibility of current generations for future generations." This is climate advocacy, not good economics.

What can the current generation do for future generations? By investing in capital, infrastructure, and technology, many generations since the industrial revolution have spurred economic growth, allowing future generations to enjoy a much higher standard of living. Dollars invested in capital and new technology grow at the interest rate, providing a reward

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to savers for forgoing current consumption. The current generation should invest in climate change mitigation that earns the same rate of return as competitive investments in a myriad of market sector alternatives. Such investments will make future generations better off. But investments in mitigation that cannot even earn a positive rate of return will be worth far less to future generations than those same dollars invested in the market. Placing climate change before investments in other important nonmarket services such as conservation, health, education, security, and transportation also cannot be justified in the name of future generations. From the perspective of future generations, it is in their interest that all investments earn the same rate of return. The ethical justification for intentionally overspending on selective projects with low rates of return is weak indeed.

Economic theory and empirical facts teach us that climate policy should follow a moderate course. Mitigation should begin modestly but globally and gradually increase over time. Aggressive near-term policies in selected countries will only increase the costs to society of this long-term problem. Climate change is a serious problem, but succumbing to alarmism will not make it better.

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Despite 100 years of relativity theory, we continue, successfully, to use Newtonian mechanics for most practical purposes. Only in very extreme applications, with interstellar distances or speeds close to that of light, do we need Einstein's equations. The analogy may seem far-fetched but when we analyze the welfare effects of climatic changes—entailing large-scale risks and taking place over centuries—we must be particularly careful with our rules of thumb. Averages and linear approximations serve us well in ordinary benefit–cost calculations but are a risk to our thinking when applied over centuries with rapid technical and socioeconomic change. In the simple case we can say that risks and distributional effects of various projects "even out" or can be dealt with separately using other policies, but for climate change we do not have this option. We must take our theory seriously and as Dietz and Stern (2008) show, strong and urgent action can indeed be defended by good economics.

As if it were the most commonplace matter, we economists assume that growth will continue at a pace that, a century hence, will leave the world ten times (or more) better off than today. Something that is far from obvious to most noneconomists is for us just the starting point of the analysis and not something we spend too much time discussing. Still, it is a truly mind-boggling scenario. Does this mean an end to poverty as we know it or does it mean that a few billion stay close to subsistence while the average gets ten times richer and the rich even more so? Clearly it makes an enormous difference. One of the fundamental ideas of welfare theory is that welfare and utility are concave with respect to income. Admittedly we do not know the degree of concavity. But we must count the costs from climate change impacts that hit the poor differently than those that hit the rich—particularly if we have high disparities. Unfortunately, this is still not the norm in economic analyses of climate change.

Just as distribution is a big question mark—so is resource allocation. If average income goes up ten times—does that mean the average person consumes ten times as much of everything? Clearly not. We cannot eat ten times more food and we should not use more gasoline. Skiing and coral reef tourism will probably decline rather than increase. Other items will change all the more. Countless new gadgets may one day appear equally important as the cell-phone or Ipod today. New services, ecological, social or spiritual, will transform our societies and their culture, influencing even the fundamentals of interpersonal relationships. In all this, there is much change in what we prosaically would call relative prices. If a third of biodiversity is gone but we are otherwise ten times richer—is it not plausible that the value of ecosystem services may have increased beyond current imagination?

When the *Stern Review* challenged the conventional wisdom and called for strong and immediate action on climate change, reactions were initially fierce. However, the ensuing debate has shown a new consensus in the making. Dietz and Stern (2008), rightly in our opinion, highlight the combined weight of ethical considerations and the large-scale risks that climate change poses. Similarly Weitzman (2007), as well as Yohe et al. (2007), focuses on risk and uncertainty, endorsing the policy conclusions of the *Stern Review* on the basis of buying greenhouse insurance. Sterner and Persson (2008), as well as Heal (2008) and Neumeyer (2007), have drawn attention to the role of limited substitutability, changing relative prices and underestimated ecosystem damages. As Geoffrey Heal (2008) puts it, there are "many ways in which we can make a case for strong action now, and few in which we can deny it."

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My response to Dietz and Stern (2008) focuses on two main subjects: (1) what I actually concluded about greenhouse gas mitigation policies, and (2) what I actually concluded is the biggest uncertainty regarding mitigation costs.

First, I do not favor a "wait and see" policy on greenhouse gas mitigation as opposed to an "act now" policy. I believe we need to act now, but that the most effective set of actions includes immediate low-cost mitigation measures, as well as energy technology R&D and work on the development of new institutions and policies to mitigate greenhouse gas emissions. Because we are just learning how to reduce greenhouse gas emissions, at every step along the way we need to balance the additional costs of acting too hastily against the additional risks resulting from climate change. If mitigation costs turn out to be higher than expected in the near term and the benefits less, that may well lead to less aggressive mitigation policies and more vulnerability in the longer term. Moreover, it is not necessary to completely commit to an aggressive long-term target today. We can first reduce greenhouse gas emissions significantly at a low cost and learn how to do it and then make the final decision on our destination when better information on impacts will presumably also be available. Thus, rather than "wait and see," I favor a policy architecture in which we try a lot of everything—mitigation, policies designed to speed the adoption of lower-GHG-emitting technologies, R&D on new lower-GHG-emitting technologies, and adaptation to climate change as it occurs—rather than putting too many eggs in the dramatic early mitigation basket. In my view, the latter has a risk associated with it that is not recognized by Dietz and Stern.

Second, I believe the risk on the mitigation-cost side relates directly to how both the "top down" and "bottom up" projections of GHG mitigation costs should be interpreted. These two types of projections are extremely useful, but highly idealized. The implementation of both approaches has generally assumed that GHG emissions reductions all over the world are taken wherever, whenever, with whatever GHGs, and however it is least costly to do so. Besides assuming an immediate worldwide consensus on what to do, how to do it, and who should pay for it, this assumes that we can design polices to not only internalize the carbon externality perfectly but also to: (1) overcome the innovation market failure that results from private companies not being able to recoup close to all the benefits resulting from their R&D investments, (2) correct the market failures resulting from, for example, imperfect information and lack of adequate financing for implementing the available options and (3) prevent politicians from spending any revenues collected from GHG taxation or permit auctions on low-value programs unrelated to GHG mitigation. In the top-down approaches, we at least make highly idealized assumptions about these details, but in the bottom-up approaches we essentially assume that policies exist and can be implemented to result in the least cost program. Thus, by using bottom-up cost projections directly as in input to policy, we implicitly give policy advice without specifying the policies to be used. Can we really figure out all the implementation details quickly enough to avoid large excess costs (far above the societal costs included in most model simulations) from making dramatic reductions in GHG emissions in the next couple of decades? Thus, my high (say 10 percent of GDP) short-run potential mitigation cost projection for stabilization results primarily from institutional pessimism rather than technological pessimism.

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