Perspective Paper

The Challenge of Global Warming

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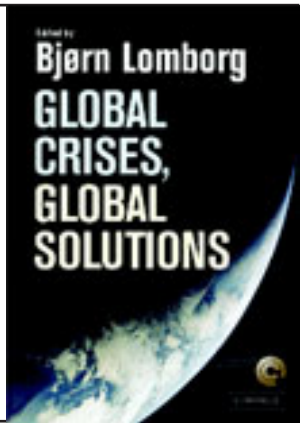

Opponent Paper on Climate Change
Copenhagen Consensus

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It is no surprise that climate change is listed as one of the top 10 pressing public policy issues in the Copenhagen Consensus. The global scale and potential seriousness of the impacts of cumulative greenhouse gas emissions make it indeed a challenge for world policy makers. The challenge paper by William Cline provides an important introduction to this complex dynamic question. The world must weigh the consequences of tampering with future climates against the cost of foregoing inexpensive energy from fossil fuels. It is by no means an easy choice and it requires all the skills that economists and natural scientists can muster just to comprehend what is at stake.

This paper was commissioned to examine Cline's paper and seek out issues or concerns with Cline's effort. Cline's paper does a good job of identifying why the world must be concerned with climate change. However, there are some problems with the presentation that need to be addressed. First, there are flaws in the economic logic of the paper. Second, many recent empirical studies of climate change impacts have been omitted. Third, the cost benefit analysis is skewed. A corrected analysis suggests that Cline's paper examines only strong to extremely aggressive abatement policies. We recommend a moderate abatement policy be added as a final policy alternative.

Greenhouse gas emissions accumulate in the atmosphere because they are assimilated back to earth very slowly. When judging whether or not to abate, the social decision maker must equate the marginal cost of abatement with the present value of the resulting stream of marginal damages (Nordhaus 1991; Falk and Mendelsohn 1993). As Cline notes, with greenhouse gases these impacts begin in 30 years and last for centuries. Because the stream of damages caused by current emissions last far into the future, we must take a long-range view of our current actions.

Although it is important to examine the consequences of today's actions far into the future, it is important not to confuse far future actions with what is done today. The impact of emissions that are made after 2100 has no bearing on what the world should do for the next 30 or even 100 years. By examining climate impacts 200 to 300 years from now, Cline mixes today's emissions with the emissions of far future generations. Instead of comparing the marginal cost of abatement in the near term (next thirty years) against the resulting stream of marginal damages, Cline compares the total cost of abatement for centuries against the total impacts for centuries. This mistake confuses our relatively benign emissions with much more dangerous emissions that could be made in the far future. Although Cline's projections are something to be afraid of, this aggregation over time makes us mistakenly attack the present generation for a problem that future generations might cause. Our first priority is to be responsible for what we ourselves do. We must stop current emissions because of what our emissions will do in the future. If every generation does the same, the problem will be taken care of over time.

Cline has made a very strong assumption by choosing to discount climate change impacts using a 1.5% discount rate. He argues that we must use a 1.5% rate to discount climate change impacts because they occur so far into the future. If we use a large discount rate, they will be judged to be small effects. However, this is circular reasoning, not a justification. Cline does not make a convincing case why only greenhouse gas damages should be discounted at 1.5%, not any other source of consumption. A dollar invested in the private sector can provide a stream of consumption at 4%. Social funds are clearly limited. If we cannot invest in every desirable social activity, clearly we should begin by investing in our best social opportunities first. If climate change can only earn a 1.5% return each year, there are many more deserving social activities that we must fund before we get to climate. Although climate impacts are long term, that does not justify using a different price for time.

Although Cline has done a good job of summarizing the literature through the early nineties, there is an extensive literature that has been developed since then. The empirical estimates in Cline's analysis rely on studies that are over 10 years old. Of course, if new work essentially supports the older figures, this would be a minor oversight. However, this is not the case. A series of studies on the impacts of climate change have systematically shown that the older literature overestimated climate damages by failing to allow for adaptation and for climate benefits (see Fankhauser et al 1997; Mendelsohn and Newmann 1999; Tol 1999; Mendelsohn et al 2000; Mendelsohn 2001; Maddison 2001; Tol 2002; Sohngen et al 2002; Pearce 2003; Mendelsohn and Williams 2004). These new studies imply that impacts depend heavily upon initial temperatures (latitude). Countries in the polar region are likely to receive large benefits from warming, countries in the mid-latitudes will at first benefit and only begin to be harmed if temperatures rise above 2.5C (Mendelsohn et al 2000). Only countries in the tropical and subtropical regions are likely to be harmed immediately by warming and be subject to the magnitudes of impacts first thought likely (Mendelsohn et al 2000). Summing these regional impacts across the globe implies that warming benefits and damages will likely offset each other until warming passes 2.5C and even then it will be far smaller on net than originally thought (Mendelsohn and Williams 2004). Compared to the estimates presented in Nordhaus and Boyer 2000, the new benefit estimates are substantially smaller.

The smaller net global impacts imply lower optimal taxes. Nordhaus and Boyer predict marginal benefits that should start at about $10/ton and gradually rise to $60/ton of carbon by 2100. The new estimates suggest marginal benefits that start closer to $1-2/ton and rise to $10-20/ton by 2100. Lower marginal benefits, of course, imply more modest programs. Cline is correct when he observes that even with the Nordhaus-Boyer estimates, the modest marginal damages imply meager abatement programs. The new empirical estimates suggest even more modest programs.

Cline complains that impact research has not included low probability high consequence events such as shutting down the thermohaline circulation or suddenly losing the West Antarctic ice sheet. Without warm currents from the Atlantic, northern Europe would cool substantially. A sudden melting of huge ice sheets would cause sea

level to rise dramatically. These changes would have large effects. The question, however, is whether one can realistically link current actions to these consequences. Although far future emissions could cause large enough changes in the earth's temperature to trigger such events, it is not probable that near term emissions would do this. It is again a flaw of comparing total costs and total damages that leads Cline into this trap. Showing that far future emissions might cause catastrophic events does not in itself prove that current emissions will cause these events.

If one focuses on comparing the marginal impacts of current actions against the marginal cost, recent economic research suggests that the optimal greenhouse gas policy is to start modestly. If damages rise more quickly in the future than we expect, the estimates can be adjusted and stricter policies can be imposed. For now, based on what we understand today, the optimal policy for controlling greenhouse gases is actually a relatively modest program.

What policies are then available to control greenhouse gases? Clearly there are a host of tools available from command and control, tradable permits, and carbon taxes. There is no question that command and control has proven to be very expensive and undesirable. This is especially clear with a pollutant where the location of emissions makes no difference. We are interested in controlling the aggregate emissions in the entire world and only tradable permits and taxes will do that efficiently. Cline and many other economists advocate using taxes because the taxes would provide a new source of revenue for governments. However, tradable permits would do the job just as effectively. Permits could be granted to existing polluters in every country in the world. This gives firms the right to pollute up to the socially desirable amount of pollution, a policy that has been followed consistently for every regulated pollutant to date. It is not clear that greenhouse gases should be treated differently. That implies the tool of choice is a tradable permit. The government should allocate permits across existing users. Users should then be free to trade amongst each other to seek efficiency gains.

Another important question is how to abate carbon. Although the bulk of carbon emissions in the future come from burning fossil fuels, policy makers should consider more than just energy policies to reduce carbon emissions. Another important policy option is to include carbon sequestration in forests. By growing timber trees longer and by setting aside vast tracks of marginal forestland for conservation, land use policies can sequester a large stock of carbon in living forests. Following dynamic tax paths such as the Nordhaus and Boyer program, it is optimal to construct a forest sequestration program that sets aside carbon equal to one-half of the abatement in energy (Sohngen and Mendelsohn 2003). That is, forest sequestration should account for 1/3 of total abatement. This must be a worldwide effort because some of the most attractive lands to use for forest sequestration are in the low latitudes (Sohngen and Mendelsohn 2003).

One of the most important questions that the Copenhagen Consensus must address is how severe a program of abatement makes sense for greenhouse gases? Cline presents three basic options. The least expensive program presented by Cline is the preferred policy from Nordhaus and Boyer, which starts with taxes at $10/ton and lets

them rise slowly to $60/ton by 2100. The next program is Cline's own preferred policy, which starts at $150/ton and rises to $600/ton by 2100. He then introduces a more aggressive policy based loosely on risk that starts at $450/ton and rises to $1200/ton by 2100.

Because economic research on impacts suggests that global net impacts are quite low for near term emissions, Cline's policies appear to be overly aggressive. That is, Cline calls for abatement that is more expensive than the damages avoided. I consequently introduce a fourth policy that is more modest than even Nordhaus and Boyer. Global market damages are closer to $1/ton for the near future. Doubling this value to take into account non-market damages and the expected value of catastrophes, the marginal damage per ton should begin at $2/ton. As carbon accumulates, this will increase speculatively to $20/ton by 2100.

Table 1 describes what these policies look like over the century and what the costs and benefits are likely to be. The benefits, in this case, are the discounted stream of benefits caused by another ton of emissions. Because the marginal damage of an emission is constant within a year, average and marginal damages are the same. I assume that average cost is about one half of marginal cost. Only the modest program has a benefit cost ratio greater than 1. Cline teases the Nordhaus and Boyer program for having such a little effect on abatement. However, the Nordhaus and Boyer program is too costly with a benefit cost ratio of about 0.67. Cline's more aggressive policies earn only 1-7 cents per dollar spent on abatement.

How does the Kyoto agreement look? This is a difficult question to answer because Kyoto is a short-term commitment made by a limited number of polluting countries. Developing countries which will soon be responsible for half of greenhouse gas emissions, made no commitments at all. Because of reductions in emissions in Eastern Europe and the introduction of North Sea oil and natural gas, European emissions are actually close to their 1990 levels. The commitments the Europeans made in Kyoto are quite modest and in line with the optimal policy. The commitments made by Japan and Canada are greater and look more like the Nordhaus and Boyer estimates. Because of growth since 1990, the United States is well above their 1990 level of emissions. To cut back to below 1990 levels requires the US to effectively make a 30% reduction in emissions. The US restrictions look much more like Cline's preferred policy. Kyoto is consequently a complex country-by-country agreement that includes everything from nothing to extreme measures. Further, it is no surprise that the US did not finally agree to Kyoto as it was negotiated.

In this paper, we present century long emission trajectories to give decision makers a sense of what they are beginning to commit themselves to. However, we are by no means suggesting that governments lock themselves into an emission path for a century. There is no question but that we will learn a great deal about controlling greenhouse gases and about climate change over even the next few decades. The optimal policy is to commit to only what one will do in the near term. Every decade, this policy should be reexamined in light of new evidence. Once the international community has a

viable program in place, it is easy to imagine the community being able to adjust their policies based on what new information is forthcoming. The trick is not to commit to a draconian program that will solve this long term problem immediately. Draconian programs such as the ones offered by Cline are extremely poor investments. The world community simply should not support such extreme measures when there are so many other pressing issues at hand. The optimal response to greenhouse gases is to start modestly. Build an international consensus to bring greenhouse gases under regulation. Focus at first on putting together an efficient control program. Armed with this solid foundation, the world will be able to tackle future emissions as they come.

Table 1
Benefits and Costs of Alternative Options

Options	2010	2050	2100
Mendelsohn-"optimal"			
Tax (marginal cost)	$2	$10	$20
Average cost	$1	$5	$10
PV Damages	$2	$10	$20
Benefit/Cost	2.0	2.0	2.0
Nordhaus and Boyer-"optimal"			
Tax (marginal cost)	$6	$30	$60
Average cost	$3	$15	$30
PV Damages	$2	$10	$20
Benefit/Cost	0.67	0.67	0.67
Cline-"optimal"			
Tax (marginal cost)	$150	$375	$600
Average cost	$75	$187	$300
PV Damages	$2	$10	$20
Benefit/Cost	0.027	0.053	0.066
Cline-"value at risk"			
Tax (marginal cost)	$450	$825	$1200
Average cost	$225	$412	$600
PV Damages	$2	$10	$20
Benefit-Cost	0.009	0.024	0.033

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