CRYING NO WOLF: WHY ECONOMISTS DON'T WORRY ABOUT CLIMATE CHANGE, AND SHOULD

An Editorial Comment

1. Introduction

The economic literature on climate change implies that there is no urgent need for serious climate policy (Hamaide and Boland, 2000; Nordhaus et al., various; Chakravorty et al., 1997; Manne and Richels, 1992; Peck and Teisberg, 1994). In economic terms, it is not a significant problem. Furthermore, if the limited abatement recommended in these studies were to be achieved at least cost, it would be undertaken in low income countries.

The results of economic models are only as credible as the assumptions upon which they are based. We identify a set of assumptions and characteristics that together define the standard for climate-economy models currently in use. The general apathy toward controlling the growth of CO_2 emissions, both at the global level and particularly in high income countries, is derived in part from conclusions based on these assumptions. In the following five sections, each of these assumptions are examined critically.

2. Marginal Abatement Costs

The Hamaide and Boland (H–B) work published in this issue illustrates a common feature of climate-economy models: presumed existence of negative and/or very low cost CO_2 abatement options in low income countries, coupled with much higher marginal abatement costs for high income countries such as the U.S., Japan, and Europe. The logical result of these assumptions is that in order to attain global efficiency, the largest abatement should be undertaken in developing countries whereas the richest countries of the world, with the largest historical CO_2 emissions, have a much lower abatement responsibility. Figure 1 is based on Nordhaus and Boyer (1999a). The results are not unique to this study: similar results are found in McKibbin et al. (1999), H–B, and Nordhaus and Yang (1996).

The figure displays countries in ascending order of the optimal control rate for CO_2 emissions and real per capita GDP in 2095. It represents their common result that efficient policy would have low income countries do most, and high income countries least in emissions reductions.

The evidence in support of such an assumption is tentative, at best. Recently, a set of parallel studies was sponsored by UNEP to develop carbon abatement cost

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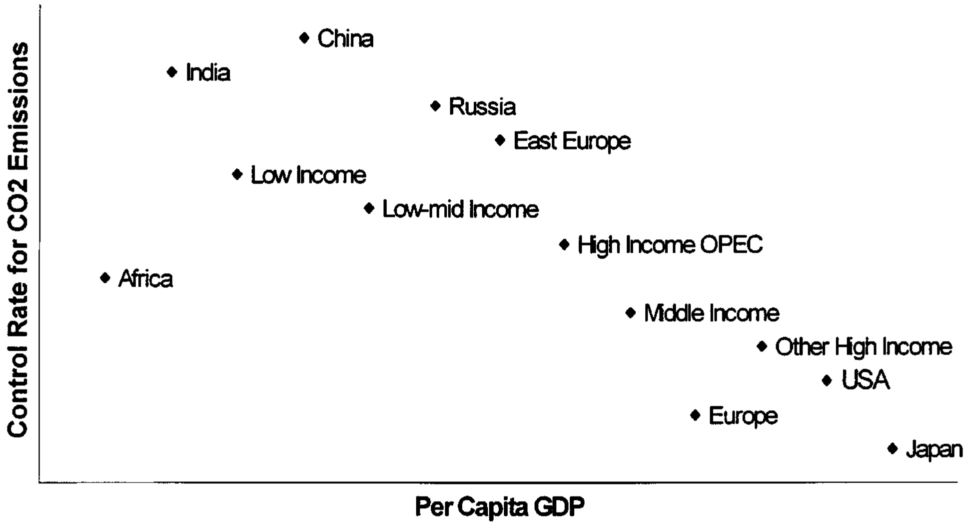

Figure 1. Correlation between recommended abatement effort and income. Source: Nordhaus and Boyer (1999a).

curves in a selection of developing countries in Asia, Africa, and Eastern Europe. These studies identified several technologies in each country with negative costs in present value terms (Halsnaes and Markandya, 1999). The economic interpretation is that these projects pay for themselves over the relevant time horizon. Thus, it is assumed that the projects would be undertaken regardless of the additional goal of reducing CO_2 emissions. If this assumption is correct, why then are none of these options being implemented now? Obviously, there are other costs which are excluded. Consider the examples below.

Zambia, one of the world's poorest countries, is estimated as having the greatest potential for reducing CO_2 releases (UNEP, 1999). The bulk of emissions reductions are expected to arise from the switch from wood fuel and charcoal to hydropower. In order to meet its electrification goals, the Zambian government would require new capacity. However, it is well known that the costs of hydropower include social costs due to inundation of large tracts of land and the resulting economic and social dislocation. These costs are not among the direct costs, and their recognition often prevents the implementation of proposed hydro projects.

The shift from wood to electric cookstoves is projected to have the largest CO_2 reduction potential in Zambia. Despite the government's aggressive electrification program, only 40% of currently electrified households are using these stoves. UNEP (1999) estimates that the cost of a stove is approximately equal to the monthly income of an average urban household ($50) compared with only $3 for the traditional stoves. Thus, the implementation of this strategy, while technically possible, is not realistically feasible. Another example of the unreal optimism of the UNEP study relates to improved charcoal stoves. A pilot project to introduce these stoves failed when the production was abandoned due to increased production time, complexity of the stove design, and the lack of raw materials. Yet, these are assumed to be ‘negative cost’ options with significant abatement potential.

Equally significant, the study seriously misinterprets the carbon cycle as it applies to sustainable fuelwood use. In a forest where fuelwood harvest is equal to or exceeded by annual growth, fuelwood use has zero net contribution to CO_2 emissions. The carbon budget developed for Zambia clearly shows that each year’s fuelwood releases are matched by the carbon fixed by new replacement or growth (UNEP, 1999, ch. 2, p. 24).

We can conclude that focussing global attention on the role of Zambia, and other similar countries, in reducing greenhouse gases will have no discernible impact on global emissions.

3. Energy Intensity and Autonomous Energy Efficiency Improvements

Climate change models typically represent technology and technical change through the production function and the changes in the numerical values of exogenously specified parameters. A key parameter in this context is autonomous energy efficiency improvement (AEEI), which represents the presumed increasing efficiency with which global or national economic systems use energy as a factor in the production process. Improvements in energy efficiency are generally assumed to be quite rapid. For instance, Manne and Richels (1999) assume the annual AEEI rate to be 40% of the annual GDP growth rate. This translates into a continuous decline in energy intensity (the energy to real GDP ratio) over time, though the growth rate declines from approximately 0.98% per year in 2000 to about 0.77% per year in 2100. This reduction in energy demand is independent of the impact of rising energy prices: it is a pure technology effect at the global level. Comparable assumptions are found in virtually every integrated assessment model of climate change. H–B do not report their economic model, and the role of AEEI in their work, if any, is unclear.

Table I shows the change in observed global energy intensity between 1980 and 1996. Clearly, at the global level energy intensity has remained constant over this seventeen-year period. The downward trend in energy intensity for high income countries is offset by the sharp upward trend observed in low and middle income countries. The same is true for carbon intensity. Despite these contrasting trends, most studies, including the latest work by Nordhaus and Boyer (1999b), project a declining carbon intensity in all regions and for the world as a whole. (The H–B work in this issue does not provide information on this parameter.)

The analysis of the logic of these widely utilized, counter-intuitive assumptions is sparse. Over the past 20 years or so, not only has the energy and carbon intensity in lower to middle income countries been rising, it has been accompanied by a rise in their share of world commercial energy consumption and economic output.

TABLE I
Energy intensity

Region	1980	1996
Low-middle income	0.53	0.71
High income	0.24	0.20
World	0.32	0.31

Source: Own calculations based on data from World Bank (1999). Units are energy (in kg of oil equivalent) to 1995 $ of GDP.

The global energy or emissions to output ratio can decline in the future if, *ceteris paribus*, the observed decline in the energy intensity of the high income countries were to outweigh the increase in the energy intensity of the other countries, or if both decline. However, if the actual observed trends in energy consumption and economic output continue into the future, the assumed improvement in energy efficiency will not occur.

4. Concave Emissions Trajectory

Some studies utilize a base case or a 'business as usual' case in which future pathways of carbon emissions are concave over time, as represented schematically in Figure 2. Chakravorty, Roumasset, and Tse (1997) (henceforth, CRT) accomplish this by postulating a base case in which solar electric technologies achieve cost reductions of 30% per decade from 1990 and thereafter through market forces alone, without significant increase in government support for basic research. Solar generating technologies displace conventional steam generation. As a result, emissions peak in the latter half of the 22nd century and then decline.

Although historical cost data for actual solar generation is unavailable, generation data show that in the U.S. the amount is small (one ten-thousandth of 1%) and has declined since 1993 (EIA, 2000).

The same serendipity in the Peck and Teisberg (P–T) work in this journal arises from the AEEI as discussed immediately above. In addition, the AEEI may be supplemented by trending shift factors, which augment world economic product, and by productivity gain independent of energy use or the AEEI (see Peck and Teisberg, 1994, p. 292). The P–T emissions track is at its base case maximum in the first half of the 22nd century and then declines.

In IPCC95 the concave emissions trajectory exists in 9 of the 10 base cases (IPCC, 1996, Figure 7, p. 25). The peaks occur between 2025 and 2100. These base cases are qualitatively different from the parabolic carbon trajectories in P–T, Cline (see immediately below), and CRT because they are non-economic: they as-

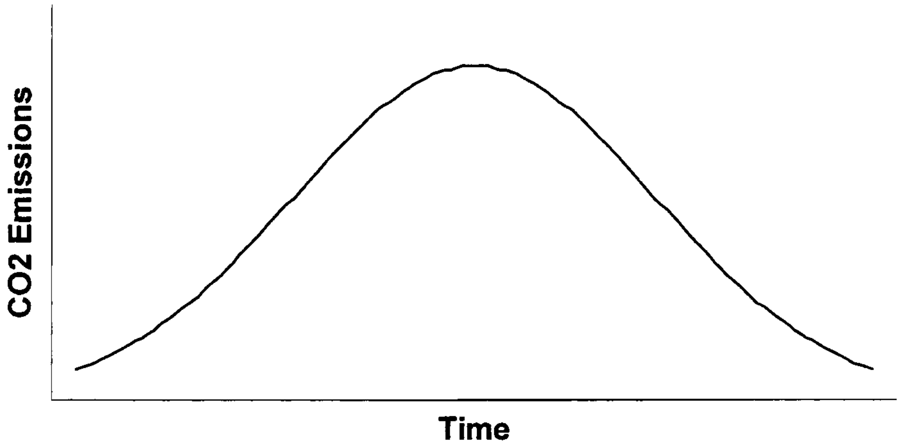

Figure 2. The 'carbon bowl'.

sume global emission policies will develop to stabilize atmospheric concentration at potential target levels.

Cline's economic analysis uses a concave emissions curve based upon the Sundquist assumption of resource-limited fossil fuel use peaking in 2100 and then declining (Cline, 1992, p. 47).

In the Nordhaus group's work, the base case without new policy generally generates an asymptotic curve. Carbon emissions base case projection data are not reported for Hamaide and Boland in this issue.

For the group of studies that take base cases in which carbon emissions peak and then decline, or grow asymptotically to a limit without policy intervention, the apparent benefits that arise from CO_2 reduction policy are rendered less important by this base case condition.

5. Discounting the Future

The climate-economy models currently in use are based on the ethic of self interest and the invisible hand principle. Together, they imply that economic efficiency alone is the guiding principle for determining social good. While there is little doubt that these principles are well suited for describing the behavior of modern economies, it is essential to remember that they ignore other moral and social determinants of human behavior (Schneider, 1997). In fact, externalities, public goods, and other forms of market failure lie outside the realm of standard climate-economy models precisely due to this emphasis on self-interest. Thus the results of models such as Nordhaus and Boyer (1999b), as well as H–B, should be interpreted with caution. These models ignore the public goods nature of climate change. Under the full cooperation scenario, countries make economic decisions altruistically, based on global costs and benefits.

This relates directly to the debate around the ‘correct’ rate of time preference. It has been argued that a 3% per year rate of time preference is most consistent with historical savings data (Nordhaus, 1994). Of course, this argument is based on the self-interest principle. However, several authors (including Rawls, 1971; Mishan, 1975; Khanna and Chapman, 1996) have argued that there is no ethical basis for a positive time preference for climate change damage. The long time scales of these events imply a comparison of the relative worth of utility across generations. Is our children’s happiness and safety really worth less than our own? Time preference is the one parameter within standard economic models that allows us to incorporate concerns like ‘what *should* the future look like’ instead of simply replicating the past.

Note that a zero time preference for environmental or climate change policy does not imply zero discounting in economic markets. Discounting future and higher income is consistent with this, and with the microeconomic principle of the declining marginal utility of income. A positive time preference, however, implies that future events are worth less than current events simply because they occur further away in time. The implication for policy findings is that the common presumption of positive time preference significantly decreases the apparent need for greenhouse gas reduction policy (Chapman et al., 1995).

6. Funding Economics of Climate Change Research

In a legal setting, potential jurors are stricken from the list of jurors if they have any affiliation with either party or their advocates. This simply recognizes that conflict of interest in making informed judgement may be influenced by associations not directly related to the matter being evaluated.

This does not necessarily imply that self-interest always leads to faulty economics. For example, the U.S. petroleum industry argued in the mid-1970s that it was competitive, and this was basically correct at that time (Chapman et al., 1976). Similarly, some electric utilities argue that a cost-effective approach to urban smog reduction would place more emphasis on transportation emissions, and this is generally correct.

However, the nature of funding of most leading economic models is a source of concern. U.S. electric utilities finance the Electric Power Research Institute (EPRI). EPRI has been a source of financial support for seven of the major authors of integrated assessment studies (Khanna, 1998, p. 84). (Source of support for the Hamaide–Boland work in this issue is not indicated.) Nordhaus is a noticeable exception to this pattern; EPRI has not sponsored his work.

EPRI (and 21 corporate affiliates of the *Energy Journal*) was a sponsor of the Special Issue of *The Energy Journal* on ‘The Costs of the Kyoto Protocol: A Multi-Model Evaluation’. Certainly other organizations sponsor integrated economic evaluations of climate change policy, particularly the National Science Foundation, Department of Energy, and the Environmental Protection Agency. The problem arises because the motivation of organizations negatively affected by strong climate change policy necessarily raises questions (as with the legal analogy above) about independent objectivity.

It would be of interest if a climate-economy study partly funded by an energy corporation or association were to find a need for near-term reduction in U.S. energy use.

In an analogous problem, the review panel evaluating the claim that polio vaccine tested in Africa may have transferred the AIDs virus from non-humans to humans has excluded any laboratory from the testing program that might be perceived as having a conflict of interest with respect to possible results (*New York Times*, 2000).

7. Conclusions

We have reviewed five categories of assumption and affiliation (abatement cost, autonomous energy efficiency, emissions trajectory, discounting, funding). Suppose in each category there is an 'A' type assumption that causes the climate economy model to tend toward results that imply no need for significant policy. Also suppose that there is a 'B' type assumption which leads modeling results to imply significant need for policy.

In each category, economists generally utilize 'A' type assumptions. The employment of five 'A' assumptions is one of 32 combinations. If each 'A' and 'B' is equally likely, the conventional climate-economy model has a 3.125% probability of being correct.

This is a schematic presentation of our perception: the general 'no significant policy is necessary' conclusion follows from assumption. We think it unlikely that the full magnitude of future climate-economy interactions is reflected by current modeling assumptions and results.

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