

**“The Economics of the Kyoto Protocol
and Global Climate Change Policy”
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Consider a graduate from the Mars School of Public Policy who knows about the science of planetary warming from greenhouse gases -- let's make it Venus -- and comes to Earth in March 2000. She observes that global weather fluctuations are increasing, and that there are fears of possible power outages in the coming summer. But she has also studied economics. She hears that the price of oil on planet Earth has tripled (from a low level) over the preceding year, and she infers that Earthlings are responding admirably to the problem of Global Climate Change by deliberately raising the price of fossil fuels to encourage a reduction in greenhouse gas emissions. Surely, she concludes with satisfaction, this response is a reflection of the international treaty to address climate change that was negotiated at Kyoto.

Unfortunately, such a conclusion could not be more mistaken. In all the recent public talk about soaring prices for home heating oil and gasoline, I have yet to read or hear one single comment even to the effect that there are environmentally beneficial side-effects of the run-up in oil prices. To the contrary, Candidate Bush has attacked Candidate Gore for voting for a measly 4.3 cent gasoline tax in 1993, a time when oil prices were unusually low. It as if some people would only be happy if the remaining 10% of the American population that are not yet driving SUVs were encouraged to switch over. Everyone takes it for granted that we need to insure lots of cheap fuel. Nowhere is the connection made with the problem of greenhouse gases.

The public debate on policy regarding Global Climate Change (GCC) occurs in a separate arena, and it is distressingly polarized. On the one hand, we hear that implementing the Kyoto Treaty would be ruinously expensive, from much of Congress, some of business and, especially, labor. On the other hand, we hear that we can address the problem at no economic cost, maybe even save money by saving energy, from some wishful-thinking environmentalists and bottom-up-modeling engineers.

According to economic models, the truth is in between. The practical voices of economists can be drowned out, to a greater extent than is true on many other subjects. Many people don't think of GCC as a subject for economists. This is especially true in other countries' governments, where the Environment Ministry and Foreign Affairs

Ministry have often been entrusted with the entire responsibility, as I found in 1996 when I began to work on this subject in the Clinton Administration. But we, the economics agencies in the government, did play a large role in developing the Administration's policy in 1996-98. (And, to be fair, most economists are not interested in GCC.)

One hears "Formal models are not useful, because they all say different things, depending on predilections of author." In fact, among mainstream economic models, variation in the answers is not fundamentally due to different assumptions about how the world works, but rather to the experiment being asked: What are the targets? How much advance notice do firms have? Is there international trading of emission permits? Are developing countries in the system? That different models give similar responses when the same question is being asked, is most easily seen when we focus on predictions of effects for the price of carbon (and therefore on prices of various forms of energy).

In the Administration Economic Analysis of July 1998, we explained the Kyoto Protocol to Congress and the public. The key bottom line of the economic analysis was as follows, in qualitative terms: *Given key elements of the Agreement and of Administration policy (including tradable permits and other flexibility features), the impact on the U.S. economy is likely to be modest.*

Those key features are of several sorts. The Administration insisted that the design of the agreement be market-based, flexible, and global. The flexibility comes in three categories:

<i>When flexibility</i>	C	1st-period reductions less drastic than some countries wanted
	C	targets phrased as multi-year averages
	C	banking
<i>What flexibility</i>	C	6 gases included, not just carbon dioxide
	C	sinks
<i>Where flexibility</i>	C	international trading in emission permits
	C	Clean Development Mechanism
		Finally, we require a global solution, to address a global problem:
	C	Without meaningful LDC participation, the President will not submit the Treaty for Senate ratification

Economic analysis of climate change policy is difficult for many reasons, which again fall into three categories.

- C It is impossible to put a single monetary number on the benefits of averting Global Climate Change. It is difficult enough to put numbers on the economic

costs of a 2-to-6 degree F increase in temperature. But that difficulty pales next to the uncertainties surrounding the appropriate discount rate, danger of catastrophic climate events, and appropriate risk aversion.

- C Some terms of the international agreement are still uncertain. (Perhaps the Sixth Conference of Parties in the Hague at the end of 2000 will help clarify some outstanding issues.)
- C Econometric models are subject to inevitable limitations. Some models are good at some things, other at others. No one model does it all. The estimates of each are subject to wide bands of uncertainty.

Despite these difficulties, we used some estimates based on SGM, a model that is well-designed (by Jae Edmonds and Battelle Labs) to handle international trading. The most important quantitative findings, supporting the qualitative finding that cost would be modest, were as follows.

- C Full and successful implementation of Annex I trading would reduce costs by one-half, relative to a situation where each country had to satisfy its commitment domestically. This shows why we think unrestricted trading is so important, and why we will fight European proposals for caps on trading.
- C Full and successful implementation of global trading (including developing countries) would reduce costs by 80-87%, again relative to the no-trading case. This illustrates one reason why we think that developing country participation is so important.
- C Global trading would reduce resource costs to an estimated \$7-\$12 b/yr in 2010, which is 0.1 % GDP in 2010. This is a cost that I would describe as, if anything, less than modest.
- C The effect on the price of carbon is estimated at \$14-\$23/ton.
 - C Δ price of natural gas = 3-5 %
 - C Δ price of fuel oil = 5-9 %
 - C Δ price of gasoline = 4-64 / gal.
 - C Δ price of electricity = 3-4 %
- C The effect on the energy bill of the average household is estimated at \$70-\$110

The SGM model, along with many other leading econometric models, participates in the Stanford-based Energy-Modeling Forum. The EMF's compilation of the results of ten of these models shows the SGM, the model that we used, in the middle of the pack of estimates of the costs of Kyoto, when standardizing on the policy experiment under consideration. The SGM's estimates of costs in 2010 are near the median, in the experiment with no international trading or in the case with Annex I trading. With full

global trading, SGM cost estimates are a bit below the median, but far from the lowest of the models.

In some respects, the CEA numbers I cited were optimistic, in other respects they are conservative. First, they are optimistic in the sense that we cannot in fact count on getting full developing-country participation in the near future. Nevertheless, the target-and-trade framework of Kyoto turns out analytically to be well-designed to appeal to developing countries, once they come to understand the economic and environmental advantages *to them* of joining. (See my Policy Brief, which explains how participation can be made advantageous to them, at <http://www.brookings.edu/comm/PolicyBriefs/pb052/pb52.htm>.) A few developing countries, such as Argentina, have responded to these arguments, breaking away from the others and accepting quantitative targets.

Second, the estimates assume full international trading, which the EU opposes. Without LDCs and trading, the costs will go up six-fold. Third, the estimates assume efficient implementation of domestic reductions through market-mechanisms. This to me means emission permits that are tradable (or its equivalent), for efficiency, with the permit requirement imposed upstream, for enforceability. If command-and-control methods were used instead, the resource costs would again be higher. Fortunately, the plan is to ratify and implement the treaty only with developing country participation, full international trading, and market mechanisms at home.

In other respects, the estimates were conservative. They omit some factors that would reduce the net costs of the agreement:

- C The Administration proposal for Federal electricity restructuring, part of its energy-and-environment policy, would save approximately \$20 billion in costs -- potentially enough to offset the increase in the household energy bill.
- C Allowance for sinks, such as land forestation, would potentially reduce the need for emission reductions substantially.
- C The President's 1998 proposal to allocate \$6.3 billion over the subsequent five years in Research and Development and tax breaks to develop and disseminate carbon-saving technologies could further reduce costs if it were enacted and if some of the technological payoff were to come in the next ten years. To be conservative, we assumed that it did not. (Much, though not all, of the first-year slice of this program was funded in the 1998 budget agreement.)
- C Ancillary non-climate benefits, such as the health benefits of reduced air pollution could reduce net costs by an estimated one-quarter.
- C Of course, the most important factor that has been left out of the above assessment is the benefit of mitigating climate change itself. A full cost-benefit analysis would include mitigation in the benefits column. The only reason we did

not do so, explained above, is the difficulty in coming up with a number to capture the monetary benefits. But nobody should lose sight of our ultimate objective -- keeping our planet the hospitable home that we enjoy today.

A popular question: "Isn't technology the solution?" My answer is "Yes," except that technology is not a policy instrument. We need to get the price of energy up to create the incentive for firms to develop and use new technologies. It doesn't help much, in a policy context, to argue that there are technologies not being currently used that potentially could save emissions and money at the same time. People need an incentive to pursue these technologies. Allow me to try out two analogies: individual weight loss and teen-age pregnancy. (1) To say that technology is the way to reduce carbon relative to economic output and therefore is the solution to GCC, is like saying that raising an individual's heart-beat rate is a way of burning calories and therefore is the solution to losing weight. The connection is true, scientifically. But raising heart-beat is not a policy instrument. Exercise is the policy-instrument, which works via raising heart-beat, and there is no quick-fix way around that unpleasant fact. (2) Technologically, we know at least one way of stopping teen-age pregnancy: birth control (abstinence would be just as good, except that it is not technological enough for my example). But teen-age pregnancy is a question of social behavior, not technology. People have to be encouraged or induced to use the technology -- forcing is too strong and persuading is too weak. Fortunately economics has an answer regarding the policy instrument to induce people to limit emissions of carbon dioxide that is clearer than in the other example. The most reliable instrument is the price of carbon dioxide. Forcing is too strong and persuading is too weak.

I will conclude with a consideration of the politics of GCC policy. There are five chasms that need to be bridged, for Kyoto or any agreement on climate change to be politically viable:

- (1) the chasm between the Congress, on the one hand, and environmentally-concerned scientists and citizens, on the other hand, regarding how genuine is the problem;
- (2) the chasm between the extent of popular concern, on the one hand, and popular unwillingness on the other hand to bear even a small increase in energy prices to address the problem. Most Americans do support action. A careful poll conducted by the Program on International Policy Attitudes found that "An overwhelming majority of the US public embraces the idea that global warming is a real problem that requires action." But support begins to diminish when costs are discussed, and to fall seriously if costs are said to rise above around \$30 per ton. The current adverse political reaction to the recent increase in world energy prices is instructive in this regard.
- (3) the chasm between the technology optimists (some engineers who say it can be done for free) and the pessimists. The realists (that is, we economists) are caught in the middle,
- (4) the chasm between American and European attitudes toward international trading of emission rights
- (5) the chasm between the United States and developing countries regarding the necessity of participation by the latter in any global plan to address global climate change. Both sides need to be educated to the virtues of a system whereby the developing countries are

assigned targets at “business as usual” (and lower than that in later budget periods) and then participate in international trade of emission permits. Such a system will benefit both those countries and the industrialized countries as well.

These five chasms are currently so wide that the viability of the Kyoto Protocol is in doubt. It is premature to give up on it, as many prominent economists did instantly. Whatever the treaty’s flaws, this is the framework within which the international deliberations will take place over the next few years. I am in fact prepared to argue that the most-feasible path to addressing global climate change runs through Kyoto. The political economy of regulation is most likely to work when emitters receive quantitative allocations first, and they are allowed to trade. (The political economy of a carbon tax, for example, is more difficult.)

In any case, if the US and other countries don’t take meaningful action soon, it will become too late to meet the Kyoto targets for 2008-2012. The energy sector of the economy simply cannot be turned around in five years. For this reason, the CEA estimates will soon be out of date. By the middle of the new decade at the latest, it will become obvious to all that the Kyoto emission targets for the end of the decade are no longer attainable -- much as it had become obvious by 1996 that the Rio targets for 2000 were no longer attainable. At that time it will be necessary to begin work on a new set of negotiations.

Even if the Kyoto Protocol is doomed, it will have made an important contribution to history. Such market-based features as international permit trading are essential to a sensible solution to the problem. I hope that these aspects of the Kyoto treaty will have become politically acceptable, or at least familiar, to the public, at home and abroad, by 2005. This will allow the hypothetical next treaty to build on the foundations of the current one, which is a good step in the right direction.