

GCC Trading Rules and Economic Analysis

10

Enclosures filed in
Oversize Attachments #

21607

NANT 18791

1/21/98 Asst Secy Mtg

-
- mechanism for private parties to obtain reparations for damages from other countries for selling bogus permits on spot or future mkt
→ futures mkt - rules discussed by Doniger would kill futures mkt.
- dealing w/ non-compliance: bwn rate (projected non-compliance)
buyer beware
- dealing w/ concerns @ compliance + hot air from EU:
make Russia de-rate their \$ from selling permits to CMC reductions (move to JI, make them do something)

Umbrella

3/9 Gore - Chernomydin - Russians want to hear from us soon
g. are we better off w/ umbrella or w/ US-R's bilateral
2^d week of March - OECD mtgs - trading big on agenda

Jonathan P. + Jon G. will work on paper on umbrella

paper on CDM passed around

3454 Treasury

Late December
Crisis mtg

analyses of target - paper

- sinks: definitions

scoring

- how do models deal w/ non- CO_2

IAT - rough MAC for non- CO_2 gases

bottom-up analyses at EPA plus some domestic sink

est. reductions @ \$75/ton

most controls for non- CO_2 are end-of-pipe

Impl. legislation must demonstrate meeting target could be
done domestically, feasible

avg pos: 418 } assumes AEO97
Kyoto: 463 }

check sinks in July 97 CAR

IPCC

sink - needs to include soils; what's in, what's out

how do we define sinks $\rightarrow$ how does it affect existing JI
agreements

$\rightarrow$ need certainty to get it to work

$\rightarrow$ group in Kyoto may have agreed that CDM is governed
under what is in Title 3

Use AEO98 #s, however same at EPA think EPA
hasn't appropriately scored CCA

1. get models fixed up
2. consistent baseline, US, all countries

Why does trading ↑ compliance

- 1) reduces total costs
- 2) borrowing penalty
- 3) political constituency to stay in compliance → those who hold futures

Westskog - see CSAB paper

- Rus + Ukr would distort prices
95 or (96) Energy I. 17(3) = 85

Westskog - Mkt Power + a system of CO₂ Quotas

OECD
Transaction costs + II

UNCTAD w/ Dick Stewart (NYU Law)
paper on legal issues + trading

UNCTAD + "Earth Council"
GHG Emissions Trading Forum
since '92

→ Papers since '92
effort w/ Maurice Strong + Sandoz
→ Dick Forister
Vice-Chair of one group

Frank Joshua point person @ UNCTAD
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Mar 13-15 London mtg. - Forister on agenda

• (only papers in book format

Combating Global Warming 92
Barnett, Grubb, Tietenberg, Sandoz

94 book: Tietenberg, Dudek

96 book: Wiener, + Phillippe Sandoz

- Legal Issues Presented by a

Pilot GHG Emis Trading System



UNCTAD would like to facilitate a mkt
educate LDCs

4 Nordic countries

Peter Bohm - trading among
→ simulation

"Trade in CO₂ Quotas Among 4 Nordic Countries"

3860	CYPRUS		1980	5295	
3912	YUGOSLAVIA		1980	5565	
3988	GREECE		1980	5901	
4021	MEXICO		1980	6054	
4040	USSR		1980	6119	
4085	BARBADOS		1980	6379	
4111	ARGENTINA		1980	6506	
4115	OMAN		1980	6521	
4177	IRELAND		1980	6823	
4195	PUERTORICO		1980	6924	
4220	SINGAPORE		1980	7053	
4253	IRAQ		1980	7242	
4283	SPAIN		1980	7390	
4287	VENEZUELA		1980	7401	
4323	GERMANYEAST		1980	7638	X
4360	ISRAEL		1980	7895	
4455	HONGKONG		1980	8719	
4587	JAPAN		1980	10072	
4596	UK		1980	10167	
4617	ITALY		1980	10323	
4623	NEWZEALAND		1980	10362	
4638	AUSTRIA		1980	10509	
4667	FINLAND		1980	10851	
4694	BELGIUM		1980	11109	
4710	TRINIDAD&TOBAGO		1980	11262	
4712	NETHERLANDS		1980	11284	
4716	BAHAMAS		1980	11305	
4719	DENMARK		1980	11342	
4745	ICELAND		1980	11566	X
4765	FRANCE		1980	11756	
4778	LUXEMBOURG		1980	11893	
4781	GERMANYWEST		1980	11920	
4797	NORWAY		1980	12141	
4822	SWEDEN		1980	12456	
4828	AUSTRALIA		1980	12520	
4845	BAHRAIN		1980	12724	
4918	SAUDIARABIA		1980	13750	
4939	CANADA		1980	14133	
4948	SWITZERLAND		1980	14301	
4982	USA		1980	15295	
5028	KUWAIT		1980	20018	
5036	UNITEDARABEMIRA		1980	31969	
5037	QATAR		1980	33946	
5039	VANUATU		1980		
5342	TONGA		1980		
5349	DOMINICA		1980		
5506	MONGOLIA		1980		
5675	BHUTAN		1980		
5936	GRENADA		1980		
6037	STKITT&NEVIS		1980		
6156	STLUCIA		1980		



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Environmental Policy Research***

*A Joint Center of the Department of Economics,
Energy Laboratory, and Alfred P. Sloan School of Management*

Greenhouse Policy Architectures and Institutions

by

Richard Schmalensee

MIT-CEEPR 96-008 WP

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Greenhouse Policy Architectures and Institutions

Richard Schmalensee¹

The IPCC Working Group III Report (IPCC (1996), hereafter "the Report") is a remarkable piece of work. It is little short of amazing that such a large group of authors and reviewers, operating under such stringent procedural and substantive constraints, could produce such a high-quality document. A policy-maker seeking guidance on the most useful things to do over the next few years could learn much from this Report about economic dimensions of climate change and about the design of efficient environmental policies in general. In aggregate, the Report does a very good job of providing a comprehensible overview of a lot of relevant intellectual territory, some of it no doubt politically treacherous. The exposition is usually clear and sometimes even elegant, and, while the Report is not fully internally consistent, the level of consistency attained is remarkable in light of the production process involved.

This said, however, I believe that a policy-maker seeking guidance for near-term actions would likely come away from the Report disappointed -- or, in the worse case, misled -- on some important issues. The main problem is omissions, not errors. The Report presents a great deal of information that would be useful to a climate czar making a once-and-for-all global policy

¹Gordon Y Billard Professor of Economics and Management, Massachusetts Institute of Technology. An earlier version of this paper was presented at the NBER Conference, "Economics and Policy Issues in Global Warming: An Assessment of the Intergovernmental Panel Report," July 23-24, 1996, in Snowmass, Colorado, and a very early version of portions of this essay was presented at an IPIECA workshop in Lisbon in November, 1993. I am indebted for financial support and intellectual stimulation to the MIT Joint Program on the Science and Policy of Global Change and to Jae Edmonds, Henry Jacoby, Bill Nordhaus, Eugene Skolnikoff, David Victor, and participants in the Snowmass and Lisbon meetings for thoughtful and useful suggestions.

choice, but there is no such czar, and the key near-term choices involve institutional designs and policy architectures, not particular policies. Moreover, the Report pays insufficient attention to the long-term consequences of possible near-term choices and fails to develop analytical points of which policy-makers should be aware.

The Report's discussion of policy issues necessarily reflects its authors' main assignment: assessment of the available literature.² The questions on which the Report concentrates – choice of policy instruments and of their optimal levels – are central to the literature on environmental economics and to the domestic policy debates that it mainly seeks to inform. As I argue in what follows, however, the arena in which climate change policy is shaped differs fundamentally from those in which domestic environmental policies are determined, particularly at this early stage in the international process. Moreover, the climate issue differs in important and perhaps fundamental ways from issues that have been addressed (with mixed success) by other environmental treaties. The authors of the Working Group III Report, and particularly the authors of Chapter 11 on "Policy Instruments," have naturally written more about what we know than about what we need to learn, but, unfortunately, the latter is presently more important. By describing important gaps in our knowledge clearly, the Report could have made a significant contribution to the intelligent determination of research priorities.

The assertion that the Report pays inadequate attention to issues related to the near-term policy agenda plainly rests on a particular view of that agenda. The next section outlines that view.

² It also reflects the Report's linkages with ongoing international negotiations, which seem fixated on mandating near-term emissions limits on a relatively small number of industrial nations (the so-called Annex I countries). As will become clear in what follows, I view this fixation as an unwise architectural decision.

The Climate Issue Today

There appears to be near-universal agreement regarding several key features of the climate change issue, most of which are developed by the Report.³ First, the relevant economic and physical processes operate globally and over decades rather than years. Most plausible emissions scenarios involve a significant human-induced increase in radiative forcing over the next century, with much of the increase coming from emissions of countries that are not now wealthy.⁴ Today's emissions will affect the chemistry of the global atmosphere for a century or more and, perhaps, affect climate for longer. Today's investments in research and in energy-sector capital will shape economic activities and affect emissions for at least several decades. Because these lags are very long, a range of current actions can be profitably thought of as having climate-related consequences that are to a first approximation irreversible. Few observers foresee substantial climate change for at least several decades, after emissions and atmospheric concentrations have increased substantially.

Second, important and probably long-lived uncertainties are ubiquitous. There are important unanswered questions involving the atmospheric chemistry of trace gases and aerosols, fundamental climatic processes, future emissions, future technologies, the costs of abating emissions, and the costs of adapting to climate changes. Despite the language of the Framework Convention on Climate Change, which calls for "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the

³ Schelling (1992) reaches broadly similar conclusions.

⁴ See, for instance, Alcamo, et al (1995) and Schmalensee, Stoker, and Judson (1995).

climate system," there are no known thresholds in that system, but I do not believe the existence of thresholds can safely be ruled out. Though emissions of many gases and aerosols apparently affect radiative forcing, significant uncertainties attach to the sources and effects of some of these emissions.

Third, the climate issue involves potentially huge stakes. On the one hand, the very survival of the human race depends on the earth's climate, so that experimenting with that climate seems mad. On the other hand, stabilizing atmospheric concentrations of greenhouse gases within a century or so, even at levels well above today's, is likely to be very expensive. It will almost certainly require reducing global emissions of carbon dioxide (CO₂) well below current levels.⁵ At the very least, since most anthropogenic CO₂ emissions are produced by combustion of fossil fuels, reducing global emissions would likely prevent today's poor nations from becoming wealthy using currently-known technologies. Reducing global CO₂ emissions substantially relative to trend would require transforming the energy systems of both developed and developing nations and, as Chapter 9 of the Report indicates, would likely involve annual costs on the order of several percent of world income. Such costs would dwarf those of eliminating CFCs from the global economy. The total direct cost of all current U.S. environmental programs, many of which are extremely controversial, comes to only about two percent of GDP. Agreeing to incur incremental costs of this magnitude without clear evidence

⁵ See, for instance, Richels and Edmonds (1995) and Chapters 8 and 9 of the Report. I am certainly not arguing that CO₂ should be the only focus of mitigation efforts, since it is not the only cause of the problem. On the other hand, CO₂ from fossil fuels is both the most important anthropogenic emission tending to increase radiative forcing and the source for which mitigation options are best understood; thus I believe that CO₂ is likely to be the main target of any serious mitigation policies adopted in the next few decades.

that *any* benefits will result also seems a bit mad -- particularly from the viewpoint of poor nations with more immediate environmental problems.

Fourth, analyses of globally optimal climate policies generally do not support imposing burdensome emission reduction policies over the next decade or so, though very stringent policies may be optimal thereafter.⁶ The basic argument is that to a first approximation damages depend on long-run cumulative emissions, and in the future we will know more about the consequences of our actions, we will have developed cheaper abatement methods, we will have had time to invest to prepare for their use, we will be wealthier, and we will have higher greenhouse gas emissions. This is of course not an argument for doing nothing today; in particular it is not an argument against developing technologies useful in abating greenhouse gas emissions or in adapting to climate change. But it is an argument for doing less to reduce current emissions than would be optimal if the world had to make a once-and-for-all policy choice.

Fifth, any serious program to control global emissions is almost certain to involve substantial international transfers, the pattern of which may change over time. As the Report (Section 2.4.2, p. 71) puts it, "International transfers, in one form or another, are likely to serve as both the building blocks of globally optimal action and the cement of global cooperation." This reflects international differences in marginal costs of abatement, with emissions reductions relative to baseline typically cheaper in poor than in rich countries (see Section 9.2.5.1 of the Report, pp. 353-343), as well as in willingness to pay for greenhouse gas abatement. In the latter connection, it is important to recognize that the identities of rich and poor nations will likely

⁶ Most of the relevant "integrated assessment" studies, which include Manne and Richels (1992), Nordhaus (1994), and Kolstad (1993, 1994), are discussed in Chapter 10; see in particular Section 10.5.3, pp. 368-88.

change, along with patterns of social and political differences, in ways that are difficult to foresee. Only a few decades ago the U.K. was among the very richest nations, after all, Korea was a dreadfully poor Japanese colony, and the Soviet Union was a rapidly growing Stalinist superpower.

Finally, whatever the merits of the case for doing so, there is currently little political support for devoting substantial resources to this issue, and there is no obvious reason to expect this to change any time soon. In the U.S., neither the Bush nor the Clinton Administration has yet gone beyond research and voluntary measures. While some other OECD nations have done more, and compulsory measures are under active diplomatic discussion as this is written, it is fair to say that no government has yet imposed burdensome restrictions on its own citizens in the name of climate change. Moreover, none have shown any serious interest in financing the massive North-South transfers that are likely to be necessary for a globally affordable transformation of the world's energy system.⁷ Poor nations, of course, generally refuse to allocate any of their own resources to the climate problem, in part because they generally have trouble finding the resources to solve environmental and other problems that are literally killing their citizens every day.

Climate change is a difficult issue for the world's political system. There is no world government, so individual nations will participate in climate-related activities, including

⁷ At the MIT Global Change Forum held in Oslo in May, 1996, during a discussion of the ongoing negotiations on emission limits for Annex I nations, it was suggested (not by the author) that perhaps negotiations should focus instead or in addition on the amount of money each rich nation would contribute to an international fund aimed at solving this problem, since any serious solution would clearly involve substantial North-South transfers. (This is consistent with Schelling's (1992, p. 14) suggestion that, "While the developing countries are feeling their way into some common attack on their own carbon emissions, a tangible expression of their interest and an effective first step would be to establish a permanent means of funding technical aid and technology transfer for developing countries, as well as research, development, and demonstration in carbon-saving technologies suitable to those countries.") One negotiator rejected this approach out of hand, and no one else even bothered to address it.

emissions control, only if they believe that the tangible and intangible benefits to them of doing so exceed the costs. Because the problem is global, unilateral emissions reductions would generally involve costs today and at most minuscule benefits ever. Because nations distrust each other and a round of broken emissions stabilization pledges will not help this,⁸ governments may be reluctant to spend resources to honor multilateral agreements. Because uncertainty is so high, of course, there is no guarantee that even global emissions reductions will yield any benefits. Under these conditions, refusal to go beyond symbolic actions is not surprising. As Skolnikoff (1990, p. 78) puts it, "...outside the security sector, policy processes confronting issues with substantial uncertainty do not normally yield policy that has high economic or social costs." Moreover, there is no obvious domestic constituency anywhere pressing for action on climate change, as distinct from other environmental issues.

All this seems to have clear implications for the near-term policy agenda. As uncertainties are resolved, and new ones are discovered, the perceived threat of climate change will almost change in importance over the next few decades. There is no guarantee that this change will be monotonic: we "learned" from models that the ozone depletion problem was not as serious as had been initially believed, before detection of the ozone hole refuted those models. A key task of current policy deliberations thus must be to seek inexpensive, politically salable actions that can be taken today to reduce the costs of substantial reductions in future emissions, should they become desirable.⁹

⁸ I believe that there is a good chance that Skolnikoff's (1990, p. 91) assertion on the eve of Rio that "A premature commitment to action can pose dangers of error and backlash and can incur costs that would affect a wide variety of interests" will turn out to have been prophetic.

⁹ I do not mean to suggest that an exclusive focus on abatement is appropriate, though the international policy process seems to have adopted such a focus. Logically, it is also important to see what can be done today to reduce the costs of adapting to future climate change.

Central to this task must be establishment of effective institutions for policy-making,¹⁰ as well as a policy architecture that permits efficient transitions between particular policies. When time is measured in centuries, the creation of durable institutions and frameworks seems both logically prior to and more important than choice of a particular policy program that will almost surely be viewed as too strong or too weak within a decade. Writing before Rio, Skolnikoff (1990, p. 92) captured the importance of process nicely:

Stringent policies to cut emissions may be politically impossible or even inappropriate today; but if they prove to be justified in the future, it would be of enormous value to have a clearer idea of the issues at stake, the policy alternatives, and a process for rapid response.

In the face of great uncertainty, robustness and flexibility are key to minimizing expected regrets,¹¹ and their achievement requires attention to institutional design rather than to policy details. This is not a call to do nothing, just as a call to focus on near-term emissions reductions is not necessary a call to take effective action; as the Norwegian Prime Minister, Gro Harlem Brundtland (1996), recently put it, "An ambitious short term emission reduction target without the introduction of long term practical policies does not necessarily imply a commitment to a long term global reduction strategy."

¹⁰ I hope it becomes clear in what follows that I am not simply calling for the adoption of a voting rule by the Framework Convention's Conference of Parties.

¹¹ In a world of uncertainty, all policies will normally generate regrets with positive probability, since there will normally be one or more states of nature in which another policy would have been better. Policies that have positive net benefits whether or not the climate problem turns out to be serious have been widely described as "no regrets" policies. I believe this terminology is misleading for two reasons. First, "no regrets" policies may impose unacceptable costs on some groups, even though they have positive net benefits in aggregate. These groups may profoundly regret adoption of "no regrets" policies. Second, if the climate problem turns out to be serious and only "no regrets" policies have been adopted, many regret that more was not done. It might have elevated the level of debate if the Report had made these elementary points or at least avoided use of "no regrets."

Developing Institutions and Architectures

I do not think the Report analyzes architectural and institutional issues in as serious and thorough a fashion as they deserve, and it thus pays insufficient attention to the development of “long term practical policies.” As Prime Minister Brundland (1996) has said, speaking of the Rio negotiations, “We knew the basic principles on which we needed to build: cost-effectiveness, equity, joint implementation, and comprehensiveness. But not how to make them operational.” In this section and the next I want to consider the Report’s treatment of two important operational issues: the importance of institutional and architectural design as against policy choice, and the implications of measurement and enforcement problems.

Much of the Report, particularly Chapter 11, is written as if the world were facing a once and for all policy choice. In this context, Chapter 11 considers command-and-control regulation, emission taxes, and tradable permit or quota regimes and comes down in favor of tradable quotas.¹² Presumably policy-makers are to deduce the fairest international allocation of quotas from the analysis of equity in Chapter 3. There a number of problems with this picture.

To start with, as Carraro and Siniscalco (1993) and Heal (1994) have emphasized, in the absence of a world government, substantive actions on climate change will be taken by sets of nations if and only if each nation believes it benefits on balance — taking into account international transfers and any intangible benefits from altruistic behavior. Though Chapter 2 of the Report does make this point in passing, the Report does not note that there is no reason to think that there is any relation between Chapter 3’s principles of fairness and quota allocations

¹² The Report usefully distinguishes between emissions quotas, allocated to governments and tradable only between governments, and emissions permits, initially allocated to governments but tradable between any parties to which governments allocate or sell them. This distinction is not important for my purposes, and I will refer to these regimes interchangeably.

that will induce widespread participation in abatement programs.¹³ Even if widespread participation is not an objective (as it does not appear to be at present), a political process is necessary to allocate quotas in any tradable quota system. When the stakes are substantial, it is generally difficult to explain political outcomes using simple philosophical principles. In the US, for instance, the allocation of tradable permits to emit sulfur dioxide among electric utilities cannot be explained by any simple principle or rule.¹⁴

The Report does not recognize the importance of political decision-making in this context, so it does not consider how a political process might operate to allocate tradable emission rights or what sorts of institutions might best facilitate its operation. This omission would not matter, of course, if the Framework Convention's Conference of Parties had already established an adequate institutional structure for this purpose. Since I believe it plainly has not done so, I think this omission is potentially important.

In fact, serious operational and political problems make it unlikely that the world will soon adopt anything like a serious (i.e., expensive) global system of tradable emissions quotas or permits.¹⁵ Thus the Report's concentration on the desirable properties of such systems seems to leave concerned policy-makers nothing constructive to do in the short run but to struggle against barriers to their adoption. Similarly, Chapter 11 seems to suggest that the only interesting research topics relate to implementation problems of these sorts of regimes. In fact, both policy-makers and researchers confront issues today that have implications both for menus of feasible

¹³ On this point, see Edmonds, Wise, and Barns (1995).

¹⁴ See Joskow and Schmalensee (1996).

¹⁵ Chapter 11 of the Report outlines some of these operation problems. For further discussion, see Chichilnisky and Heal (1995), Tietenberg and Victor (1992); see also Victor's (1991) argument that monitoring problems would currently limit any tradable permit scheme to CO₂ emissions from fossil fuel combustion.

future policies and for transitions to such policies. Moreover, the inevitability of multi-dimensional social, economic, and scientific change on the time-scales involved here makes once-and-for-all adoption of any particular set of climate-related control policies inconceivable.

At the simplest level, it seems almost inevitable that the optimal stringency of emissions control policies will change over time in response to changes in scientific knowledge and the development of new technologies. Thus, even though Chapter 11 appears almost exclusively concerned with once-and-for-all adoption of either a long-term emissions trajectory or of “hard” or “soft” abatement policies, such a decision would be both extremely unwise and almost certainly temporary. Any international climate regime that responds to new evidence and swings of opinion will change course over time, so an important near-term task is to establish institutions capable of doing this effectively and efficiently. If, for instance, it is decided (unwisely, I will argue) that the right policy architecture involves a focus on CO₂ emission limits, it follows that one must initially confront the institutional/constitutional questions of how and how often such limits are to be revised.

Questions of this sort, which are generally ignored by the Report, are far from trivial. While flexibility is a virtue, it is important to recognize that policy uncertainty inhibits desirable investment in new technologies and long-lived capital goods, so that stability is also a virtue. In the context of tradable permits, an unanticipated increase (decrease) in allowable emissions imposes capital losses (gains) on the holders of existing rights to emit. Similarly, unanticipated changes in fossil fuel prices alter the value of past investments in energy-producing and energy-using assets. Thus today’s policy choice creates winners and losers from an array of possible

future policy choices, and the effects of those interests will depend on the institutional/political structure within which future policies are chosen.

Joint implementation illustrates the likely complexity of future policy changes. When marginal abatement costs differ, global costs can in principle be reduced by international coordination of abatement policies. However, the U.S. experience with emissions trading programs demonstrates that substantial potential cost reductions may go unrealized when transactions costs are high. The current version of joint implementation, "activities implemented jointly" involves both high transactions costs and "trading" in undefined property rights. It thus seems very unlikely to produce noticeable short-term economic gain.¹⁶ On the other hand, attempts to reduce transactions costs and to clarify property rights may yield substantial long-term gains. And attempts to coordinate abatement policies serve to increase developing country participation in climate-related activities and to demonstrate the link between international cooperation and cost-effectiveness.

Similar issues are raised by shortcomings of current measurement technology. The Report (Section 11.7, p. 429) notes that "technology for accurately monitoring many sources and sinks of greenhouse gases has not yet been developed." Indeed, David Victor (1991) has persuasively argued that it may only be possible today to monitor CO₂ emissions from fossil fuel combustion with the reliability necessary for a tradable permit system. Since, as I discuss further below, it is hard to imagine any serious mitigation policy in which outcomes cannot be monitored, it seems likely that the only policy of this sort that could be adopted in the near future

¹⁶ On the U.S. experience, see Hahn and Hester (1989); for discussions of the potential of joint implementation and the steps necessary to realize it, see Torvanger, et al (1994), Selrod, Ringius, and Torvanger (1995), and Richards (1996).

would focus almost exclusively on CO₂ emissions from fossil fuels. But today's measurement problems will some day be solved, and we may learn that CO₂ is less important relative to other greenhouse gases than we now understand.¹⁷ The more comprehensive the coverage of trace gases in an abatement policy, all else equal, the lower its global costs. It follows that we need to establish policy architectures and institutions that permit changing the treatment accorded emissions of each of a long list of trace gasses.

Finally, it must also be possible to change the treatments accorded to different nations. It would be a great departure from history and from current growth projections if countries' relative incomes did not change markedly between now and, say, the middle of the next century.¹⁸ Thus to the extent fairness depends on relative incomes, burden-sharing arrangements that are fair today will surely not be fair in a few decades. Unfortunately, history, particularly the history of long-term economic forecasting, also teaches that it is essentially impossible to know how relative incomes will have changed over such a period. There seems to be widespread agreement now that China will continue to grow rapidly for some time, while Brazil's future seems more problematic. Not long ago, however, Brazil's prospects looked rosy, while China's seemed hopeless.

For these and other reasons, an institutional structure is required both to generate and to readjust political bargains as circumstances, inevitably, change, as well as an architecture that permits rational adjustment of policy choices over time. There is, perhaps, much to be learned from such institutions as the GATT (now the WTO), the ILO, and the OECD. The Report's

¹⁷ It is, of course, equally likely that we will learn that CO₂ is relatively more important than we currently believe.

¹⁸ For discussions of this point and its implications in the climate context, see Edmonds, Barns, and Ton (1993) and Edmonds, Wise, and Barns (1995).

near-total silence on these long-term issues seems likely to reinforce the unfortunate tendency of the diplomatic process to focus on "an ambitious short term emission reduction target" to the exclusion of "long term practical policies."

Monitoring and Enforcement

Much of the Report is written as if there were a world government capable of levying taxes, enforcing emission limits, and defending property rights.¹⁹ Thus chapter 1 (Section 1.3.4.3, p. 30) simply asserts that "In the absence of compulsory taxation, externalities can only be addressed with well-defined property rights ... and a legal system that enforces compensation for externalities" without seriously addressing the consequences of the absence of all of these elements from the current scene. All supranational discussions of climate change occur within the conventional framework of international law, within which compliance with treaty obligations is voluntary or, in some cases, enforced by limited sanctions. And there is no provision in the Framework Convention as it now stands for any use of sanctions to compel parties to meet their obligations. While it is conceivable that global institutions dealing with climate change could somehow come to exercise the sort of supranational authority that has been given to, say, the European Union, the enormous effort necessary to create the Union in a relatively small, culturally and economically homogeneous region indicates how very far away we are from anything like "compulsory taxation."

¹⁹ Indeed, one sometimes gets the impression that some sort of global climate czar is implicitly assumed. Thus, in discussing the effects of future carbon taxes, the Report notes (Section 1.5.5.5, p. 39), "If that were the only matter of concern, one could simply announce a commitment to impose such a tax sometime in the future..." Who could the "one" in this sentence possibly be?

The problem of inducing compliance with emission mitigation policies without the ability to impose sanctions is raised toward the end of Chapter 11 (Section 11.6.5, p. 426), only to be immediately dismissed:

Indeed, it is a fundamental norm of international law that treaties are to be obeyed, and as a rule countries do not negotiate, sign, and ratify agreements with the intention that they will not comply fully with all relevant provisions. Hence, compliance is not as great a problem as it is sometimes taken to be. More difficult are the problems of negotiating an agreement that requires real sacrifices by the parties and of getting countries to sign the agreement in the first place.

Two examples are discussed just below this asserted proposition, presumably in order to support it. Instead, they seem to cast serious doubt on its validity.

It is first argued that widespread noncompliance with the reporting requirements of the Montreal Protocol have arisen not from bad intentions, "but rather because [countries] did not have the resources and technical know-how needed to carry out their obligations." As even non-economists know, "I don't have the money," almost always means, "I have better things to do with the money." If half the signatories to the Montreal Protocol are willing to claim in public that they couldn't afford to meet the Protocol's reporting requirements, it does not take much imagination or cynicism to predict near-universal non-compliance with a climate protocol involving costs that are orders of magnitude larger. A history of partial compliance with low-cost environmental treaty obligations argues that compliance with any burdensome future climate-related agreements is likely to be very spotty indeed.

Second, it is noted that noncompliance with certain oil pollution treaties was solved when an equipment standard was adopted that made monitoring easy, and it is asserted in passing that "monitoring of international agreements may be the more important problem." This assertion is hard to dispute; one can only wish its implications had been explored. Most international

environmental agreements rely on self-reporting, and almost none are well-monitored.²⁰ And, as I noted above, it is at least arguable that for technical reasons only CO₂ emissions from fossil fuels can be reliably monitored today.

Of course, as long as there is little political support anywhere for spending significant resources to control greenhouse gas emissions, problems of monitoring and compliance are not a binding constraint on the policy process. If there is no effective pressure to act, barriers to action have no consequences. But if perceptions and the political climate change, failure to have dealt with monitoring and enforcement problems may suffice to block significant collective action to mitigate climate change. After all, the compliance problem is not merely that agreements will fall short of their stated goals, but that nations fearing noncompliance by others will not sign agreements in the first place.²¹

Part of the solution to these problems clearly lies in research on methods of measuring greenhouse sources and sinks. If the world is to have the option of adopting a significant, comprehensive program of emission mitigation in the future, it must at least be possible for nations to monitor each others' emissions. But an important part of the solution also lies in architectural and institutional design. Any serious abatement policy requires investment in collection of credible, internationally comparable data on sources and sinks. This, in turn, requires an institution with technical expertise, financial resources, and some degree of independence.

²⁰ See, for instance, Ausubel and Victor (1992) and U.S. General Accounting Office (1992).

²¹ The is but one reason why, in a world of poorly-monitored treaty compliance, it is a bit hard to take seriously the assertion quoted above that compliance is less of a problem than inducing nations to sign.

More importantly, I believe that even though the Report's acceptance, particularly in Chapter 11, of the importance of at least nominally fixing the level of greenhouse gas emissions in the short run reflects the current tenor of international negotiations, it is nonetheless unwise.²² Countries can almost always plausibly blame unexpected fluctuations in domestic output or world markets -- or the previous government -- for failure to meet fixed emissions targets. And, if only because there is a stochastic element in economic activity, and governments do change, it is difficult to imagine an international regime imposing sanctions tough enough to serve as deterrents on the basis of past violations of emission limits, particularly in the face of (nearly inevitable) promises to do better in the future.

Alternative Architectures

Because the Report does not seriously consider alternative institutional paths to strict global emission control regimes, it suggests that architectural issues of policy sequencing and dynamics are unimportant. This, in turn, tends to support simply doing the easiest tasks first. I believe that international negotiations are currently taking us down a path of this sort, with inadequate thought being given to where it is likely to lead.

The current focus of international negotiations is on achieving reductions in CO₂ emissions from fossil fuel use by industrialized (Annex 1) nations over the next few decades. In the summer of 1996, the U.S. joined other nations in calling for "legally binding" emissions

²² The Report asserts (Section 11.7.3, p. 431) that "the main advantage" of a tradable quota scheme over a carbon tax approach is that under the former "the resulting global emissions will be known with certainty for a global agreement and, net of carbon leakage for a nonglobal agreement." It is at least very optimistic to assume perfect compliance in the absence of sanctions, as this statement does, and it is absolutely unclear why, when incomes, technologies, abatement costs, climate processes, and impacts are uncertain, there would be some special value in making emissions certain even if one could do so.

limits.²³ It is not clear exactly what "legally binding" can mean in the absence of international enforcement, but the only way to guarantee that any nation's emissions do not exceed any particular limit is to use a system of tradable permits domestically. Presumably little will be accomplished until most Annex 1 nations are willing to impose such systems on their domestic energy markets; what will happen thereafter will depend on how seriously nations choose to take the limits to which they have subscribed.

The policy architecture implicit in this approach may be characterized as "deep, then broad," since any serious program of emission control must involve participation by developing as well as developed nations.²⁴ Unfortunately, it is not likely to be easy to broaden a geographically narrow tradable permits regime. In the first place, tradable permits regimes tend to be resistant to policy changes of any sort, since changes impose capital gains and losses on those with long or short positions in permits. In addition, as many studies have shown, any geographically limited regime would induce investment in CO₂-intensive activities in non-participating nations, and the owners of those investments would be new opponents of their nations' participation. The need to obtain their assent would increase the international transfers required to broaden participation. Unfortunately, little if any attention is now being paid to the institutions necessary to effect such transfers or, more generally, to produce efficient international allocation of abatement effort. As noted above, achieving such an allocation would require moving well beyond the current pilot phase of joint implementation.

²³ Statement of Hon. Timothy E. Wirth, U.S. Under Secretary of State for Global Affairs, to the Second Conference of the Parties to the Framework Convention on Climate Change, Geneva, July 17, 1996.

²⁴ It will also ultimately be necessary to broaden emissions coverage beyond CO₂ emissions from fossil fuel use, but I believe the problem of broadening in this direction does not differ in severity between the alternative architectures considered here.

Schelling's (1992, p. 13) reaction to commitments he anticipated that rich nations would make to specific percentage reductions in emissions points to an alternative architecture that I believe is superior on both environmental and economic grounds:²⁵

I cannot help believing that adoption of such a commitment is an indication of insincerity. A serious proposal would specify policies, like taxes, regulations, and subsidies and would specify programs (like research and development), accompanied by very uncertain estimates of their likely effects on emissions. In an international public forum, governments could be held somewhat accountable for the policies they had or had not put into effect, but probably not for the emission levels achieved.

As I interpret Schelling's comments, they point to a "broad, then deep" architecture. This alternative would place less stress on near-term emissions reductions, which are of relatively little importance over the long haul, and would concentrate instead on developing institutions to ensure broad international participation in emissions abatement, which is essential to any serious effort. "Deepening" would involve later tightening constraints on global emissions and, perhaps, developing the institutions necessary to give teeth to "legally binding" emissions constraints, when and if participating nations make a collective decision to do this.

In order to enhance participation in a "broad, then deep" approach, I believe attention should not initially focus on actual emissions, which are affected by many factors beyond governments' control. Instead, I would follow Schelling and adopt a hybrid between tax and tradable permit regimes. This hybrid would involve international review of government actions, as do proposals for harmonized greenhouse gas taxes, but, unlike those proposals, it would not prescribe the form of domestic emissions control policies. It would make participation more attractive by not forcing nations to choose between adopting tradable permit systems and risking

²⁵ To be clear, I do not believe that all nations that have adopted percentage reduction commitments have necessarily done so insincerely. A can be an indication of B without their being perfectly correlated.

involuntary violations of their treaty commitments. It would involve internationally negotiated emission targets, as do tradable quota or permit schemes. Negotiation would concentrate on maximizing participation at acceptable cost, not on implications of abstract notions of fairness, and targets would accordingly not burdensome on average in the short run. In order to provide policy flexibility, nations would demonstrate compliance by showing *ex ante* that their targets would likely be met rather than by demonstrating *ex post* that they were actually met.

The general approach of concentrating on *ex ante* evaluation of policies rather than *ex post* assessment of outcomes is not common in environmental treaties, but it has been employed to good effect by the OECD and the IMF, among other international organizations.²⁶ It also bears some resemblance to the administration of clean air policy in the U.S., which involves federal review of state implementation plans that link planned actions with achievement of air quality standards. It is in any case much easier to hold governments accountable for current policies than for past emissions, since the latter depend on policies in effect and random shocks occurring in the past.²⁷

Key to this hybrid approach, of course, is the ability to relate a nation's current policies to its likely future net trace gas emissions. This requires developing both data sources and modeling capabilities, as both the OECD and the IMF have done. If international public opinion is to be the main enforcement agent for the foreseeable future, and I believe this is likely to be the case, public opinion should be well and credibly informed by, at least, able and objective

²⁶ For an insightful discussion of this approach and of the importance of developing data and expertise (along with a critique of the current "targets and timetables" approach), see Victor and Salt (1995).

²⁷ Largely for this reason I would favor an international carbon tax over a tradable permit or quota scheme, had I not been convinced by Chapter 11 that the carbon tax involves more serious implementation problems.

audits of national emissions forecasts. Developing an international institution capable of predicting individual nations' greenhouse gas emissions with accuracy comparable to, say OECD predictions of national inflation rates is a difficult task, but, I would argue, an important one.

Both the "deep, then broad" and "broad, then deep" architectures imply feasible short-run agendas. The latter would build information, institutions, and international participation that have considerable insurance value, while the former would have difficulty moving beyond limited abatement efforts in a few nations. The hybrid approach described above would prepare the ground for more stringent policies, should they turn out to be justified. An important challenge would be to make this approach consistent with effective international cooperation involving both equitable burden-sharing and equalized marginal abatement costs. At the very least, it is hard to see the case for adoption of a "deep, then broad" architecture based on tradable permits without any serious analysis of "broad, then deep" architectures or other alternatives.

Some Additional Issues

The Report's discussion of several issues not mentioned above could have been more useful to policy-makers. First, and in some ways most important, is the Report's failure to point out the inconsistency between the cost-benefit approach and the objective specified in Article 2 of the Framework Convention:

... to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The first and more quoted of these sentences presumes the existence of a threshold level of greenhouse gas concentrations, above which lies danger and below which lies safety. It seems to me that the charge to explore the use of benefit-cost analysis to inform climate change decision-making carries with it the requirement to consider the consistency of such analysis with the climate change objective that has been adopted by the international community. Since I have seen nothing suggesting the existence of a meaningful concentration threshold, I suspect this Emperor has no clothes. One could argue that the Report says as much, implicitly, by discussing the assessment of costs and benefits elsewhere instead of the existence or measurement of thresholds, but straight talk would have done much more to elevate the level of debate.²⁸

The second sentence quoted above seems to involve thresholds relating to rates of change of atmospheric concentrations. It appears to be presumed that ecosystems and food production can adapt without harm to rates of change below some level, while economic development will not be adversely affected if emissions and thus rates of change are (at least temporarily) above some level. The presumption that these goals are not inconsistent requires that the second of these thresholds is above the first. Again, nothing I have seen in the Report or elsewhere that justifies any of these presumptions. If the Convention's objectives require policy debates to be somehow driven by unknown and probably imaginary thresholds, policy-makers should surely be told this. The high cost of a serious mitigation program could be substantially increased if it must be erected on an unsound conceptual foundation. On the other hand, if the Convention's

²⁸ Similar problems have arisen in other contexts, of course. U.S. Clean Air legislation rests on the assumption that there are threshold atmospheric concentrations of "criteria pollutants," below which human health is protected "with an adequate margin of safety." Limitations of measurement typically make it possible to find concentrations below which no health effects have been detected and, generally with a straight face, to identify those as the sought-after thresholds, but there is little support for the idea that such thresholds actually exist. See, e.g., Portney (1990, pp. 31-36)

stated objectives were not intended to be taken seriously, IPCC Working Group I's much-publicized analysis of stabilization at alternative concentration levels was largely wasted effort.

Second, the Report almost completely ignores the non-trivial scientific/economic problem of how to compare emissions of different greenhouse gases for the purpose of designing policy.²⁹ In the cost-benefit framework, comparisons of emissions of different gases at the margin must logically be based on discounted net damages. This basic principle implies that the GWPs computed by Working Group I and endorsed by the IPCC have no logical foundation or value for policy-analytic purposes. If this principle is ever stated (or disputed, for that matter) in the Report, I missed it.³⁰ Certainly, the Report does not attempt to apply this principle. It thus ignores an economic question that is central to the design of the comprehensive, multi-gas policies mandated by both the Framework Convention and common sense.

Third, the Report also pays insufficient attention to analytical issues raised by North-South resource transfers. At several points the Report does note both the likely importance of such transfers in any substantial mitigation effort and the difficulty of effecting them; e.g., Section 2.4.2, p. 71:

Nevertheless the political and managerial difficulties surrounding such transfers need to be understood and respected by all parties if the process is not to collapse into an unproductive struggle over resource transfers.

Unfortunately, "the political and managerial difficulties" are not spelled out, nor are any related economic issues examined. Chapter 11 considers the potential role of carbon taxes or allocations

²⁹ For treatments of this problem, see Hammit, et al (1996), Kandlikar (1995), Reilly and Richards (1993), Schmalensee (1993). The last of these papers is cited in passing in Chapters 1 and 11.

³⁰ The closest the Report seems to come to such a statement is to note (Chapter 1, note 8, p. 41) that Schmalensee's (1993) criticisms of GWPs would be immaterial "if all greenhouse gases had the same rate of decay." But, of course, they don't.

of tradable quotas or permits in effecting transfers, but the discussion stops short of providing any useful guidance -- or even indicating whether such guidance can currently be provided.

Finally, the Report properly notes at several points that because of the long time intervals involved, the development of new technologies has the potential to reduce dramatically the ultimate costs of both mitigation and adaptation policies. And at several points the Report goes to argue for increased government spending for basic and near-basic research as insurance against the need to adopt stringent climate-related policies in the future. Most integrated assessments similarly conclude that near-term policies should include acceleration of the development of technologies that would be useful in connection with such policies.

But advances in basic research do not generate new commercial technologies without considerable additional investment, and it is not clear how, if at all, governments can usefully enhance this critical stage of the innovation process. As the Report (Section 1.5.4, p. 37) correctly notes, "...there is a general consensus among economists that the patent system provides a better basis for financing applied research than do government grants, largely because of the difficulties government has in picking those innovations most likely to produce high returns." U.S. experience appears consistent with this consensus.³¹ Thus we have a potentially important and difficult question that the Report ignores: How can governments most efficiently encourage the development of new technologies that will reduce future abatement and mitigation costs? A related set of ignored questions have to do with efficient policies to enhance North-South technology transfer.

³¹ For an overview in the context of energy supply technologies, see Schmalensee (1980). Few observers would claim that the U.S. government's large investment in research on those technologies has yielded competitive returns.

In a recent paper, Grubb, Chapuis, and Duong (1995) argue that a good way, perhaps the only good way to encourage development of energy-saving technologies is simply to raise the price of energy. Thus they argue that recognition of induced innovation tends, for instance, to raise optimal global carbon taxes. An interesting question in this context is whether or not slightly higher energy prices tend to accelerate development of technologies useful at much higher energy prices. It seems at least plausible that slightly higher prices would call forth incremental improvements, while the best response to much higher prices would be to investigate radical departures from current technologies. If this is true, the insurance value of feasible induced innovation is limited, and the search for alternative, relatively efficient approaches to encouraging the development and deployment of efficient, greenhouse-friendly technologies becomes more important.

Concluding Remarks

On the whole, the IPCC Working Group III Report is a very impressive document that clearly embodies many, many hours of hard and competent work. It presents much useful information on the economics of climate change, and its discussions of cost-benefit analysis and the principles of cost-effective environmental policy should be required reading for policy-makers with a wide range responsibilities. Its generally negative evaluation of traditional command-and-control approaches to environmental policy should be read closely by those advocating adoption of common standards of various sorts by Annex I states.

On the other hand, the Report does not cover in adequate depth some issues that are important to near-term decisions. Considerable attention is devoted to hypothetical once-and-

for-all policy choices that are not on the table, while the longer-term implications of current decisions are largely ignored. While the Report does note that the stringency of optimal abatement policies are likely to vary over the next several decades, the implications for institutional and architectural choice are not explored. The Report understates the importance of monitoring and enforcement problems. It is written as if a comprehensive global tradable permits regime were a live policy option instead of possible but distant goal. It ignores the value of building global participation and climate-related institutions and accepts the myopic focus of current international negotiations on (relatively) short-term reductions in emissions from industrial nations. To be clear, all these gaps mirror shortcomings in the existing literature, but that does not make them less important.

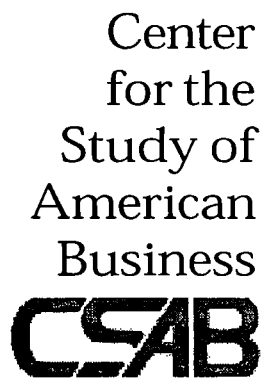
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***Designing Global Climate Policy:
Efficient Markets versus
Political Markets***

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CENTER FOR THE STUDY OF AMERICAN BUSINESS

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Contents

Executive Summary	1
Cost-Effectiveness	1
Global Coverage	2
Implementation	2
Politics	3
Introduction	4
The Challenge of Climate Change Policy	6
Global Impacts	6
Global Emissions Sources	7
Varying Costs and Benefits	8
Uncertainty About Costs and Benefits	9
International Legal Rules and Institutions	10
The Efficiency of Climate Policy Design	11
"Policies and Measures"	12
A Quantity Constraint (Targets or Caps)	14
Inflexible: National Caps	14
Flexible: Allowance Trading, JI, and Banking	14
Spatial Flexibility	15
Temporal Flexibility	16
Quantifying the Advantages of Flexibility	17
A Price Constraint (Taxes)	21
The Politics of Climate Policy Design	23
The Coalition in Favor of Efficient Policy Design	24
The Coalition Against Efficient Policy Design	25
Market Defects	25
Morals	28
Fairness	29
Social Engineering	31
Stringency Gaming	32
Rent-Seeking	32
Applying the Hypotheses	33
Europeans' Opposition to Trading	33
Developing Countries' Opposition to Trading	35
Conclusion	38
Table 1: A Hypothetical Example of Gains from Tradeable GHG Allowances Conclusions	42
Notes	43

Executive Summary

Countries meeting in Rio de Janeiro in the summer of 1992, in Berlin in the spring of 1995, and now in Kyoto, Japan, in December 1997 have struggled with the question of how best to respond to potential global climate change. Although the news headlines have centered on *how much* control of "greenhouse gas" emissions countries would undertake in a global treaty, an equally crucial issue is the choice of *how to* control emissions under any such treaty — the choice of "policy design" or "regulatory instrument" embodied in the terms and structure of the global legal regime.

Greenhouse gases (GHGs) include carbon dioxide (CO₂), methane (CH₄), and several other trace gases that trap heat in the earth's atmosphere. The set of regulatory instruments that might be used to control GHG emissions in an international treaty includes: internationally harmonized policy measures; uniform emissions reductions by each country; emissions reductions by each country with the flexibility to trade units of emissions abatement across countries (tradeable allowances); and coordinated emissions taxes.

Cost-Effectiveness

Flexible regulatory instruments such as a market-based system of tradeable emissions allowances can help mitigate the conventional dilemma of costs versus environmental protection — achieving more environmental protection and more innovation at less cost than the alternatives. Experience with national environmental regulation such as the control of SO₂ emissions to combat acid rain provides some basis for optimism about the efficiencies to be gained from an emissions trading program. Studies suggest that an international market-based system of tradeable allowances could achieve a given level of GHG emissions control at global cost savings of 50 percent or more compared to inflexible quantity controls. A trading system also would stimulate greater innovation and diffusion of lower-emissions technologies and practices. Allowance trading appears even better suited to GHGs than to control

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of SO₂, because of the relative absence of local environmental impacts (hot spots) and because of the very wide range of GHG emissions abatement costs across countries, increasing the “gains from trade.”

Global Coverage

At the international level, the choice of regulatory instrument confronts an additional factor not ordinarily critical at the national level — participation. Whereas national environmental regulation is adopted by majority rule and, therefore, can bind dissenting interest groups and geographic regions, at the international level each country can be bound only by its voluntary assent. Thus the choice of policy design at the international level must pay acute attention to the incentives it creates for, or against, participation by sovereign nation-states. Without participation by developing countries, a climate treaty might reduce emissions in wealthy countries only to see emissions increase in developing countries. This, of course, would thwart the environmental objectives of the treaty at significant economic cost to industrialized nations (and deter initial action by wealthy countries who fear this very result).

Harmonized policies, uniform emissions controls, and coordinated emissions taxes would offer no direct incentives to developing countries to join the treaty. But a system of allowance trading would attract participation by developing countries which could earn profits from selling emissions allowances (and, at the same time, it would ease the costs of participation by wealthy countries). Because virtually universal participation in any climate treaty will be essential to its environmental and economic success, this coverage-expanding feature of a market-based regulatory instrument for GHG control is of enormous importance.

Implementation

Proposals for an efficient market-based policy design to control GHG emissions have not earned universal acclaim. Some doubt the ability to initiate, monitor, manage and enforce an international emissions trading market to ensure real reductions in global GHG emissions. These concerns apply generically to *any* policy that would constrain emissions, with or without trading; and a market-based policy would actually ease these concerns somewhat. Other concerns — about transaction costs, market power, and nation-state meddling — are germane to an international market-based system. These concerns would need to be addressed in the design of an international allowance trading system.

Politics

The more worrisome problem is that adoption of *efficient markets* for GHG emissions control may be blocked by the distortions present in *political markets*. Individual countries and interest groups may favor globally inefficient policy designs that would, nonetheless, be more to the liking of these interests. Persuading the world that market-based policy designs are efficient may be of little help in surmounting the coalition of interests arrayed against efficiency.

Some may oppose GHG allowance trading because they advance moral and fairness objections to trading pollution allowances. Yet, such a system could offer both improved pollution control and improved relative economic standing for poorer countries. Others may oppose GHG allowance trading because their real agenda is social change in industrialized countries, not cost-effective protection of the global climate. And others, worrying that allowance trading could invite too little, or too much, stringency in the control of GHG emissions, may be pursuing their concerns about the optimal stringency of control by a flank attack on the regulatory instrument for control.

Most interesting, and most troubling, is the possibility that certain industry and national interests may benefit from an inefficient GHG emissions control policy that hurts them a little while it much more substantially raises their economic rivals' costs. Industrialized countries with low domestic emissions abatement costs might be opposing global allowance trading because it would enable their rivals with high domestic abatement costs to purchase equally low-cost abatement services worldwide. An inflexible control regime might be globally inefficient, but it could be an effective weapon for rivalry among competing countries with varying costs of abatement. This strategy of "predation through regulation" might explain some of the observed opposition from industrialized countries to a global market-based policy design, and the preference of these countries for allowance trading only among industrialized countries.

In a related vein, diplomats from both developing and industrialized countries might oppose allowance trading because they feel better able to control official centralized government aid. They may even feel their power base threatened by a system that would empower the decentralized decisions of market actors.

Thus, the problem is not just that policymakers must weigh how much to protect the climate and that they must choose the most efficient policy design for how to protect the climate, but also that efficient market-based policy design must do battle in the *po-*

litical marketplace. Efficient climate policy requires developing not only an efficient policy design, but also a political constituency for efficiency.

Introduction

At the Earth Summit in Rio de Janeiro in 1992, virtually all of the world's countries signed the Framework Convention on Climate Change (FCCC), establishing the basic blueprint for global collective action to manage the threat of the greenhouse effect.¹ The FCCC called on industrialized countries to take actions to limit their emissions of "greenhouse gases" (GHGs), such as carbon dioxide (CO₂), methane (CH₄), and other gases, with the aim of keeping these emissions no higher than their 1990 level in the year 2000.² Developing countries are also obliged to take measures to limit emissions, but with no quantitative goal.³

In 1995, the governing body of the parties to the FCCC met in Berlin and announced a plan to negotiate a more rigorous constraint on GHG emissions, particularly for the period after the year 2000. The agreement envisioned in this "Berlin Mandate" was to be adopted at the parties' meeting in Kyoto, Japan, in December 1997.⁴

Throughout these negotiations, a crucial issue has been the choice of "policy design" for the treaty — what kind of legal structure would be created, and what impact that structure would have on key outcomes such as costs, environmental effectiveness, incentives, innovation, fairness, participation, trade, and related matters. This paper does not attempt to resolve the scientific controversies surrounding global warming. Thus, it does not consider such questions as whether GHG restraints would have a worthwhile impact on global climate. It assumes that restraining GHG emissions may become an important international commitment, and examines policy alternatives for meeting that objective.

Whatever overall target is set for how much climate protection is warranted, a variety of policy designs could be employed to achieve that goal — each with its own set of advantages and disadvantages. Experience with domestic environmental regulation has shown that the choice of policy design has an enormous influence on these key outcomes just noted. Smart policy design can help mitigate the conventional dilemma of costs versus environmental protection — achieving more protection at less cost than old style uniform control policies.

In the late 1980s, proposals for a global climate change re-

gime centered on command-and-control requirements to mandate specific, uniform fixes in specific sectors of the economy. New climate policy proposals were introduced by the United States in late 1989, and by Norway about a year later, to employ more flexible, performance-oriented policy designs — such as tradeable emissions allowances and emissions taxes — that provide incentives to reduce emissions in the most cost-effective ways. In 1992 the FCCC endorsed an informal version of tradeable allowances, dubbed “joint implementation” (JI), in which countries (or their private sector actors) can reduce global GHG emissions via projects outside their national territories.⁵

A system of joint implementation could protect the global climate most effectively at least cost, stimulate innovation, and mobilize the resource and technology flows to developing countries.

As negotiations toward a binding constraint on emissions have gathered steam in the last three years, interest has intensified in the design of efficient policy instruments, such as a formal system of tradeable emissions allowances. Such a system could protect the global climate most effectively at least cost, stimulate innovation, and mobilize the resource and technology flows to developing countries that will be crucial to engaging those countries in avoiding rapid future emissions growth.

In preparation for the Kyoto meeting, the United States has officially proposed that a formal international system of tradeable emissions allowances be incorporated into the climate treaty.⁶ Over 2,000 economists, including several Nobel laureates, have signed a statement endorsing this general approach.⁷ Despite their attractiveness, these proposals for efficient market-based policy design have not earned universal acclaim. Concerns have been raised about the ability to initiate, monitor and manage an international emissions trading market to ensure real reductions in global GHG emissions — concerns about allocating allowances, deterring free riders, preventing cross-border emissions “leakage,” establishing “baseline” forecasts of business-as-usual emissions, and monitoring compliance.

These concerns, however, apply generically to *any* policy that would constrain emissions. When compared to an emissions limitation policy that did not employ flexible market-based incentives,

a market-based policy would actually ease these concerns. Other concerns — about transaction costs, market power, and nation-state meddling — are germane to a market-based system, and need to be addressed in its design.⁸

The more worrisome obstacle to the adoption of efficient policy design for climate change is the *political economy* of global regulation: individual countries and interest groups may favor inefficient policy designs that would cost global society but would be more to the liking of these interests. Persuading the world that market-based policy designs are efficient may be of little help in surmounting the coalition of interests arrayed against efficiency.

The problem is not just that policymakers must weigh efficient versus inefficient policy designs, but that efficient market-based policy design must do battle in the political marketplace. Efficient climate policy requires developing not only an efficient policy design, but also a political constituency for efficiency.

The Challenge of Climate Change Policy

Whether or not a major new climate accord is reached at Kyoto, the complex and difficult issues of global climate policy will be a defining challenge of the post-Cold War era. The stakes in global climate policy — including ecological and human health, prosperity and poverty, trade competitiveness, technological change — are probably the largest of any environmental policy issue. Rapid and significant global warming might yield damages that dwarf those caused by traditional environmental policy problems like regional acid rain and local habitat loss. But rapid and significant curbs on GHG emissions could also yield social costs that dwarf those imposed by traditional environmental laws.

Agreement on global climate policy is so difficult because the issues are so complex, the impacts of policies are potentially so large and so unevenly distributed, and the costs of erring in any direction are very high.

Global Impacts

The impacts of GHG emissions are essentially global. Each molecule of carbon dioxide (CO₂) — the most abundant GHG — emitted anywhere on the planet has essentially the same global effect on the heat-trapping ability of the earth's atmosphere. The same is more or less true for most of the other major GHGs.

Hence, in contrast to pollutants like airborne toxic substances, there are essentially no local "hotspots" of environmental impacts caused by higher local GHG emissions. The global impacts of re-

ducing GHG emissions are independent of where the emissions abatement takes place.

One implication of globally spread impacts is that the atmosphere is a global open-access resource, and its protection is a global “public good.” A given GHG abatement effort has global environmental impacts that everyone shares, and no one can be excluded from sharing the benefits of abatement (indeed, the individual abater is likely to receive only a tiny fraction of the global benefits of her abatement efforts).⁹ In addition, the costs of abatement would be borne today while the benefits would largely accrue to future generations. Thus, if GHG abatement is costly to the provider of that abatement, it is highly likely that private markets and individual countries — absent some kind of international co-operation — will invest in substantially less GHG abatement than would be desirable from a global collective point of view.

This is a straightforward implication of the theory of the “tragedy of the commons.” Each individual country would prefer to avoid the costs of abatement while enjoying the shared benefit of others’ abatement (to “free ride”). If all countries adopt this strategy, there will be an undersupply of abatement effort.¹⁰ If so, without some collective constraint on use of the open-access resource, it will likely be overused — in this case, overloaded with GHGs.

Global Emissions Sources

The sources of GHG emissions are globally dispersed. In every country, virtually every human activity directly or indirectly emits GHGs: fossil fuel and biomass combustion, leaks from natural gas pipelines and coal mines, clearing forests and grasslands, wet rice farming, raising ruminant animals such as cattle and sheep, using nitrogen fertilizers to grow crops, disposing of wastes in landfills, manufacturing nylon, etc. All countries have opportunities to emit GHGs. They also have opportunities to reduce GHG emissions, especially given the opportunity to expand GHG sinks, such as forests, which remove GHGs from the atmosphere.

Although most GHG emissions currently emanate from wealthier countries, over the next three decades the balance is forecast to shift to poorer countries, where emissions are currently growing much faster than in wealthy countries.¹¹ Moreover, constraints imposed on some but not all countries could induce GHG-emitting activities to shift to unconstrained countries — the problem of cross-border “leakage.”

Leakage may result in the short term because reduced demand for energy (or reduced supply of timber) would change world

market prices and increase the quantity of energy consumed (or timber harvested) elsewhere. In the longer term, leakage would occur because businesses could relocate to unconstrained countries.

Thus, a climate treaty must be nearly universal in breadth if it is to avoid competitiveness distortions, and to accomplish effective global environmental protection. The competitiveness concern appears to be motivating the U.S. Senate to oppose ratification of any treaty that does not bind developing countries as well.¹² The environmental downsides of "leakage" could warrant nearly global coverage even if there were only minimal competitiveness effects. Thus the policy design adopted in the climate treaty must find a way to maximize coverage of both industrialized and developing countries.

Varying Costs and Benefits

The costs and benefits of GHG emissions abatement vary widely across countries. Abatement costs vary because national differences in technology and economic structure (among other factors) make avoiding future emissions much less costly in some places than in others. One study found a 50-fold difference in GHG abatement costs just within the membership of the European Union.¹³ Variation in abatement costs across the entire world, including developing countries, Eastern European countries, and the Former Soviet Union, as well as industrialized countries, is likely to be much greater. This variation in abatement costs implies that, just as with all sorts of other goods and services, there is comparative advantage and thus gains from trade in GHG abatement services.

Abatement benefits also vary because, although the climatic effects of GHGs on the atmosphere are spread globally, countries vary in the physical damage that a given increment of climate change would induce. Some countries may be particularly vulnerable to sea-level rise, storm surges, changes in precipitation, and changes in ocean circulation and monsoon patterns. Other countries may be more resilient or might even stand to gain from some global warming (e.g. colder countries where growing seasons could expand in a warmer world).

Countries may also vary in how much value they place on avoiding equal physical damages due to climate change. For example, wealthier populations might be more inclined to invest scarce social resources in climate protection than might poorer populations struggling to address other more immediate priorities for survival and prosperity.¹⁴

Thus beneficiaries of climate protection may need to offer side payments to induce cooperation by countries uninterested in, or averse to, limiting GHG emissions. "International transfers ... are likely to serve as both the building blocks of globally optimal action and the cement of global cooperation."¹⁵

Uncertainty About Costs and Benefits

Climate policy is surrounded by enormous uncertainty. There is great uncertainty about the rate and impacts of climate change (and hence about the benefits of climate protection policy). There is also great uncertainty about the costs of emissions abatement. "Top-down" macroeconomic models tend to show high costs of GHG control; "bottom-up" technology-based analyses tend to show low costs or even long-run benefits.¹⁶

Because of the enormous uncertainty about the benefits and costs of emissions abatement, the optimal (net-benefit-maximizing) constraint on emissions is very incompletely characterized. Some argue that the optimal near-term climate policy, in light of such uncertainty, would be to impose no immediate constraint on emissions, but rather wait a decade or so while gathering further information and building institutions for adaptive decisionmaking.¹⁷ Hasty adoption of climate policy under great uncertainty could yield "dangers of error and backlash"¹⁸ — policy mistakes that undermine the long-term effort to prevent possible undesirable climate change.

It may even be that the impacts of gradual near-term global warming would be innocuous or even benign.¹⁹ Longer term or rapid global warming, however, might cause substantial damages.²⁰ Some also point to the "supplementary benefits" of GHG emissions control, such as reductions in urban ozone (smog) and sulfur particulate pollution as fossil fuel combustion is reduced.²¹ But a complete analysis requires equal attention to the problem that the reduction in GHGs and associated changes in other pollutants could also cause "supplementary harms" (countervailing risks), such as reduced CO₂ but increased CH₄ from natural gas leaks, or the risks of non-fossil energy sources.²²

A full analysis of the optimal GHG emissions constraint is well beyond the scope of this paper, nor is it the point of this paper. The point here is to analyze the choice among policy designs to implement a climate policy ("how to" control GHGs), not the optimal degree of policy stringency ("how much" to control GHGs). If no constraint is warranted, the choice of policy design is moot. But if some limits on emissions might be warranted — or if they might

be adopted by diplomats, regardless of what economists advise — then the choice of policy design is crucial.

International Legal Rules and Institutions

The international institutional context is different from the legal institutions for environmental policymaking under national law. The decision-making rule is quite different. There is no majority rule in international law. In general, a country can be bound by the terms of a treaty only if the country agrees to become a party to the treaty.

International treaties are thus more analogous to negotiated multiparty contracts than to majority-vote legislation.²³ Each party's cooperation depends on its perception of its own gain, which in turn depends in part on its perception of whether other parties are likely to keep their end of the deal. Cooperation is essential and delicate.²⁴

An international climate change treaty must be not only collectively attractive, but also individually attractive to every signatory.

This institutional arrangement prevents any sovereign nation from being bound by an international law from which it dissents. But it also enables each nation to act as a holdout, insisting on conformance to its interests as the price for its assent. And uncertainty about others' likely cooperation may induce widespread non-cooperation (free riding) even though all would be better off under a cooperative regime.²⁵ As a result, an international climate change treaty must be not only collectively attractive (improving global well-being), but also individually attractive to every signatory (improving each nation's well-being).

The voluntary assent voting rule inhibits the "tyranny of the majority," but it also makes international treaties difficult to negotiate. It reduces the costs imposed on dissenters, but increases the costs to the group of taking any action.²⁶ It enables the "tyranny of one" — each nation whose cooperation is needed can hold up and distort the entire treaty.²⁷ The costs to the entire group of negotiating a consensus treaty are high both in terms of the opportunity cost of the time and effort needed to craft a successful consensus, and in terms of the collective gains foregone when individual countries object on parochial strategic grounds.

Meanwhile, in order to encompass all GHG emissions sources and to prevent “leakage,” as noted above, climate protection warrants nearly universal global breadth of treaty coverage, at least of present and future major emitters. Achieving universal coverage under a unanimous assent rule requires a policy design that attracts widespread voluntary participation by sovereign nation-states.

Meshing an international climate treaty with the diverse legal cultures of the participating countries will be a significant challenge. An international climate treaty will cover numerous countries with varying national interests, different legal systems, and diverse cultures. Their interests in environmental protection and in other social priorities will vary widely. Many countries important to a climate treaty may have legal and cultural traditions that are less “market-friendly” than are U.S. norms. Even in the United States, environmental law has only lately begun to shift from central planning to market-based approaches.

The Efficiency of Climate Policy Design

Several different policy designs might be adopted in global climate change policy. Each would have different consequences for efficiency, innovation, distributional equity, participation, and related outcomes. No policy design is perfect; the challenge is to select the best design from among several imperfect alternatives. Normative regulatory theory counsels selection of the policy option that maximizes overall global net benefits (including both environmental and economic consequences, and including qualitative and intangible factors as well as quantified factors), and that achieves a given goal most cost-effectively.

If climate protection is a global public good warranting some collective emissions constraint to prevent overuse — or if international political actors are headed toward agreement on some emissions constraint, regardless of a careful optimality calculation — there remain important choices about which kind of policy design to employ. In principle, societal constraint on the use of an open-access resource may take many forms. They include:

- allocation of rights to use certain areas or amounts of the resource and to exclude others, thereby inducing the owner to face the costs of overuse and to conserve the resource appropriately (“private property”);
- rules of social reciprocity inducing mutual restraint within a community that shares the resource in common (“common property”);

- collectively legislated requirements regarding the technology of resource use (“command-and-control regulation”); and
- collectively legislated requirements regarding the quantity or price of resource use, inducing users to face the social costs of overuse and to conserve the resource appropriately (“reconstitutive regulation”).²⁸

Global climate policy involves a public good that is difficult to parcel into private domains (the atmosphere), and involves a large and heterogeneous population (the entire world) that seems unlikely to negotiate efficient private bargains or to embrace shared community norms. Hence the regulatory forms of societal constraint have attracted the most attention.

The “reconstitutive” regulatory designs — tradeable allowances²⁹ and emissions taxes³⁰ — have several important advantages over their less flexible command-and-control counterparts. Chief among these is greater *cost-effectiveness* — the ability to deliver a given environmental benefit at lower cost, or to achieve greater environmental benefits at a given cost. Cost-effectiveness is a key criterion under the FCCC, which states in Article 3(3) that “policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.”

But cost-effectiveness in emissions abatement is not the whole story. Several other attributes of policy options warrant examination as well, including incentives for innovation, resource flows to developing countries, and incentives for countries to join the agreement and expand its geographic coverage.

“Policies and Measures”

One option to constrain emissions is to adopt a treaty that obliges parties to engage in coordinated or harmonized policies and measures. For example, the treaty could impose global automobile fuel economy standards (similar to the CAFE standards in force in the United States) or energy efficiency standards for appliances and industrial processes.³¹ Or the treaty might even require global installation of specific emissions control technology, such as CO₂ scrubbers on all new coal-fired power plants built after 2020.³²

These approaches are similar to the tradition of centralized “command-and-control” environmental regulation adopted in many U.S. laws over the last 25 years. It may be hard to imagine international negotiators formulating worldwide design standards for specific technologies, but the prospect should not be discounted.

While the negotiations on the FCCC were underway at the Palais des Nations in Geneva in 1991, another group of diplomats was meeting down the hall behind a door labeled "Group on the Design of the Automobile."

A different version of "harmonized policies" could involve a global agreement to phase out subsidies for emissions-intensive activities, such as subsidies for coal mining and combustion, for certain agricultural exports, and for deforestation.³³ Energy subsidies alone account for a significant percentage of current global GHG emissions.³⁴ This approach would be similar to the tariff-reduction rounds of the General Agreement on Tariffs and Trade (GATT), but focused on domestic subsidies of GHG-emitting sectors. Because each country could perceive competitive disadvantage if it eliminated its own subsidies unilaterally, international agreement might be necessary to "disarm" these subsidy regimes in partnership.

The United States is moving to adopt market-based performance policies that allow flexibility in the location of abatement efforts among emitters.

Reducing subsidies could be highly cost-effective. But harmonized emission control policies could be highly cost-ineffective. Requiring all countries to adopt the same policy measure would take no account of the variation in abatement costs across countries, nor of the variation in policy contexts. A harmonized policy that makes sense in one country might make little sense in another.

Uniform technology standards could be even worse. Experience with technology standards in the United States has indicated that: (1) they impose high costs; (2) do not necessarily limit emissions effectively; (3) tend to involve end-of-pipe controls, which ignore more cost-effective process changes and which induce emitters to shift pollution from one medium to another; (4) tend to involve special requirements on new sources, which discourage innovation and encourage emitters to keep older, dirtier equipment in operation longer; and (5) tend to squelch technological innovation because emitters see no gain to developing a technology different from the one mandated by regulation.³⁵

U.S. environmental policy, therefore, is moving to adopt performance-based policies that limit emissions or concentrations but

leave the choice of compliance method up to each emitter.³⁶ This compliance flexibility encourages diverse cost-effective approaches and technological innovation. Further, the United States is moving to adopt market-based performance policies that allow flexibility in the location of abatement efforts among emitters.³⁷ It would be ironic if the international climate change treaty were to ignore this learning and adopt a high-cost, low-innovation approach to GHG emissions control.

A Quantity Constraint (Targets or Caps)

A frequently discussed policy design for climate change is a performance-based quantitative limitation on emissions — imposing a “target” or “cap” on emissions. The FCCC sets a “fuzzy” target, obliging industrialized countries to take steps to limit emissions with the “aim” of returning to the 1990 level by 2000. In the talks flowing from the Berlin Mandate, other targets have been suggested, such as reducing industrialized country emissions in the year 2010 to 5 or even 15 percent below their 1990 level.

Inflexible: National Caps

A policy design commonly advocated in the climate negotiations would require each country to cap its emissions at a certain target level by a certain date, acting on its own. These national caps would add up to a global aggregate constraint on the quantity of emissions.

Compliance with such caps would have to be monitored by an international body, based on national reporting of emissions inventories, with international verification. The regime would impose penalties on violators for exceeding the caps or reporting false information.

Inflexible caps would allow each nation the choice of domestic abatement options — intra-national flexibility — and in this performance-based respect would be more cost-effective than a treaty imposing harmonized policies or technology standards. But inflexible caps would not take advantage of the variation in abatement costs across countries, and so would be less cost-effective than a set of caps with cross-national flexibility in the location of abatement.

Flexible: Allowance Trading, JI, and Banking

An alternative to inflexible national caps is a flexible quantity-based policy in which countries accept national caps, but have

flexibility *where* abatement occurs (cross-national, spatial flexibility) and *when* abatement occurs (temporal flexibility).

Spatial Flexibility. The global impacts of GHG abatement are independent of the location of that abatement, yet the costs of GHG abatement vary widely across countries. Thus, allowing flexibility where abatement occurs — “spatial” or “locational” flexibility — can offer significant cost savings. Just as with other desirable goods and services in an economy, where opportunities vary, there are potential gains from trade; all benefit via mutual cooperation.

Two types of international markets in cross-boundary emissions trading have been proposed. One is a formal market, a system of tradeable allowances or “cap and trade.” In this market, the international agreement sets a treaty-wide cap on emissions, and allocates an initial total of GHG emissions allowances (privileges to emit) to each participating country for each year. National governments then sub-allocate these allowances to subnational entities (the private sector), which hold allowances and conduct trades. The allowances are fungible and may be traded internationally. Organized exchanges arise to facilitate trades. At the end of each year, each country’s report of its actual emissions (verified by an international monitoring body) is compared to the allowances held by its emitters; if the country’s emissions exceed its allowances, it is subject to sanctions.

Allowing flexibility where abatement occurs can offer significant cost savings.

In this formal market system, businesses in countries with low-cost abatement options will sell allowances at a profit, and businesses in countries with high-cost abatement options will purchase allowances rather than incur the high cost of local abatement. The aggregate abatement will be the same — the global cap will be achieved — but the location of abatement will be different than under an inflexible caps approach, because here the high-cost abaters will invest in abatement services provided by low-cost abaters. The prospect of earning a profit on allowance sales will encourage businesses to devise lower-cost ways to reduce emissions. This system is similar to the model used in the U.S. sulfur dioxide allowance trading system enacted in 1990 to control acid rain.

In an “informal” market, the international agreement sets

national obligations to reduce emissions, but does not allocate formal allowances. Instead, each country is bound to achieve its emissions obligation and may meet that obligation in part through contracts for abatement services outside its territory.

Emitters seeking to invest in abatement services may purchase "credits" for emissions abatement from projects in other countries, including projects in host countries not subject to emissions caps. In order to determine whether these credits represent real reductions in actual emissions, abatement must be measured against baseline forecasts of what emissions would otherwise have been at the host project.

The system of "joint implementation" (JI) launched by the FCCC corresponds to this informal market model. Because the 1992 FCCC does not set a binding quantitative cap on emissions, a formal system of tradeable allowances was not germane. Instead, during the FCCC negotiations, the United States proposed in 1991 that the FCCC allow countries to enter into "cooperative arrangements" to limit emissions. At about the same time, Norway similarly proposed that countries implementing measures to limit emissions under the FCCC should be allowed to do so "jointly."³⁸ Hence the term "joint implementation," or "JI."

But JI hit a bump in 1995. Article 4(2)(d) of the FCCC directs the Conference of Parties (COP) to "take decisions regarding criteria for joint implementation," and at its first meeting in Berlin in March 1995, the COP set criteria for a "pilot phase" of JI to last no longer than until the year 2000. This pilot phase allows JI but, in deference to countries which expressed concern about licensing a full market in GHG abatement services, it expressly disallows the receipt of any "credits" for extraterritorial abatement investments.

Without credits to record in satisfaction of their own emissions abatement obligations, there is little incentive for emitters to invest in JI.³⁹ The prices that investors do offer for no-credit JI projects will be so low that far fewer hosts will be interested in such deals. The pilot phase has thereby created a political Catch-22 for JI. If no one participates in the pilot phase, critics will label JI a failure; but if there is substantial participation, critics will assert that credits are unnecessary.

Temporal Flexibility. A second form of flexibility involves the timing of abatement. Because capital investments such as large electric power plants last a long time, it can be much less costly to match abatement efforts to the turnover of the capital stock. Some businesses might want to wait until current equipment is scheduled to be replaced and then make very large emissions reductions. Other businesses might be ready to make very large

emissions reductions right away and would want to apply these extra reductions to future years.

The mechanisms for temporal flexibility are typically dubbed "banking" and "budgets." Under "banking," emitters assigned yearly emissions caps would be able to "save" extra reductions achieved in early years for later "withdrawal," allowing for less stringent caps in future years. Emitters might also be permitted to "borrow" against future caps by emitting more than their caps in the early years and then repaying via tighter caps in the future. Under a "budget" approach, emitters would be assigned aggregate caps over several years with the flexibility to spread these emissions over the period as they see fit.

Flexible policy provides more cost-effectiveness, greater incentives for innovation, resource flows to developing countries, and is more likely to attract expanded participation.

Temporal flexibility could reduce costs, but it would not generate all of the advantages of spatial flexibility. Temporal flexibility would not, for example, generate resource flows to developing countries. And although the spatial location of emissions does not affect global environmental impacts, the timing of emissions may well affect global environmental impacts. Earlier emissions have more long-lasting impacts, hence earlier abatement may be more environmentally protective than later abatement.⁴⁰ If so, "borrowing" of future years' allowances may require payment of a positive "interest rate," i.e. higher future reductions, to render it environmentally equivalent.

Quantifying the Advantages of Flexibility. Flexible policy design has substantial advantages over inflexible constraints and technology standards. Flexible policy provides more cost-effectiveness, greater incentives for innovation, resource flows to developing countries, and is more likely to attract expanded participation.

A system of international tradeable emissions allowances would accomplish the cost-effectiveness gains from spatial flexibility. A simple example is shown in Table 1 for a world of two countries, A and B. Requiring each country to install a particular emissions control technology, such as a scrubber, would require A and B to each spend \$40, for a total cost of \$80.

An inflexible quantity constraint, requiring each country to cut its emissions independently by 20 percent, results in a global emissions total of 8, at a cost of \$50. Allowing locational flexibility under the quantity constraint — creating a market for emissions abatement services, in which the high-cost abater (B) can pay the low-cost abater (A) to reduce another unit (from 4 to 3) on B's behalf — yields the same global emissions total of 8, but at a global cost of only \$20. A earns at least \$10 in payments from B in return for A's extra abatement. The global cost savings of \$30 (below the \$50 total cost of the inflexible uniform policy) would be shared by A and B as profits for A (above its cost of \$10) and/or savings for B (below its next best option at \$40).

Numerous studies of policies to limit GHG emissions show that allowing global flexibility in the location of GHG emissions abatement would cut the estimated global cost, compared to an equal constraint on emissions without such flexibility, by roughly 50 percent.⁴¹ Actual estimates of cost savings vary depending on the stringency and timing of the emissions constraint, the countries covered by the constraint, the countries eligible to participate in the emissions trading system, and other factors.

Numerous studies show that allowing global flexibility in the location of GHG emissions abatement would cut the estimated global cost by roughly 50 percent.

In the climate policy context, a potential 50 percent cost saving is likely to be huge. Several models suggest that a best estimate of the total global cost over the next five decades of holding GHG emissions in the industrialized countries to 20 percent below their 1990 level by the year 2010, without flexible policy design, would be almost \$2 trillion (in a range from \$1.5 trillion to \$8 trillion).⁴² Hence a 50 percent cost saving offered by spatial flexibility would mean saving about \$1 trillion or more.

One recent study by several of the world's top climate economists, using four different energy-economic models, found that adopting spatial flexibility would reduce the costs of a stringent constraint (in which industrialized countries must reduce emissions by 20 percent below 1990 levels by the year 2010, and other countries are unconstrained) by 70 percent. (The study found that adopting both spatial and temporal flexibility would reduce costs by a bit

more, up to 80 percent.)⁴³

This study also found that the cost saving due to spatial flexibility was greater than the cost saving realized by adopting a somewhat less stringent, but still inflexible, constraint: delaying an inflexible 20 percent emissions reduction below 1990 levels to the year 2020 instead of the year 2010 cut costs by 30 percent; and just capping emissions inflexibly at 1990 levels after the year 2000 cut costs by 60 percent. Moreover, these weaker but inflexible constraints would also mean lower climate protection benefits, which the efficient policy designs would not entail.⁴⁴ In other words, selecting an efficient policy design can be more important than making some adjustments to policy stringency.

Still, these models remain imperfect representations of reality. They might overstate cost savings because, for example, they typically omit the “transaction costs” involved in arranging contracts for trade in emissions abatement services.⁴⁵

On the other hand, they might understate cost savings. The models generally consider cost savings only across regions and omit possible additional cost savings among countries within regions. They also typically examine only energy-sector CO₂ abatement opportunities, whereas reducing emissions of methane (CH₄) from energy systems, and decreasing CO₂ via storage in forest sinks, would open even lower-cost abatement options.⁴⁶ Moreover, innovation spurred by flexibility could further reduce costs.

Maximizing cost-effectiveness saves resources for important social goals, such as reducing poverty, improving health care, reducing local pollution, and supporting education. Lowering the price of abatement can also be expected to increase the amount of abatement undertaken — making GHG emissions control less costly enables the group of countries to “buy” more emissions control than they otherwise would.

In addition, the new opportunity to profit by selling GHG abatement services motivates emitters and other entrepreneurs to devise better ways to control emissions. This would spur technological innovation and further improve the cost-effectiveness of global emissions control.⁴⁷

Furthermore, this policy design has built-in inducements to expand the breadth of treaty coverage, reducing free riding and leakage. More industrialized countries can be expected to join an international treaty if the costs of participation are lower, and more developing countries would join if they could earn revenues from allowance sales. A market-based policy would channel resources and technology to low-cost abaters in return for allowance sales.

Since low-cost GHG emissions abatement opportunities appear to be more plentiful in developing countries and in Eastern Europe, where older energy systems need upgrades and carbon-storing forests can be protected or expanded, the market-based approach promises substantial resource flows to these areas.

Indeed, studies suggest that under a globally inclusive market-based policy in which industrialized countries must stabilize or cut their emissions at or below 1990 levels by 2010 (and developing countries can emit as much as they would have emitted with no climate policy in place, or earn revenues for selling reductions from that level), the financial value of international payments for abatement would dwarf total official Overseas Development Assistance and might even match or exceed the total of all resource flows, public and private, now going to developing countries.⁴⁸

Gains to developing countries would both save abatement costs to industrialized ones, help improve the prosperity and health of people in developing countries, and broaden participation on the climate treaty.

Even more striking is the finding in some of these studies that the developing countries would be net *losers* under an industrialized country-only emissions control rule (without trading), because the reduction in imports and economic growth in the industrialized countries would reduce the export earnings of developing countries.⁴⁹ These studies indicate that developing countries would be net *gainers* — better off than if *no* action were taken by anyone — under a policy that restricts industrialized countries' emissions and allows them to obtain abatement services worldwide (unleashing a major new revenue stream for developing states).⁵⁰

These gains to developing countries would both save abatement costs to industrialized ones, help improve the prosperity and health of people in developing countries, and broaden participation on the climate treaty. These resource flows would help put developing countries on a lower-emissions economic growth path — bringing lower-emissions technologies and practices to countries that otherwise might increase their emissions so rapidly that costly emissions controls undertaken by industrialized countries would be of little global effect. Gaining development country participation in any GHG emissions control effort seems essential to any effec-

tive climate treaty; without it, industrialized countries' abatement efforts would be futile and competitiveness-conscious industrial states would not participate to begin with. A market-based policy would create an automatic mechanism and powerful incentives for industrialized countries to invest in developing countries, and for the latter to see abatement as a new source of economic value and foreign investment earnings.

These gains from a GHG emissions abatement market are not purely speculative. Similar results have been demonstrated in practice with the markets that have been created to address regional pollution problems. The United States has used market-based approaches to phase out lead (Pb) in gasoline, to cut emissions of sulfur dioxide (SO₂) as a means to reduce acid rain, to control urban pollutants in Los Angeles, and to control overharvesting of fisheries. The cost savings in the lead and SO₂ cases were substantial, at least 50 percent, compared to a control policy in which no trades were allowed.⁵¹ And the SO₂ experience suggests that the more cost-effective market-based policy enabled the Congress to "buy" more pollution control than it would have if control were more expensive; Congress had an implicit social budget constraint, and it "spent" up to that budget at the estimated price per ton of SO₂ for different options. The SO₂ policy also stimulated significant technological innovation and energy efficiency investments. New Zealand has successfully used market-based policy to manage its fisheries.⁵² Internationally, there is precedent in the Montreal Protocol's limited market in CFC production.

GHGs may be an even better subject for a market-based policy than these successful antecedents. Unlike SO₂ and urban pollution hazards, most GHGs involve no problem of local "hotspots" in which emissions "bunching" through allowance purchases could escalate local damages. And the diversity of abatement costs for GHGs is likely to be larger than the range for SO₂ and other regional pollutants.

A Price Constraint (Taxes)

A constraint on the price of GHG emissions — a global GHG tax, or a system of coordinated national taxes — could, in principle, generate the same cost-effectiveness gains as quantitative constraints on emissions with tradeable allowances. Compared to a quantity-constrained system of tradeable allowances, a tax would pose less risk of high cost overruns. The tax would fix the upper end of the price that emitters would pay, whereas allowance prices would be uncertain and could escalate. But the tax would offer less

certainty that emissions would be abated than would a quantitative limit on emissions. Which risk is of greater social concern — cost overruns or emissions overruns — would be important in choosing between a quantity-based constraint and a price-based constraint.⁵³

A tax would avoid the transactions costs of the emissions abatement market, though it would involve the major administrative costs of estimating and collecting the tax. An international or nationally coordinated tax system would raise thorny questions about who collects the revenues, who controls the use of the revenues, and on what criteria. By contrast, a market in emissions abatement services would leave the financial decisions in the hands of many decentralized private decisionmakers, each investing in a small part of the overall market.

A tax system would require the same monitoring and compliance enforcement systems as quantity constraints. Someone must check to be sure emitters are paying taxes on their full emissions. But the tax policy might be circumvented by unobservable national tax cuts and subsidies targeted to counteract the burden of the GHG tax on high-emitting industry sectors. The complexity of national tax codes could make it very difficult for outsiders to monitor full compliance with a GHG tax. Although tax relief and subsidy games might also be played to cushion domestic industries from the costs of complying with quantity-based policy designs, these strategies would not influence the total emissions of the country under a quantity-based regime, whereas they would influence the total emissions under an international tax regime.

In addition, emitters can be expected to oppose taxes (or auctioned allowances) which force them to pay for every unit of their emissions. Allowances issued to emitters for free (such as in proportion to their historical emissions) do not force emitters to pay for all their residual emissions. Similarly, technology-based standards and inflexible quantity constraints do not charge emitters for their base emissions.

Thus emitters can be expected to lobby in particular against emissions taxes and allowance auctions.⁵⁴ This political pressure makes adoption of a GHG tax less likely, and it makes surreptitious circumvention of any international GHG tax that is adopted even more likely.

Perhaps most importantly, unlike a market in abatement services, an international GHG tax would not create an automatic mechanism and incentive for resource transfers to developing countries, which are a key to getting developing countries engaged in

GHG emissions abatement efforts on terms acceptable to them. Although the tax revenues could be used for foreign aid to developing countries, the revenues could also be retained for national fiscal purposes (e.g., deficit reduction, as is assumed in many models which estimate low costs of a GHG tax). Using the tax revenues for international transfers to poorer countries would mean a highly visible increase in official government foreign aid, which might face political opposition in both donor and recipient countries. A formal allowance market would accomplish these transfers via decentralized private sector trade, not government aid.

The Politics of Climate Policy Design

Efficiency is about aggregate gains; political adoption is largely about the distribution of gains and losses.⁵⁵ In contrast to normative regulatory theory, positive regulatory theory seeks to explain not which policy design is optimal, but which policy design actually gets adopted by political decision makers. If political calculations diverge from socially efficient calculations, adopted policy will diverge from efficient policy.

Countries have multiple objectives in the climate change negotiations, and categorizing countries' policy views in any simple way is fraught with error. Nation-states are thinking not only about climate protection benefits but also about numerous other considerations. For example, they are concerned about (1) their competitive economic status with respect to current and potential rivals; (2) their autonomy and sovereignty; (3) principles of fairness and moral desert; (4) domestic social and economic goals unrelated to climate change or for which climate policy is a convenient vehicle; and (5) global environmental protection.

The decision of each country to favor or oppose any treaty proposal is a multi-level, multi-player "game," involving the national government; different political factions and different branches within the national government; subnational jurisdictions (states, provinces); non-governmental organizations (NGOs) representing environmental interests, industry interests, and other interests; and other groups. Political decision makers consider not only their countries' national interests but also their own power, prospects for reelection, and other personal goals.

Meanwhile, although much theoretical and some empirical scholarship has been undertaken on the political economy of U.S. environmental policy,⁵⁶ much less has been conducted on the political economy of international environmental regulation.⁵⁷ The

fact that many countries have expressed concerns about a market-based approach to controlling GHG emissions, despite the advantages of such a policy design, suggests the need for this research. If emissions trading is so great, why is it so hard to get it adopted?

The Coalition in Favor of Efficient Policy Design

The United States is now pressing for the creation of a full formal market in tradeable GHG emissions allowances as a prerequisite for signing an emissions limitation agreement in Kyoto. The June 1997 draft protocol circulated by the State Department would establish a market-based system of formal international allowance trading among countries covered by emissions caps, and it would confer official credit on joint implementation (JI) projects undertaken in other countries. It also would allow intertemporal flexibility through saving and borrowing, with an interest rate to be charged on borrowing.

The United States is joined in its support of a cost-effective policy design by countries including Norway, Japan, Canada, Australia, and New Zealand. These countries tend to be high-cost abaters for whom a cost-minimizing policy design would be important.⁵⁸ The United States and New Zealand are also two of the countries with the most extensive national experience in employing allowance trading;⁵⁹ and the Nordic nations have recently conducted experimental GHG allowance trading games.⁶⁰

The industrialized advocates of tradeable allowances get some support from some low-cost abaters who seek the resource flows from allowance sales — such as Costa Rica, Poland, the Czech Republic, and possibly Mexico and South Korea. These countries may prefer to earn revenues without incurring caps, however, and thus tend to endorse JI (with credits) more vocally than a cap and trade system.

International support for a GHG tax has been less visible. Economists tend to model a cost-effective policy as a tax, but few countries have advocated such a policy. This may reflect emitting countries' hesitation to impose costs on every unit of their residual emissions; they would prefer tradeable allowances allocated in proportion to historical emissions (or some other non-auction method).⁶¹ In the early 1990s, France proposed an international carbon tax, with the proceeds to be put in an internationally managed fund and used to finance purchases of low-GHG-emitting energy technologies in developing countries. This proposal probably had less to do with France's advocacy of cost-effective policy than with France's prospect of making profits. It might hope to sell its

nuclear energy technology to developing countries newly financed by the fund, and to face low compliance costs under such a tax in light of its heavy reliance on nuclear energy for its own electricity.

The Coalition Against Efficient Policy Design

The sources of opposition to GHG allowance trading are varied and not always clear. Several intuitive hypotheses, in part or in concert, may help explain the observed opposition to tradeable allowances at the international level. These hypotheses are as yet empirically untested and are not necessarily descriptive of any party's actual views.

Market Defects

Objections to allowance trading may derive from genuine concerns about the functioning of a market-based policy design at the international level. The legal and analytic weaknesses of international institutions pose special problems for market-based policy design not present at the national level.

Concerns have been raised about the ability to initiate, monitor and manage an international emissions trading market to ensure real reductions in global GHG emissions — concerns about allocating allowances, deterring free riders, preventing cross-border emissions “leakage,” establishing “baseline” forecasts of business-as-usual emissions, and monitoring compliance. These concerns, however, apply generically to any international policy that would constrain emissions. When compared to an emissions limitation policy that did not employ flexible market-based incentives, a market-based policy would actually ease these concerns.⁶²

Allowance trading would defuse the allocation impasse by enabling post-treaty reallocations to ease the distortions of initial allocations. It would offer built-in incentives for participation by both wealthy and poorer countries (lower costs for the former, and allowance sale revenues for the latter), thus reducing free rider and leakage problems. And a cap and trade regime would be no worse than inflexible policy in its measurement, monitoring and compliance functions.

Monitoring and enforcement would be necessary under any treaty that sought to limit countries' emissions, whether the treaty employed allowance trading or not. The political motivations that help explain nation-states' reluctance to invest in optimal protection of global public goods, and their opposition to the adoption of

efficient market-based policies, might also contribute to opportunistic evasion or shirking once a treaty is adopted. All international law is vulnerable to noncompliance. A treaty with formal allowance trading would employ the same monitoring and enforcement methods as a quantity-based treaty without trading. Countries would report their national emissions inventories, which would be subject to independent verification. If a country's emissions exceeded its allowed total for that year, such noncompliance would subject that country to agreed penalties, including fines (perhaps levied against bonds posted by the country in advance) and perhaps multilateral trade sanctions. But a market-based treaty would enable better compliance assurance than a treaty without allowance trading. First, trading would reduce the costs of compliance, thus reducing the incentives to violate the treaty. Second, a wider arsenal of penalties could be brought to bear on the violator, including reducing the country's future allowance allocations pro rata for its past exceedances. Third, under an allowance trading system, new constituencies would arise to favor compliance and lobby in favor of strong national enforcement, such as holders of shares in the allowance "futures" market who would stand to lose if future allocations were curtailed.

A market-based treaty would enable better compliance assurance than a treaty without allowance trading.

Some argue that a system of tradeable GHG allowances is a "political non-starter" because developing countries will refuse to accept caps, and industrialized countries will refuse to make large resource transfers.⁶³ But any binding control regime will face difficult political hurdles, and a cap and trade system has important advantages over the alternatives. Resource transfers via allowance sales can make accepting phased-in caps (with future growth headroom) attractive to developing countries. It is hard to see how developing countries could be engaged in any emissions control without such resource flows. Proposals for national taxes or harmonized policies would not generate such resource flows, so they would fail to engage developing countries. Without developing countries on board, industrialized country action to limit global emissions would be frustrated by rapid emissions growth in developing countries, and by leakage that could offset industrialized country

constraints. Moreover, industrialized countries would be highly unlikely to constrain their own emissions without developing country participation, given industrialized countries' fear of the competitive disadvantage from GHG leakage to developing countries.⁶⁴

Meanwhile, wealthy countries would undertake the large resource transfers contemplated under a cap and trade system because these resource transfers would be a bargain. They would yield significant (50 percent or more) cost savings compared to a policy that constrained emissions but did not allow wealthy countries to purchase abatement services in low-cost developing countries. And these resource transfers would be handled via myriad small private transactions, which would not raise the political specter of official foreign aid.

In contrast to these generic concerns, certain problems are particularly germane to an international market-based climate policy. These include the problems of high transaction costs in the JI and allowance markets; market power; and meddling in the international market by national governments.

Transaction costs can be increased by limits and conditions imposed on JI and allowance trading. They can be reduced by formal allowance trading on organized exchanges.⁶⁵ But proposals to reduce search and negotiation costs through centralized allowance purchasing and selling agents (such as the World Bank or a G-77 sales office) would only create new problems of market power.⁶⁶

Market power is especially a concern if the market involves a small group of countries, a narrow scope of gases and sectors, cartels or state-run players (such as a state-run energy company in a large allowance seller such as China or Russia), and if the voting rules enable strategic exclusion of candidate new members.⁶⁷ Because there is no international antitrust law, the GHG allowance trading market will need to be designed to deal with market power on its own terms. The market would need to require sub-allocation of allowances to private sector entities, could retain a central reserve of allowances to deploy against price manipulation, and should include customized competition rules for the GHG allowance market.⁶⁸ Still, effective antitrust enforcement against nation-states may be difficult, to say the least.⁶⁹

National government meddling in the global allowance market may include border taxes, limits on trading, exercise of market power by state-run businesses, and expropriation of allowances or of JI projects. Efforts by American states to interfere with the U.S. SO₂ trading system were rebuffed under the free trade doctrine of the U.S. Constitution's "commerce clause."⁷⁰ Such practices by nation-states might likewise be inhibited by the international law

governing free trade (GATT/WTO), but this depends on the untested question of the applicability of such trade law to a novel object of trade like GHG emissions allowances.⁷¹

Morals

Some may oppose cost-effective policy design because their goal is not climate protection per se but rather moral condemnation of those responsible for pollution. In this view, what is most important is the moral statement society expresses in law, not the consequences of the law. This philosophy seeks to blame and punish those who cause high emissions, not to achieve efficient or optimal correction of market "externalities."⁷² It views pollution as ethically wrong, not economically inefficient. From this vantage point come arguments that tradeable allowances would amount to "licensing the right to pollute."⁷³

The moralist view overlooks some practical realities and promotes the very evil it would punish.

The moralist view overlooks some practical realities. Under an allowance trading system, industrialized emitters would *pay* to reduce emissions -- they would still have to shoulder the burden of generating global emissions reductions. Second, *any* policy amounts to a "license to pollute" unless it is a total ban on emissions. Inflexible national caps, harmonized policies, and technology-based standards (all of which the moralists often prefer to trading) would all license countries to emit significant amounts of GHGs. Moreover, whereas GHG taxes and tradeable allowance systems make the emitters pay for their emissions (by paying the tax, purchasing allowances, or foregoing the revenues they would earn by selling their allowances), the alternative policies license countries to emit for *free*. Once the polluter installs the specified technology, or meets the cap, the remaining pollution is free of charge. Hence tradeable allowances would force polluters to pay *more* effectively than the inflexible policies the moralists tend to favor.

Furthermore, there is a moral irony here. The moral claim is that the person who causes higher emissions is blameworthy and should be punished irrespective of the pragmatic consequences. But the case for tradeable allowances argues that because they are more cost-effective than alternative policies, and because they pro-

vide continuous incentives for technological innovation and diffusion, tradeable allowances would lead countries to undertake more emissions abatement than they would under alternative, higher-cost policy designs. They also would attract more countries to join the emissions control regime. If so, then those who oppose tradeable allowances and favor inflexible policy designs (on moral or other grounds) would be the people directly responsible for *increasing* global emissions. The anti-trading moralist would thus cause higher emissions. The moralist view promotes the very evil it would punish.⁷⁴

Fairness

A related but distinguishable view is that fairness requires the industrialized countries to “take the lead” in controlling GHG emissions first, before developing countries are asked to make any sacrifices in this effort. On this view, flexible policy designs such as tradeable allowances may be letting industrialized emitters off “too easy,” letting them pay their way out of their “fair share” of sacrifice.

Even some who would tolerate allowance trading or JI also propose that it be limited to a small percentage of a wealthy country’s total compliance to ensure that these wealthy nations shoulder their costs mostly at home.⁷⁵ Leadership by industrialized countries is seen as “fair” because they are wealthier, or because they have historically contributed the bulk of the elevated atmospheric concentrations of GHGs (they have “used up the common space”), or both. It would be unfair, in this view, to make poorer developing countries worse off for a problem caused by wealthier nations.

Whether or not one agrees with these fairness claims, they do not counsel rejection of flexible cost-effective policy designs such as allowance trading. In fact, allowance trading would be *more* fair to developing countries than alternative policy designs. Industrialized countries would “take the lead” under an allowance trading system; they would pay the costs of global emissions abatement. The initial allocation of allowances is a matter of political bargaining, but developing countries would almost certainly demand and receive allowances with generous “headroom,” roughly enough to emit up to their baseline forecasts. Hence the burden of most or all of the reduction from the global baseline forecast would be allocated initially to industrialized countries. Moreover, developing ones would thereby be able to sell large quantities of extra allowances at a profit — a new and valuable asset which they formerly did not have. Far from asking developing countries to sacrifice, this arrangement would be a great boon to developing countries

even as it reduced global abatement costs. As discussed above, a treaty controlling emissions in industrialized countries without allowance trading would hurt developing countries as well by decreasing wealthy nations' demands for imports from the developing countries. The latter would be net losers, even worse off under such a treaty than under no treaty at all. But a treaty employing allowance trading would reduce the loss of developing countries' export sales to industrialized countries (by reducing the abatement costs on them), and moreover would deliver resource flows to developing states from allowance sales.⁷⁶ The combined result is major gains to developing countries from an allowance trading treaty — they would be net winners, even better off than under no treaty at all.⁷⁷

*Hoping for industrialized countries to "take the lead"
without any constraint on developing countries'
emissions growth is wishful.*

The basic logic of international law and of allowance trading markets — voluntariness — precludes any treaty in which developing countries are asked to sacrifice beyond their desires. Treaty compliance requires voluntary assent. Developing countries would not join a treaty that disserved their interests. Thus as a purely practical matter, the treaty must make them better off. The same is true of each allowance transaction or JI project; it must make the involved developing parties better off, or the transaction will not occur. JI and allowance trades are voluntary arrangements that necessitate mutual benefit.

Saying that industrialized countries must control emissions at home, not overseas, is profoundly *unfair* to developing countries. It assumes a zero-sum game in which sacrifices by industrial countries are gains for developing ones, but the real world does not work that way. It ensures a treaty in which developing economies are net losers, whereas under allowance trading they could be net gainers. Requiring industrial countries to act only at home is like insisting that rich people must only spend their money in rich neighborhoods, and never invest in poorer neighborhoods. Denying developing countries the revenues from GHG allowance sales in the name of fairness to them is particularly ironic, given that many (notably excepting small island states) probably would put far more value on the benefits they would reap from allowance sales —

in prosperity and in control of local pollutants — than they would on global climate protection. Hoping for industrialized countries to “take the lead” without any constraint on developing countries’ emissions growth, and for such a move to lead developing countries by persuasive example, is wishful. Industrial countries concerned about competitiveness will not do so; the result will be no treaty at all.

If such a treaty were adopted, it would likely be counterproductive. Leakages and increased emissions in developing countries could offset or exceed abatement in industrial ones. Leakage would make developing economies more GHG-intensive and, thus, less likely to join the treaty in the future.⁷⁸

Social Engineering

A different perspective favoring high-cost climate policy may be held by those whose real agenda is a transition from “hard path” to “soft path” energy systems and from high-consumption to low-consumption lifestyles in industrialized countries. Many groups have been fighting for decades to replace fossil fuels and nuclear energy with solar power and energy conservation. The climate policy negotiations may just be another venue for this social agenda to be pressed. These social engineers may oppose cost-effective climate policy designs because, by easing the costs on industrialized countries, such policy designs could reduce the pressure on them to shift to wholesale alternative energy systems and to change their high-consumption lifestyles. Allowance trading will encourage conserving forests in developing countries and investing in new energy technologies in developing areas. Hence the social engineers criticize JI and tradeable allowances or try to limit the scope of overseas abatement services to a small fraction of industrial countries’ compliance measures, arguing that these states should bear most of the costs at home.

It may well be true that optimal energy policy would induce a greater shift to solar power and conservation than does present policy. Fossil fuels may be underpriced (at least in the U.S.) compared to the optimal price when their environmental impacts are included. A better solution to this problem would be full social-cost pricing of these fuels and products, not an inefficient climate policy. Building excessive costs into a climate policy has all the downsides articulated previously (including higher cost, less climate protection, and less participation). It also thwarts the protection of the world’s forests and investments in technological innovation for de-

veloping countries. If social engineers want a technological reformation, they should favor it in these countries as well as in industrial ones.

Stringency Gaming

Opposition to tradeable allowances might also be a move to exert leverage over the stringency of the policy constraint. Such games might be played by both sides.

Advocates of aggressive climate protection may be withholding support for trading until it is paired with a stringent cap. They may fear that trading is so complex or open to abuse that it will not result in effective emissions limits. Or they may simply realize that trading is desired by high-cost abaters and thus can be used as a bargaining chip to extract concessions on the stringency of the cap. Even if these advocates like trading, they may initially say they oppose it as a ploy to twist the arms of those who oppose a stringent cap.

Meanwhile, skeptics of aggressive climate policy may fear the opposite: that cost-effective tradeable allowances would be an all-too-alluring "fast train to the wrong station." They possibly fear that the cost-saving claims of trading will entice countries to blithely adopt *overly* stringent quantity-based emissions limits which are then resistant to relaxation even as costs escalate.

These two opposing critiques can lead both aggressive advocates and skeptics to say they favor a high-cost policy design. Of course, the stringency of climate policy should be chosen with great care. But gaming policy stringency by promoting a high-cost policy design is a very dangerous tactic — both parties might just get what they are asking for. The aggressive advocates risk imposing a very costly treaty or getting no treaty at all. The skeptics' gambit of urging a higher-cost "slow train," in the hopes that it will derail any GHG limitations agreement, may just invite a much more costly, inflexible treaty design.

Rent-Seeking

Another source of opposition to cost-effective policy design and tradeable allowances may be those who would profit from an inefficient, high-cost policy. It is now common to explain national regulatory policy choices as the result of "rent-seeking" — political pressure by special interests who gain economic favors from distortionary policies.⁷⁹ In the climate policy context, the rent-seekers (and their potential victims) view the treaty as a negotiation over competitive

advantage, not environmental protection. At least three hypothetical kinds of rent-seeking seem helpful in explaining the observed opposition to tradeable allowances for GHG control.

The first is trade rivalry. Some countries may favor high-cost policy designs because, even though such a policy would cost them something, it would cost their trade rivals far more. In particular, low-cost abater countries may favor costly policies that sock it to their high-cost abater trade rivals. These low-cost abater countries are acting as predators, seeking to exploit the heterogeneity in abatement costs across countries for competitive gain.⁸⁰ Tradeable allowances would give every country the same chance to find low-cost compliance options worldwide, depriving the predators of the opportunity to burden their rivals.

Second, some countries may see the negotiations as a zero-sum game, in which the costs they impose on other countries amount to benefits for their country. For example, some may think that high costs imposed on industrialized countries will hold back their economic growth and thus help developing countries to "catch up."

Third, rent-seeking may be occurring within countries' political regimes. Allowance trading would assign to the private sector the role of transferring resources from industrialized countries to developing countries, through myriad decentralized transactions. But powerful interests in governments in both industrial and developing countries may prefer to keep control over these resource transfers in central government hands. Consider that the diplomats negotiating the treaty often come from the very government agencies and elite cliques which would be enlarged and enriched by the task of handling these resource transfers. Riding herd on private sector transactions might be much more difficult for these government officials, and letting the private sector handle such wealth might even undermine the political position of elites in some countries.

Applying the Hypotheses

These positive political hypotheses can be assessed in a preliminary way in terms of the positions taken by opponents of JI and allowance trading in Europe and among developing countries.

Europeans' Opposition to Trading

European opposition to tradeable allowances may be based on misunderstanding, on disagreement about the merits of allowance trading, and on the failure of trading advocates to explain the mer-

its and allay concerns. Europe has little experience with environmental allowance trading, and may not share U.S. confidence in this policy design.⁸¹ Still, other reasons may also underlie European opposition.

Europeans may be suspicious of the United States and of allowance trading, until the latter agrees to an emissions target. Many environmental groups in the U.S. acid rain (SO₂) debate favored allowance trading only after it was connected to a stringent cap.

Europe, in particular Germany, may be guided more by a Kantian perspective in which the solution to pollution is moral conduct (cease polluting) rather than a Benthamite perspective in which pollution is seen as a market failure to be corrected by market pragmatism. From this perspective it may make little sense to consider flexible schemes of reallocation; the simple solution is for each country to "act properly." Combined with the lack of experience with trading in practice, this perspective may explain Europeans' response that allowance trading is "just not the way we think about these things."

Preliminary evidence suggests that the industrialized countries which oppose or would limit allowance trading are also the countries who face low abatement costs.

Domestic political constituencies in Europe may dislike trading, perhaps based on moralist, fairness, or social engineering grounds. And these groups and Green Parties may be even more influential in European politics than are their counterparts in U.S. politics. Environmental groups in the United States used to be generally hostile to allowance trading, until several policies using tradeable allowances were adopted over many environmental groups' objections and then proved successful (e.g. the lead phasedown and the CFC phaseout). The role of the Environmental Defense Fund (EDF) in helping design the SO₂ trading system for acid rain control may also have reduced objections. Nowadays, one hardly hears the moralist critiques of trading ("license to pollute") in the United States; the debate is almost entirely a pragmatic discussion of which policy designs best accomplish desired goals. It may take time and experience, and philosophical change for the positions of European environmental groups and Green parties to evolve in this direction.

Of most concern is the possibility that European opposition reflects predatory trade rivalry among industrialized countries.

Industries in Europe may want to impose higher costs on their rivals in the U.S. and Japan by insisting on non-tradeable, CO₂ only controls, which the Europeans would be able to meet at lower cost than could their rivals. Flexible and comprehensive policies would erase this cost advantage for European industry. Preliminary evidence suggests that the industrialized countries which oppose or would limit allowance trading are also the countries which face low abatement costs, relative to the industrialized countries which favor allowance trading.⁸² Meanwhile, the EU proposal for the treaty to be adopted in Kyoto would allow differentiation of GHG control obligations within an EU "bubble." This suggests that the EU can favor flexible policy design when its own interests warrant — that its objections to global allowance trading are strategic, not substantive or philosophical.⁸³

Thus, in addition to other explanations, European opposition to cost-effective allowance trading may derive from the preference of both European environmentalists and European industries for an inflexible, high-cost policy design.⁸⁴ If so, this opposition will be difficult to overcome. It will likely be couched in moralist language for public relations purposes.⁸⁵ Empirical studies are needed to test this hypothesis and reveal such strategic rent-seeking against trade rivals if indeed it is occurring.

Developing Countries' Opposition to Trading

The majority of developing countries (voiced through the G-77 negotiating bloc) seem opposed to allowances trading.

As with European opposition, much may be based on inexperience and misunderstanding, on the failure of trading advocates to explain the merits and allay concerns, and on genuine disagreement about policy merits. Still, there may be other reasons for opposition.

Developing countries may see climate policy as a zero-sum game in which losses to industrial ones are gains to themselves. They may think that high costs and slower growth imposed on industrial countries will enable developing states to "catch up" economically. But this perception is surely wrong, as discussed above because costs to industrial countries mean reduced imports from developing ones, which harms the latter's economies; developing countries would be *worse* off economically under an inflexible industrialized emissions constraint and better off under a global allowance trading regime.⁸⁶

Developing countries may resist accepting any cap on their own emissions, even if it is coupled with large resource transfers.

But, if this is so, they must be assessing their ability to increase emissions indefinitely as more valuable than the revenue they would receive for allowances. This suggests that expected allowance prices might be too low to attract the participation of developing countries.

In particular, these countries may fear “carbon colonialism” — the prospect that industrialized countries would exercise power over their economies through allowance purchases. Sometimes this fear is expressed as a concern that the best abatement options of developing countries will be “skimmed off” by industrial ones, leaving only more costly abatement options in the future when caps become binding on all nations.

Developing countries may fear “carbon colonialism” — the prospect that industrialized countries would exercise power over their economies through allowance purchases.

But developing countries could just set allowance prices to reflect the full long-run opportunity cost of giving up the allowance. If the price is too low, the allowance would not be sold. If the allowance is sold at a price that covers the opportunity foregone, then in the future developing countries would have sold the attractive abatement option, but they would also have the even more lucrative return on investment from the revenues received for the allowance.

This fear, like the fear that caps will constrain economic growth more than the allowance sale revenues will stimulate it, probably reflects real doubts about the competitive efficiency of the allowance trading market. Developing countries fear that allowance prices will not cover long-run costs because price competition by other similar states will prevent raising prices to full social value, and because market power exercised by industrialized countries will depress prices. This market power could take the form of a monopsony purchasing agent (e.g. the World Bank) or the asymmetric information and expertise held by wealthy countries which are adept at playing the global markets game.

A related issue is that developing countries may fear intrusive exploitation of their resources by former colonial powers. They may worry that their land would become controlled by industrial investors, such as for carbon-storing forest plantations. This may not seem like a real concern in a market economy where land is

commonly bought and sold and is not seen as the basis of economic value, but it could be a sharp concern in an agrarian state-run economy where land is viewed as the national patrimony and as the only secure basis for durable prosperity. Foreign ownership of land-use rights may be particularly politically volatile in countries where foreign colonial dominion is a living memory.

To deal with these concerns about the market power of industrial countries, developing states might be holding out for higher allowance prices or for other concessions. It is odd, however, that their initial strategy on JI was to declare that as a legal matter, JI under the 1992 FCCC applied only to Annex I countries. This claim rested on a strained reading of Article 4(2)(a), which plainly states that parties undertaking policies and measures to limit net GHG emissions "may implement such policies and measures jointly with other Parties." There is no limitation on which parties they may be. Nonetheless, developing countries asserted that they were legally ineligible to participate in JI. It is a curious strategy for someone trying to bid up the price of participation to say that participation is flatly illegal. If this is so, there is no price increase or other concession that could induce participation. Either the assertion about their legal ineligibility was a strategic mistake, or bidding up the price was not the developing countries' motivation.

An alternative hypothesis is that developing governments' representatives to the climate treaty negotiations may gain "rents" at home from managing, or skimming, government-to-government aid, but not from private financial flows. Private financial flows may even seem threatening to political elites in developing countries. So these nations might benefit from private sector allowance trading, but their diplomats might have reasons to resist. This is not just a problem in developing states. For similar reasons of bureaucratic power, diplomats from industrial countries may also prefer government-controlled aid to private-sector trade flows. If this hypothesis is accurate, countries' positions on allowance trading might vary depending on whether the domestic allies of the market sector (e.g. finance and economic ministries) are well represented on their climate change negotiating or policymaking teams.

Developing countries' fears of low allowance prices deriving from market power, and of intrusive landholdings, need to be addressed on the merits. Policy designs need to be articulated that ensure competition among investors, diversified ownership through mutual funds and fungible allowances, and time-limited allowances (more akin to leases than sales). Proposals to concentrate investment decisions in one entity, such as the World Bank, may only drive developing

countries away from participation in such a market.

The hypothesized rent-seeking behavior of diplomats needs to be studied. If it is indeed occurring, merely bringing it to light could be sufficient to undermine the case against trading. Further, a prime strategy for trading advocates would be efforts to involve the pro-market government agencies and businesses in the relevant countries.

Conclusions

Though a portion of this paper reviewed “the challenge of climate change policy,” this paper is first and foremost an analysis of the efficiency and politics of various climate change policy alternatives. It is not about whether global climate change is a serious imminent threat, but rather about how to design an efficient and politically feasible policy *if* there is an international consensus to control greenhouse gas emissions.

Flexible market-based policy designs such as internationally tradeable GHG allowances promise enormous advantages over inflexible alternatives. These advantages include: (1) global cost savings of 50 percent or more; (2) major stimulus for innovation and diffusion of improved technologies (particularly to developing countries); (3) large resource flows to poorer countries (at a cost that is worthwhile to industrialized countries); (4) and built-in incentives for increased breadth of participation and treaty coverage. No other policy design combines all of these advantages.

Although concerns about allowance allocation, free riders, leakage, baselines, and monitoring and compliance are often raised as difficulties of a tradeable allowance regime, these concerns afflict *any* climate policy that would place an effective constraint on GHG emissions. Moreover, compared to an inflexible emissions constraint, formal allowance trading would actually ease these concerns.

In contrast to these generic concerns, problems particularly germane to market-based climate policy include high transaction costs in the JI and allowance markets, market power, and meddling in the international market by national governments. These problems deserve closer scrutiny and climate policy needs to be designed to ameliorate each of these concerns.

Climate policy design is not just a once-and-for-all choice, but must contemplate the long-term nature of the climate change issue and, thus, the long-term architecture of policy institutions.⁸⁷ There must be flexibility to adjust the overall constraint in light of adaptive learning over time, subject to the decision costs and dis-

ruption costs of frequent readjustments. Different policy designs may inculcate different attitudes toward adjustments. Allowance holders may resist relaxing the stringency of the constraint, whereas taxpayers may resist tightening its stringency. Devices such as time-limited allowances, a futures market, and advance notice of adjustments (much as central banks foreshadow changes in interest rates) could reduce transitional dislocations in an allowance system.

If an allowance trading system is adopted, it will be imperative to keep transaction costs low to enhance cost-effectiveness and to ensure the latitude to reallocate initially assigned allowances easing the impasse over the initial allocation method. Key steps include:

- relying on private sector actors to conduct trading; requiring little or no preapproval of each individual trade;
- imposing few or no taxes or discounting on JI or on allowance sales across the board;
- imposing no limits on the amount of trading, reportable abatement credits, or types of abatement technologies that can be employed;
- fostering organized exchanges to facilitate trades and spread information;
- fostering mutual funds to diversify risk among JI projects;
- and making opt-ins easy (or automatic) with no large barriers to entry (save appropriate buffers against allowance price destabilization).

Perfect integrity of the allowance trading system should not be the enemy of overall social efficiency. Monitoring and accounting criteria should be rigorous without overburdening the trading system. The major societal and environmental gains from trading, from attracting more participants, and from comprehensive coverage of all GHGs and sectors, justify a system that is effective without demanding perfect precision.

Most importantly, analysts need to take seriously the distinct political economy of *international* environmental regulation. Much effort has gone into studying the positive political theory and practice of national regulation. Given the stakes involved in issues like global climate policy, vigorous study of the political economy of international regulation is warranted.

If the climate negotiations are not just (or even mostly) about

the climate protection consequences of policy designs, but are also (or mostly) about moral visions, fairness, social engineering, trade rivalry and predation, or political power, then a wholly different approach may be needed to understand and predict actual climate policy. Empirical study of these hypotheses is sorely needed.

International application of efficient policy design confronts some institutional challenges not faced in the national domestic context. The voting rule is quite different at the international level; the requirement of voluntary assent invites greater play for holdouts, free riders, and special-interest rent-seekers. The treaty must meld the diverse legal systems and cultures of over 150 countries, some of which are important to the climate problem but not especially market-oriented.

The optimal geographic coverage of a climate treaty appears to be nearly universal, but achieving this result under a voting rule of voluntary assent requires choosing a policy design that attracts nearly universal (or widespread and growing) participation. By lowering costs and offering resource flows, allowance trading appears to be the best policy design for ensuring broad participation. Meanwhile, allowance trading works best when many countries participate and the exercise of market power is thereby checked. A GHG market should not be limited to industrialized ("Annex I") countries — any interested country should be invited to participate.

Adoption of an efficient policy design requires building a political "constituency for efficiency." Education about the efficiency advantages of allowance trading may increase the demand for and supply of such policies, but may not be enough if the political opposition derives from a non-efficiency or anti-efficiency agenda. Opposition to efficient policy design motivated by non-climate political and economic objectives needs to be studied and revealed. The distribution of gains from an efficient policy design to each country — such as cost savings, allowance sale revenues, and local pollution control — needs to be analyzed and publicized. These local gains could provide the basis for assembling a political constituency for efficiency in relevant countries.

Given the voting rule of unanimity, one way that efficiency might be ensured in climate policy design is for a major player to be a holdout in favor of efficiency. The most likely candidate to play this role is the United States. Thus future global climate policy design may depend fundamentally on the U.S. policy position, as it did in the negotiations leading to the adoption of the FCCC in 1992.

Compared to the alternatives, the current U.S. proposal for

formal allowance trading has to be judged encouraging. Still, it can be improved, and it remains to be seen how the U.S. policy is advanced toward the Kyoto meeting in December 1997 and thereafter.

Some say the environment is too important to be left to markets. Others say the environment is too important to be left *out* of markets. Integrating global environmental protection with world markets — if it can surmount the political obstacles to efficient policy design — promises dramatic environmental and economic rewards.

Table 1

A Hypothetical Example of Gains from Tradeable GHG Allowances

	(0) No GHG Control		(1) Install Scrubber		(2) Each Reduce 20%		(3) Each Reduce 20%, with Trading	
	Emissions	Cost	Emissions	Cost	Emissions	Cost	Emissions	Cost
<i>Country A</i>	5	0	4?	\$40	4	\$10	3	2@10 = \$20 - \$10+ from B = \$10
<i>Country B</i>	5	0	4?	\$40	4	\$40	5	\$10+ paid to A
<i>Global Total</i>	10	0	8?	\$80	8	\$50	8	\$20

It would require A and B to each spend \$40, for a total of \$80, with emissions reductions that would likely be less than the desired amounts.

Source: Author's calculations

Notes

1. See *Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change* (FCCC), Fifth Session, 2d Part, New York, 30 April - 9 May 1992, United Nations Document A/AC.237/18 (Part II)/Add.1 (1992), reprinted in 31 I.L.M. 851 (hereinafter "FCCC").
2. FCCC Article 4(2)(a), 4(2)(b).
3. FCCC Article 4(1).
4. United Nations Framework Convention on Climate Change, Conference of the Parties, First Session, Berlin, 28 March - 7 April 1995, Agenda Item 6(c), "Review of the Adequacy of Article 4, Paragraph 2(a) and (b) of the Convention, including Proposals related to a Protocol and Decisions on Follow-Up," Document FCCC/CP/1995/L.14 (7 April 1995); see also *United Nations Climate Change Bulletin*, No. 7 (FCCC Secretariat, Geneva: 2nd Quarter 1995).
5. See FCCC Article 4(2)(a) ("These Parties may implement such policies and measures jointly with other Parties"). On the U.S. proposal for policy design which became codified in this and related provisions of the FCCC, see Richard B. Stewart and Jonathan B. Wiener, "The Comprehensive Approach to Climate Change: Issues of Design and Practicality," 9 *Ariz. J. Int'l & Compar. L.* 83 (1992); Richard B. Stewart and Jonathan B. Wiener, "A Comprehensive Approach to Climate Change: Using the Market to Protect the Environment," *American Enterprise*, Nov.-Dec. 1990, at p. 75.
6. U.S. Submission to the UN FCCC Secretariat, containing "U.S. Draft Protocol Framework," attached to memorandum of Mark G. Hambley, Bureau of Oceans and International Environmental and Scientific Affairs (OES), U.S. Department of State, June 4, 1997.
7. See letter from Kenneth J. Arrow, Dale W. Jorgenson, Paul R. Krugman, William D. Nordhaus, and Robert M. Solow, January 3, 1997; see also Peter Passell, "Economic Scene: Yawn. A Global-Warming Alert. But This One Has Solutions," *New York Times*, February 13, 1997 (reporting on letter signed by over 2,000 economists endorsing tradeable allowance system to deal with global warming).
8. See Jonathan Baert Wiener, "Designing Markets for International Greenhouse Gas Control," Issues Brief, Resources for the Future (RFF), October 1997 (available at <http://www.rff.org>).

9. See Joseph E. Stiglitz, "The Theory of International Public Goods and the Architecture of International Organizations," Background Paper No. 7, Third Meeting of the United Nations High-Level Group on Development Strategy and Management of the Market Economy, Helsinki Finland (8-10 July 1995), pp. 1, 7.
10. See Stiglitz, *supra* note 9, at 1, 7; Garrett Hardin, "The Tragedy of the Commons," 162 *Science* 1243 (1968). Private bargains to manage the shared resource, as suggested by Ronald H. Coase, "The Problem of Social Cost," 3 *J. Law & Economics* 1 (1960), are unlikely where large and dispersed groups, uncertain causal linkages, and rife free riding all make such transactions very costly. See William J. Baumol and Wallace E. Oates, *The Theory of Environmental Policy*, pp. 9-13 (Cambridge University Press, 2nd ed., 1988); Howard K. Gruenspecht and Lester B. Lave, "The Economics of Health, Safety and Environmental Regulation," in 2 *Handbook of Industrial Organization*, pp. 1507, 1513-1514 (Richard Schmalensee and Robert D. Willig, eds., New York: North-Holland/Elsevier, 1989); W. Kip Viscusi, John M. Vernon and Joseph E. Harrington Jr., *Economics of Regulation and Antitrust*, pp. 716-717 (Boston: MIT Press, 2nd ed., 1995).
11. See Intergovernmental Panel on Climate Change (IPCC), *Climate Change 1995: Economic and Social Dimensions of Climate Change*, pp. 254-256 (James P. Bruce, Hoesung Lee, and Erik F. Haites, eds., Cambridge University Press, 1996) (hereinafter "IPCC Econ. 1995").
12. The Byrd resolution passed the Senate 95-0 in July 1997. See also John J. Fialka, "Senators Warn Global-Warming Pact Largely Hinges on Developing Nations," *Wall Street Journal*, June 20, 1997, at p. A20.
13. See Scott Barrett, "Reaching a CO₂-emission Limitation Agreement for the Community: Implications for equity and Cost-Effectiveness," 1 *European Economy*, p. 3 (1992).
14. See William J. Baumol, "Environmental Protection and Income Distribution," in *Redistribution Through Public Choice*, pp. 93-114 (Harold M. Hochman and George E. Peterson, eds., Columbia University Press, 1974) (demand for environmental protection typically increases with income).
15. IPCC Econ. 1995, at p. 71.
16. See IPCC Econ. 1995, chapter 9; National Academy of Sciences, *Policy Implications of Greenhouse Warming — Synthesis Panel Report*, pp. 60-63 (1991).

17. E.g. Richard Schmalensee, "Greenhouse Policy Architecture and Institutions," MIT CEEPR 96-008 WP (September 1996), at pp. 3-8; M.E. Schlesinger and X. Jiang, "Revised Projection of Future Greenhouse Warming," 350 *Nature*, pp. 219-221 (1991). But see James K. Hammitt, "Evaluation Endpoints and Climate Policy: Atmospheric Stabilization, Benefit-Cost Analysis, and Near-Term Greenhouse Gas Emissions," Center for Risk Analysis, Harvard School of Public Health (19 November 1996).
18. Eugene Skolnikoff, "The Policy Gridlock on Global Warming," 79 *Foreign Policy*, pp. 77, 91 (Summer 1990).
19. Evidence on this point is reviewed in Jonathan Baert Wiener, "Protecting the Global Environment," in *Risk vs. Risk: Tradeoffs in Protecting Health and the Environment*, pp. 193-225 (John D. Graham and Jonathan Baert Wiener, eds., Harvard University Press, 1995).
20. See Intergovernmental Panel on Climate Change (IPCC), *Climate Change 1995: Impacts, Adaptation and Mitigation of Climate Change* (R.T. Watson, M.C. Zinyowera and R.H. Moss, eds., Cambridge University Press 1996); Robert L. Peters and Thomas E. Lovejoy, eds., *Global Warming and Biological Diversity* (New Haven: Yale University Press, 1992).
21. See IPCC Econ. 1995 at pp. 157, 215-218, 271, 409; Roy Boyd, Kerry Krutilla and W. Kip Viscusi, "Energy Taxation as a Policy Instrument to Reduce CO₂ Emissions: A Net Benefit Analysis," 29 *J. Env'tl. Econ. & Mgmt.*, p. 1 (1995).
22. See Wiener, *supra* note 19. See Randall Lutter and Christopher Wolz, "UV-B Screening by Tropospheric Ozone: Implications for the National Ambient Air Quality Standard," 31 *Env'tl. Science & Technology*, no. 3 (March 1997) at pp. 142A-146A.
23. See Andrew Hurrell and Benedict Kingsbury, "The International Politics of the Environment: An Introduction," in *The International Politics of the Environment: Actors, Interests and Institutions*, pp. 1-11 (Andrew Hurrell and Benedict Kingsbury, eds., Oxford: Clarendon Press, 1992).
24. See Detlef Sprinz and Tapani Vahtoranta, "The Interest-Based Explanation of International Environmental Policy," 48 *Int'l Organization*, pp. 77-105 (Winter 1994).
25. See Hurrell and Kingsbury, *supra* note 23, at p. 5; Viscusi, Vernon and Harrington, *supra* note 10, at pp. 737-740.
26. See Dennis C. Mueller, *Public Choice II* (New York: Cambridge

University Press 1989) at p. 54; James Buchanan and Gordon Tullock, *The Calculus of Consent*, pp. 63-91 (Ann Arbor: University of Michigan Press, 1962).

27. Even after becoming party to the treaty, nation-states can withdraw. Although such withdrawal might be made technically illegal under the terms of a treaty, the practical issue is whether any enforceable penalties can be brought to bear against the defector. The threat of withdrawal gives the nation a continuing ability to exact concessions from other parties to the treaty.
28. See Guido Calabresi and A. Douglas Melamed, "Property Rules, Liability Rules, and Inalienability: One View of the Cathedral," 85 *Harv. L. Rev.*, p. 1089 (1972); Martin Weitzman, "Prices vs. Quantities," 41 *Review of Economic Studies*, p. 477 (1974); Richard B. Stewart, "Reconstitutive Law," 46 *U. Md. L. Rev.*, p. 86 (1986). The classic argument for price tools is A.C. Pigou, *The Economics of Welfare* (1920); see also Baumol and Oates, *supra* note 10. The classic argument for quantity tools is Coase, *supra* note 10. See also Thomas D. Crocker, "The Structuring of Atmospheric Pollution Control Systems," in *The Economics of Air Pollution*, pp. 61, 81-84 (Harold Woloizin, ed., 1966); John H. Dales, *Pollution, Property and Prices* (Toronto: University of Toronto Press, 1968); W. David Montgomery, "Markets in Licenses and Efficient Pollution Control Programs," 5 *J. Econ. Theory*, p. 395 (1972).
29. See Crocker, Dales, and Montgomery, cited *supra* note 28.
30. See Pigou, *supra* note 28; Baumol and Oates, *supra* note 10.
31. For example, the Bergen Declaration (1989) advocated coordinated adoption of more stringent automobile fuel economy standards. See Richard Cooper, "A Treaty on Global Climate Change: Problems and Prospects," Harvard University, draft October 1996 (suggesting that nations could more readily agree on a set of "actions" rather than on national emissions targets).
32. See Jae Edmonds and Marshall Wise, "Exploring a Technology Strategy for Stabilizing Atmospheric CO₂," Pacific Northwest Laboratory, Washington D.C., draft August 1, 1997.
33. See Murray Weidenbaum, Christopher Douglas, and Michael Orlando, *Toward a Healthier Environment and a Stronger Economy: How to Achieve Common Ground* (St. Louis, MO: Center for the Study of American Business, Washington University, January 1997).

34. See World Bank, *World Development Report 1992: Development and the Environment*, p. 161 (Oxford University Press, 1992).
35. See Daniel J. Dudek, Richard B. Stewart and Jonathan B. Wiener, "Environmental Policy for Eastern Europe: Technology-Based versus Market-Based Approaches," 17 *Colum. J. Envtl. L.*, p. 1 (1992).
36. See Executive Order 12866 (October 1993); Beth S. Ginsberg and Cynthia Cummis, "EPA's Project XL: A Paradigm for Promising Regulatory Reform," 26 *Envtl. L. Rep.*, pp. 10059 (February 1996).
37. See Dudek, Stewart and Wiener, *supra* note 35; Robert W. Hahn and Robert N. Stavins, "Incentive-Based Environmental Regulation: New Era from an Old Idea?" 18 *Ecol. L. Q.*, p. 1 (1991).
38. The FCCC incorporated both formulations. Article 3(3) encourages "cost-effective" efforts to be "carried out cooperatively by interested Parties;" and Article 4(2)(a) provides that "Parties may implement such policies and measures [to limit net GHG emissions] jointly with other Parties."
39. Emitters may still be motivated to use the pilot phase of JI to pursue public relations rewards, to learn about JI and make international contacts in anticipation of participating in a full market, to satisfy non-FCCC emissions limits such as national or state/provincial requirements where credit is granted, and to make early investments in projects that could generate real credits after the pilot phase ends
40. Note that in several models of temporal flexibility, the marginal intertemporal transfers of abatement have close to no net impact on accumulated GHG concentrations. E.g. Richard Richels, Jae Edmonds, Howard Gruenspecht and Tom Wigley, "The Berlin Mandate: The Design of Cost-Effective Mitigation Strategies." Energy Modeling Forum 14, Stanford University, draft of February 3, 1996, Figure 6.
41. E.g. Alan Manne and Richard Richels, "The Berlin Mandate: The Costs of Meeting Post-2000 Targets and Timetables," 24 *Energy Policy*, pp. 205-210 (1996); Richels, Edmonds, Gruenspecht and Wigley, *supra* note 40; U.S. Government, "Economic Effects of Global Climate Change Policies," Results of the Research Efforts of the Interagency Analytic Team (IAT) (draft dated May 30, 1997); Jean-Marc Burniaux, John P. Martin, Giuseppe Nicoletti and Joaquim Oliveira Martins, "The Costs of Reducing CO₂ Emissions: Evidence from GREEN," OECD Economics Department Working Paper No. 115, OCDE/

GD(92)117 (Paris: OECD, 1992).

42. Richels, Edmonds, Gruenspecht and Wigley, *supra* note 40, Figure 3.
43. *Ibid.*, Figure 4.
44. *Ibid.* at 10 and Figure 8.
45. See Daniel J. Dudek and Jonathan Baert Wiener, "Joint Implementation, Transaction Costs, and Climate Change," OCDE/GD(96)173 (Paris: OECD, 1996).
46. See Richard B. Stewart and Jonathan B. Wiener, "The Comprehensive Approach to Global Climate Policy: Issues of Design and Practicality," 9 *Ariz. J. International & Comparative L.*, pp. 83, 94 and n.45 (citing studies by DOE and the World Bank showing that including all GHGs lowers the cost of abatement, compared to a CO₂-only policy, by about 75 percent; and including the forest sector lowers the cost of abatement, compared to an energy-sector only policy, by about 90 percent).
47. See Adam B. Jaffe and Robert N. Stavins, "Dynamic Incentives of Environmental Regulation: The Effects of Alternative Policy Instruments on Technology Diffusion," 29 *J. Envtl. Econ. & Mgt.* S43-S63 (1995).
48. See Edward A. Parson and Karen Fisher-Vanden, "Joint Implementation and Its Alternatives: Choosing Systems to Distribute Global Emissions Abatement and Finance," Environment and Natural Resources Program, Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University (April 28, 1997), at p. 5; Scott Barrett, "Transfers and the Gains from Trading Carbon Emission Entitlements in a Global Warming Treaty," chapter VII in *Combating Global Warming: Study on a System of Tradeable Carbon Emission Entitlements* (Geneva: UNCTAD 1992); Manne and Richels, *supra* note 41.
49. See Manne and Richels, *supra* note 41; Richels, Edmonds, Gruenspecht and Wigley, *supra* note 40.
50. *Ibid.*
51. See Robert W. Hahn and Gordon L. Hester, "Marketable Permits: Lessons for Theory and Practice," 16 *Ecol. L. Q.*, p. 361 (1989). Some or much of the cost savings in the SO₂ case may derive from the performance-based (intra-firm) flexibility introduced in the 1990 law, rather than the trading (inter-firm) flexibility the law also afforded.

52. See Dudek, Stewart and Wiener, *supra* note 35, at p. 45.
53. See Weitzman, *supra* note 28; Gruenspecht and Lave, *supra* note 10, at pp. 1516-1519; Robert N. Stavins, "Correlated Uncertainty and Policy Instrument Choice," 30 *J. Envtl. Econ. & Mgt.*, p. 218 (1996).
54. See James M. Buchanan and Gordon Tullock, "Polluters' Profits and Political Response: Direct Controls Versus Taxes," 65 *Amer. Econ. Rev.*, p. 139 (March 1975); Nathaniel Keohane, Richard Revesz and Robert Stavins, "The Positive Political Economy of Instrument Choice in Environmental Policy," RFF Discussion Paper 97-25 (February, 1997), at p. 31 and nn. 53-54.
55. See e.g. Donald N. Dewees, "Instrument Choice in Environmental Policy," 21 *Economic Inquiry*, pp. 53, 53 (January 1983) ("The general failure to adopt policies of proven efficiency has been viewed with despair by economists. But if we are to understand why policies are not adopted and to develop policy designs that may be both efficient and politically attractive, we must analyze the essence of political decisions: the distributional effects of policies.") (citation omitted). See also Keohane, Revesz and Stavins, *supra* note 54, at 41; Hahn and Stavins, *supra* note 37.
56. For reviews see Keohane, Revesz and Stavins, *supra* note 54; Robert W. Hahn, "The Political Economy of Environmental Regulation: Toward a Unifying Framework," 65 *Public Choice*, p. 21 (1990); Roger Noll, "The Politics of Social Regulation," in R. Schmalensee and R. Willig, eds., *Handbook of Industrial Organization*, vol. 2 (1989).
57. A notable example is Sprinz and Vaahtoranta, *supra* note 24.
58. See IPCC Econ. 1995 at pp. 254, 318.
59. See Dudek, Stewart and Wiener, *supra* note 35.
60. See Peter Bohm, "A Joint Implementation as Emission Quota Trade: An Experiment Among Four Nordic Countries," *Nord* 1997:4 (Copenhagen: Nordic Council of Ministers, 1997).
61. See Buchanan and Tullock (1975), *supra* note 54.
62. See Jonathan Baert Wiener, "Designing Markets for International Greenhouse Gas Control," Issues Brief, Resources for the Future (RFF), October 1997 (available at <http://www.rff.org>).
63. E.g. Cooper, *supra* note 31; Warwick McKibben and Peter Wilcoxon, "A Better Way to Slow Climate Change," Brookings

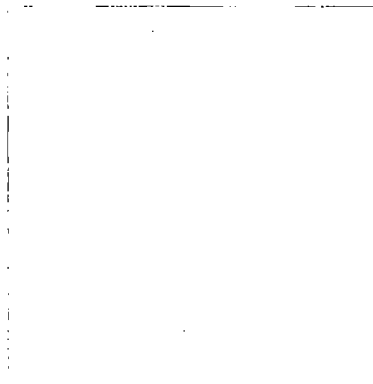
Policy Brief No. 17, June 1997.

64. Hence the Byrd Resolution passed 95-0 in July 1997.
65. See Daniel J. Dudek and Jonathan Baert Wiener, "Joint Implementation, Transaction Costs, and Climate Change," OCDE/GD(96)173 (Paris: OECD Environment Directorate, Nov. 1996). See also Robert N. Stavins, "Transaction Costs and Tradeable Permits," 29 *J. Envtl. Econ. & Mgmt.*, pp. 133-148 (1995); Vivien Foster and Robert W. Hahn, "Designing More Efficient Markets: Lessons from Los Angeles Smog Control," 38 *J. Law & Econ.*, pp. 19-48 (April 1995).
66. See Dudek and Wiener, *supra* note 65, at p. 53.
67. See Wiener, *supra* note 8; Robert W. Hahn, "Market Power and Transferable Property Rights," 99 *Quarterly J. Econ.*, p. 753 (1984); Walter S. Misiolek and Harold W. Elder, "Exclusionary Manipulation of Markets for Pollution Rights," 16 *J. Envtl. Econ. & Mgmt.*, pp. 156, 164 (1989); Hege Westkog, "Market Power in a System of Tradeable CO₂ Quotas," 17 *Energy J.*, pp. 85, 86 (1996).
68. See Richard B. Stewart, Jonathan Baert Wiener, and Philippe Sands, "Legal Issues Presented by a Pilot International Greenhouse Gas Trading System" (Geneva: UNCTAD, November 1996) at pp. 33-35.
69. See Eleanor M. Fox, "Toward World Antitrust and Market Access," 91 *Amer. J. Int'l L.*, p. 1 (1997).
70. See "Pollution Control: Unshackling the Invisible Hand," *The Economist*, January 4, 1992, at p. 66 (states seeking to meddle in SO₂ allowance market); *Alliance for Clean Coal v. Miller*, 44 F.3d 591 (7th Cir. 1995) (striking down Illinois law restricting use of low-sulfur out-of-state coal enacted in response to 1990 acid rain SO₂ trading program); Elizabeth Bailey, "Allowance Trading Activity and State Regulatory Rulings: Evidence from the US Acid Rain Program." MIT CEEPR Working Paper 96-002 (March 1996).
71. See Stewart, Wiener and Sands, *supra* note 68, at 35-40.
72. See Steven Kelman, "Cost-Benefit Analysis: An Ethical Critique," 5 *Regulation*, no. 1 (January-February 1981) at pp. 33-40.
73. This viewpoint is described (not endorsed) by Howard Margolis as seeing polluters "as intrinsically evil. So of course whatever these actors want to do should be impeded: probably whatever they want to do is bad, and, even if on this occasion it is

not, undercutting their claims to legitimacy and authority is a good thing anyway. And since the by-products of these disgusting institutions are profoundly polluting, it is implausible that they can really be cleaned up at all and downright wrong to suppose that they can be cleaned up easily – that is, without some significant expiation of the sin they represent.” Howard Margolis, *Dealing with Risk*, p. 25 (Chicago: University of Chicago Press, 1996).

74. Unless the moralist advocates a truly zero emissions policy.
75. See Karin Arts, Paul Peters, Nico Schrijver, and Peter van Sluijs, “Legal and Institutional Aspects,” in *Joint Implementation to Curb Climate Change: Legal and Economic Aspects*, pp. 1, 48-53 (Onno Kuik, Paul Peters and Nico Schrijver, eds., Dordrecht Netherlands: Kluwer Academic Publishers 1994) (citing proposed limits on JI).
76. Furthermore, if the local “supplementary benefits” of GHG abatement are important in developing countries – as is suggested by the high levels of local air pollution in Mexico City and Beijing, among others – then allowance trading provides a direct mechanism to control that pollution, which domestic-only action by industrial countries would do nothing to address.
77. See *supra* text accompanying notes 47-49.
78. See Schmalensee, *supra* note 17.
79. E.g. George J. Stigler, “The Theory of Economic Regulation,” 2 *Bell J. Econ.*, pp. 3-21 (1971); Sam Peltzman, “Toward a More General Theory of Regulation,” 19 *J. Law & Econ.*, pp. 211-240 (1976); Robert Tollison, “Regulation and Interest Groups,” in *Regulation: Economic Theory and History*, pp. 59-76 (Jack High, ed., Ann Arbor: University of Michigan Press, 1991).
80. E.g. Ann P. Bartel and Lacy Glenn Thomas, “Predation Through Regulation: The Wage and Profit Effects of the OSHA and the EPA,” 30 *J. Law & Econ.*, pp. 239-264 (1987); Michael T. Maloney and Robert E. McCormick, “A Positive Theory of Environmental Quality Regulation,” 25 *J. Law & Econ.*, pp. 99-124 (1982); Tollison, *supra* note 79, at pp. 64-66; Peter B. Pashigian, “Environmental Regulation: Whose Self-Interests are Being Protected?” 23 *Econ. Inquiry*, pp. 551-584 (1985); Bruce A. Ackerman and William T. Hassler, *Clean Coal / Dirty Air* (New Haven: Yale Univ. Press 1981).
81. See Keohane, Revesz and Stavins, *supra* note 54, at p. 2 n.7 (citing Stewart 1996 draft).

82. The IPCC cites "bottom-up" studies showing that Germany, France, and the Netherlands face low domestic GHG abatement costs - indeed close to zero cost to keep their emissions at 1990 levels by 2000 - but that the U.S., Japan, Norway and others face much higher domestic abatement costs. See IPCC Econ. 1995 at pp. 318, 321. These bottom-up studies are probably more pertinent to industry-specific perceived costs, and hence to industries' strategic behavior, than are macroeconomic top-down studies of costs to the entire economy.
83. The predation strategy is complicated by the fact that under a tradeable allowances system, the low-cost abaters could also earn revenues from allowance sales (depending on their initial assignment of allowances). Thus, predation makes sense if the low-cost abaters would gain more from an inflexible policy's impacts on high-cost rivals than they would gain from a flexible policy's revenue prospects. Global GHG allowance trading would direct allowance sale revenues to developing countries and Eastern Europe, not to Western Europe, whereas an inflexible policy would hurt the United States and Japan relative to Western Europe. But trading among industrialized countries ("Annex I") only could direct revenues to Western Europe. In short, to be politically successful, a trading policy must not only reduce abatement costs to each country, but must deliver gains exceeding those of predation.
84. This would reflect the combination of both "Baptist" (environmentalist) and "Bootlegger" (industry rent-seeker) special interests that Bruce Yandle argues must undergird domestic environmental regulation. See Bruce Yandle, "Bootleggers and Baptists in the Market for Regulation," in *The Political Economy of Government Regulation*, pp. 29-54 (Jason F. Shogren, ed., Boston: Kluwer Academic Publishers, 1989).
85. See Yandle, *supra* note 84 (bootleggers pursue their strategic interests under cover of Baptist slogans).
86. See Manne and Richels, *supra* note 41; Richels, Edmonds, Gruenspecht and Wigley, *supra* note 40, at p. 10.
87. See Schmalensee, *supra* note 17; Stiglitz, *supra* note 9.



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3/9/98 mtg w/ Chichilinsky

April workshop (3 days) at Columbia U. on IBES proposal
(w/ Raul Estrada) - wants Admin team

Would this work be useful? How will it be used?

In developing institutions - draw from experience w/
development banks

1/13/98 GCC intl trading mty

Can we trade w/ given protocol

separate decision document from Kyoto $\rightarrow$ COP4 should set out rules $\rightarrow$ however, US interpretation is that we can trade now

Options

lay out default + negotiating positions in memo

- multiple scenarios 1) play tough - just focus on accountability, verification $\leftarrow$ limited agenda
- 2) open up rules debate

do a prospective trade based on our rules

- possible bilateral agreement w/ Canada

(experimental rules $\rightarrow$ do some experiments w/ trades)

3) do trading to force matters

Umbrella?

- 2 steps: 1) estimate economic effects

2) develop diplomatic strategy (legal)

3 takes on umbrella: 1) negotiating bloc

2) group of countries that want to trade

3) exclusive club

Rules

provide Sharon w/ comments

What do we want - rules

interpreting sinks language paper - Charlie has lead
Rich Birdsey working on sinks #5 - by Friday
Stern packet w/ talking points

3 minor - EPA may have better data
CO₂-EIA may be better

Aus - net-net sink

Tues 3

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