PUBLIC CHOICE ISSUES IN COLLECTIVE ACTION: CONSTITUENT GROUP PRESSURES AND INTERNATIONAL GLOBAL WARMING REGULATION

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April 4, 2000

The authors acknowledge the support of the International Center for Economic Research (ICER), Turin, Italy.

ABSTRACT

There is a large and growing literature on scientific issues and regulatory instruments, such as emissions permits, in international efforts to control greenhouse gas (GHG) emissions. The underlying collective action issues have received much less attention. In particular, the bargaining problem among sovereign states, the associated public choice problem within negotiating countries and the implications for agreement and sustained compliance have been neglected. This paper examines the problems of international cooperation when the aggregate benefits and costs of the objective are uncertain; the corresponding net gains to bargaining parties are uncertain; when the parties are heterogeneous with respect to the distribution of benefits and costs; and when adherence to the agreement by sovereign states is voluntary. We outline a bargaining framework, including the public choice tradeoffs facing politicians, for analyzing international bargaining to address global common-property resource problems. We focus on the likely net gains from agreement for major negotiating countries and on politicians within industrial democracies, such as the US, and their decisions to respond to constituencies who support global agreements, constituencies harmed by them, and taxpayers who must fund transfers both to internal parties to compensate for treaty costs and to other countries as side payments for participating. We apply this framework to the Law of the Sea Treaty of 1982 (LOS), the Montreal Protocol to Control Substances that Damage the Ozone Layer of 1987, and the Kyoto Protocol of 1997. There are similar negotiation and compliance issues in all three collective actions. The analysis provides implications for the success of international efforts to control temperature change.

I. Introduction.

Concerns about the accumulation of greenhouse gases in the atmosphere and possible effects on global temperatures have led to a series of international initiatives for collective action. These include the United Nations Framework Convention on Climate Change (FCCC) signed at Rio de Janeiro in 1992 where countries pledged to voluntarily reduce carbon emissions to 1990 levels by 2000; a meeting in 1995 in Berlin of the Conference of Parties (COP), created at the Rio conference, to define a structure for further action; and the Kyoto Protocol on Global Warming of December 1997 (Sparber and O'Rourke, 1998).

Under the Protocol, thirty-eight developed countries are to reduce greenhouse gas (GHG) emissions by approximately 95 percent of 1990 levels by 2008-2012. The United States is to reduce its discharges of carbon dioxide (CO_2) to 93 percent of 1990 emissions by the same time period. These reductions will not be without costs. Most CO_2 is released from burning fossil fuels, such as coal, and the United States currently is the largest emitter (U.S. Department of Energy, December 1998). A restructuring of the American and other industrial economies will be necessary with a possible reduction in GDP (Manne and Richels, 1990; Burniaux, Martin, Nicoletti, and Martins, 1992).. The macroeconomic effects will depend on each country's energy intensity of production, energy sources, and the magnitude and pace of emission reductions implemented. On a microeconomic level, there will be distributional effects within and across countries, both from global warming and efforts to control it. Some countries are more vulnerable to the negative implications of global warming and within countries energy-intensive industries will bear the brunt of emission controls. Taxpayers will be called on to fund the implementation and monitoring of regulations and to pay for compensating transfers to sectors harmed by regulation. Further, they will be required to pay for side payments to other countries as inducements to participate in collective action. Consumers may also be effected if costs and prices rise from a shift to less-polluting forms of production. On the other hand, those constituencies that favor action to mitigate potential global warming will benefit. These distributional effects set up potential public choice problems with implications for the success of international collective action. These public choice issues have been relatively neglected in the literature.[1]

Global warming is a common-property resource problem. With access to the atmosphere unrestricted, gases such as carbon dioxide (CO_2), Nitrous Oxide (N_2O), Chlorofluorocarbons (CFCs) and methane (CH_4) are released as by-products of human activities and other natural sources across countries. CFCs are the most potent per molecule, but CO_2 is most abundant gas. Regardless of their origin the gases are spread around the globe with potential external effects. The gases retard the re-radiation of the sun's energy from the earth's surface back into space. Under debate are whether and how much the further accumulation of these gases will generate a damaging rise in global

[1] A large and growing literature has emerged about the scientific phenomena of global warming, its possible effects, various regulatory instruments, and the role of international law in environmental policies. It is not possible to be inclusive given the size of this literature. Some selected citations are Cline (1992), Driesen (1998), Hanafi (1998), Hoel (1997), Hollick and Cooper (1997), Houghton (1997), Moore (1998), Nordhaus (1991a, 1991b, 1993), Paterson (1996), Poterba (1993), Shogren (1999), Schmalensee (1993a, 1993b), Weyant (1993), and Wiener (1999).

temperatures.[2]

In the past 100 years, global mean temperatures have risen from between .5-1.1^0 F, and there are projections of a further increase of 2-6.5^0 F with 3.5^0 F the best guess within the next century. The causal relationship between the build up of CO_2 and an increase in global temperatures has not been defined conclusively. Nevertheless, the expected linkages have stimulated international efforts to control emissions and thereby mitigate any possible rise in temperatures.[3] There is concern by some that absent coordinated action, global warming could have undesirable, even catastrophic results, including a greater incidence of tropical diseases, more heat-related mortality, reduced agricultural output in certain areas, and a rise in sea levels that would threaten low-lying areas.[4]

Collective action to address potential climate change will be a formidable challenge. The very nature of global environmental externalities presents incentive problems. Abatement by any country benefits others as a public good, but if abatement is costly to a country's citizens, its politicians have incentive to invest less in reduction efforts than would be globally optimal and free ride on cutbacks taken elsewhere. Research on collective action to address more tractable, local common-property resources indicates that these incentive problems can occur even when there is agreement about the magnitude of the problem and the aggregate benefits of resolving it.[5] As we describe, these bargaining issues are more complex in international environmental agreements where the benefits are uncertain, the costs of compliance differentially spread across countries and sectors within them, and where enforcement among sovereign countries is voluntary.

II. Theoretical Framework for Analyzing International Collective Action to Address Common-Property Resource Problems.

In this section we develop a simple model that frames the international negotiation of

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[2] CO_2 levels, for example, have risen from 275 parts per million 200 years ago to 350 ppm today, and are projected to reach 500 ppm by the end of the next century. Current global carbon emissions are estimated to be about 4 percent of the stock of CO_2 in the atmosphere attributable to human activity and about 1 percent of total atmospheric carbon. Hollick and Cooper (1997, 159), Weyant (1993, 27-30), and Moore (1998, l12).

[3] IPCC (1995, Sec. 3). Various temperature projections are given, depending on the source. See IPCC estimates noted by Moore (1998, 13) and Hoel (1997, 172). Moore notes that the 1990 temperature projection was higher, 6 to 14^{0}F by 2050. The adjustments underscore the uncertainty involved.

[4] These are summarized and criticized in Moore (1998, 69-128).

[5] The importance of the parties' heterogeneities and the skewness of the proposed share distribution as significant sources of intense political conflict in bargaining is described by Libecap (1989). These are the same lessons that are drawn from the cartel literature as to when cartels can be self-enforcing. In the case of global warming agreements, there is discussion of the efficiency and public finance effects of different regulatory devices, such as tradable emission permits and other carbon taxes. See Poterba (1993), Wiener (1998), and Driesen (1998).

environmental treaties as a collective action problem. Consistent with the empirical treatment of the various international treaties studied in the paper, the model emphasizes the important public choice issues arising during both state and international negotiation. International negotiations do not take place detached from the underlying political realities within each of the bargaining countries. Rather, a country is represented by an agent who is accountable to domestic constituencies. This agent must adopt an international negotiating position that simultaneously leads to a resolution of the international common-property problem *and* generates the greatest political support among his/her electorate.[6] In our model, the benefits and costs of an international treaty are borne not only by the underlying constituencies, but also by the elected agent.[7] Hence, the agent will be very cautious before committing his/her country to an agreement because imposing even minor costs on a constituency, or constituencies, without commensurate benefits may lead to large defections in political support.

One way political support may be obtained is by allocating transfer payments to key constituents. The collective action literature makes clear the importance of mitigating differences between bargaining parties and inducing important economic actors to join.[8] Side payments may be used to accomplish both of these ends. Among the international agreements examined in the paper, side payments are particularly important because treaty costs differ greatly across countries. At the same time, generating consensus among rival political factions within a country would be nearly impossible without compensating losing constituencies.

To formalize the general framework above, we model the international collective action problem in two parts: first, we address the international negotiation task, and second, we examine how the underlying public choice concerns give way to a single negotiating position in the international negotiations. The framework is consistent with and is motivated by Olson's (1965) rational choice basis for collective action.

Consider first international negotiations. Suppose that a group of I countries is negotiating towards resolution of a common-property resource problem. The total utility that country i derives from a treaty agreement is the sum of the expected net benefit of the treaty, whose value is determined in a way described below, and any transfer payments t_i that it receives from or provides to other countries as a condition of agreement. Hence, each country *i's* preferences can be expressed in terms of whether there is agreement, the expected net benefit of agreement and the transfer payment that is conditional on agreement as follows.

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[6] These two tasks that international negotiators face, and more generally the complicated links between domestic and international politics, have been discussed by many others. See, for example, the readings in Keohane and Levy (1996).

[7] For enforcement reasons, constituencies in one country do not negotiate directly with constituencies in other countries, rather they do so through their political representatives as agents.

[8] Again, consider the problem of forming a cartel where there are large cost differences. It is difficult to get low cost producers to join if their share of excess profits do not account for the cost differences. Also, having the largest producers under agreement is critical to the success of any production cartel.

$$u_i(\text{agreement}, q_i, t_i) = q_i + t_i,$$
$$u_i(\text{no agreement}, q_i, t_i) = 0. \qquad (1)$$

Given individually rational representative agents, no country will participate in the international agreement unless the sum of expected benefits of the treaty, including transfer payments, is greater than its value of non-agreement.[9]

Realizing that success in negotiations depends upon the viability of transfer payments, we employ the well-known AGV mechanism suggested by d'Aspremont and Gerard-Varet (1979) and Arrow (1979). The mechanism provides a convenient transfer payment formula that guarantees "budget balance," or that any monies transferred to one country are paid in full by other countries.[10] More importantly, the approach is highly instructive in illustrating the importance of transfer payments in international negotiations, and how small changes in the transfer scheme, such as defection by one of the international players, can have large consequences for the overall agreement.

Initially, countries' agents do not know each other's expected net benefits, q_i. One reason for this is that the agents themselves may be unsure of the nature of the domestic support for the treaty, and hence their own q_i, since camps in support and in opposition to international treaties often solidify only after actual negotiations begin. However, we assume that the distribution of each $q_i, (i = 1, ..., I)$, is common knowledge.[11]

Each negotiator aggregates the preferences of his or her constituency, according to a procedure described below, to determine the expected net benefit to report during the international negotiations. Let q_i denote the expected net benefit reported by the agent for country i. The AGV mechanism's decision rule is to implement the treaty if and only if the aggregate reported expected net benefit is positive, or

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[9] Note that we have assumed without loss of generality that each country's expected net benefit is reported in relation to a non-agreement value of zero.

[10] Essentially, the AGV transfer payments compensate "losers" by paying them the expected net benefit of all the others conditional on their own report. Although there is a strong sense in which the AGV mechanism is incentive compatible, to avoid technical issues that distract from the focus of this paper we assume that negotiators truthfully report to the negotiations an expected net benefit that derives from a vote maximization calculation described below. This assumption is consistent with our view that the agent acts in his/her own political interest because the agent's future political support depends on how faithful the constituency believes the agent is in representing their views. It is likely that, where the benefits of an agreement accrue over a long period of time, as is typically the case in resource problem treaties, it may be very difficult for the agent to persuade the constituency that acting in violation of their stated views is, in fact, in their best interest.

[11] A regularity condition required for the AGV mechanism is that each country's expected net benefit distribution is common knowledge (see d'Aspremont and Gerard-Varet , 1979, 38).

$$\sum_{i=1,I} q_i > 0. \qquad (2)$$

The transfer payments implied by the AGV mechanism if the treaty is implemented are given by (see d'Aspremont and Gerard-Varet, 1979)

$$t_i(q) = E_{q_{-i}}\left[\left(\sum_{j\neq i} q_j\right) I(\{\sum_{j\neq i} q_j\} + q_i > 0)\right] + t(q_{-i}) \quad i = 1,...,I \qquad (3)$$

where $q = \{q_1,...,q_I\}$, $q_{-i} = \{q_1,...,q_{i-1},q_{i+1},...,q_I\}$, $t(q_{-i})$ does not depend on q_i and is chosen to ensure budget balance, and $I(\cdot)$ is an indicator function that takes value one if $\sum_{j\neq i} q_j + q_i > 0$ and is zero otherwise.

The first term on the right hand side of equation (3) is the sum of other countries' expected surplus conditional on the reported expected net benefit of country i. The second term in (3) is a function whose value is independent of country $i's$ report and which is chosen to ensure budget balance, or that

$$\sum_{i=1,I} t_i(q_i) = 0. \qquad (4)$$

Before moving on, it is worth noting that the model thus far yields several well-known results from the collective action literature. First, the reported expected net benefits $\{q_i\}_{i=1,I}$ in conjunction with Equation (2) will determine the initial feasibility of successful collective action.[12] If the $\{q_i\}_{i=1,I}$ are highly heterogeneous and include both positive and negative values then implementing the international treaty requires transfer payments.[13] Furthermore, if parties view the status quo as more attractive than the expected utility of agreement (net transfers), a collective agreement is not likely.[14] Indeed, where the agreement value is close to the status quo, a transfer payment may still be needed to move a party from its initial position.

It would be possible to proceed relying solely on the above framework, but such an approach would ignore important public choice issues that are central to our analysis, and which we believe will have a sizeable impact on any attempt to negotiate an international global warming treaty.[15] For

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[12] For related discussion, see Buck (1998).

[13] Heterogeneous in this context refers to the difference across countries of net benefits versus the status quo. For example, if half of the countries expect positive gains from agreement and the other half expects losses, agreement is far less likely (without transfer payments) than when all countries receive positive benefits from agreement.

[14] For a similar ranking of options in addressing common-property resource problems in fisheries and in oil fields see Johnson and Libecap (1982) and Wiggins and Libecap (1984).

[15] For discussion of the transactions costs of cross-country bargaining, see Yarborough and Yarborough (1994) and discussion of individual actions in the Law of the Sea

instance, the empirical analysis described later in the paper suggests that successful negotiations must account for the potentially highly heterogeneous preferences of underlying constituencies within a country. The way the country's agent fixes the negotiation position depends on these preferences, and as political economy research has made clear, agents must be responsive to important interest groups in order to secure and maintain political office (see, e.g., Peltzman (1976)).

Suppose there are N_i constituencies to which the agent for country i must respond, and denote the expected net benefit of the treaty to group n_i by B_{n_i}, where this value is again in relation to a "disagreement" value of zero. In addition to B_{n_i}, if the negotiations are successful group n_i may be required to pay (or receive) part of country $i's$ transfer payment; denote this amount by R_{n_i}. Thus, each member of interest group n_i, which includes m_{n_i} members, has preferences represented by:

$$V_{n_i} = (B_{n_i} + R_{n_i})/m_{n_i},\ n_i = 1,...,N_i, \text{if agreement takes place.}$$
$$V_{n_i} = 0 \text{ otherwise.} \qquad (5)$$

The agent for country i is interested in maintaining political office and, consequently, in maximizing political support.[16] In the spirit of Peltzman (1976), suppose that the likelihood that any member of group n will vote for agent i is a positive and strictly concave function of their preferences $p_n(V_n)$, where $p_n^{/} > 0$, $p_n^{//} < 0$ and p_n takes values in the interval $[0,1]$. Hence, the number of votes the agent expects to obtain from group n if there is an international agreement is $m_n p(V_n)$. Also, because the value of disagreement is zero, the likelihood that a member of group n will vote for the candidate in the event of disagreement is written $p_n(0)$.

Since the distribution of other countries' expected net benefits q_{-i} is known to the agent, the probability of agreement given any reported q_i is obtained from

$$p(q_i) = E_{q_{-i}} I\Big(\sum_{q_j \neq q_i} q_j + q_i\Big). \qquad (6)$$

We assume that the distributions of the variables underlying the expectations are such that $p' > 0$ (which follows from (6) for any proper distribution function for q_{-i}) and $p'' < 0$. The agent's goal, therefore, is to choose a domestic transfer payment allocation and an expected net benefit position in order to solve the following vote maximization problem:

$$\max_{q_i, \{R_n\}_{n=1,..N}} p(q_i) \sum_{n=1,N} m_n\ p_n(V_n(B_n, R_n)) + (1 - p(q_i)) \sum_{n=1,N} m_n p_n(0)$$
$$\text{s.t.} \qquad (7)$$
$$\sum_{n=1,...,N} R_n = t_i(q_i).$$

where

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negotiations, see Sebenius (1984).

[16] In the sequel, to avoid cumbersome repetition of the *i* double-script, we will suppress this notation whenever it is clear from the context that we are discussing features of a county *i*'s domestic political setting.

$$t_i(q_i) = E_{q_{-i}}[\sum_{j \neq i} q_j \mid (\sum_{j \neq i} q_j + q_i > 0)] + E_{q_{-i}} t(q_{-i}). \quad (8)$$

Equation (8) gives the expected transfer payment to country i conditional on an international agreement and their agent reporting q_i.[17]

It is worth emphasizing that the agent's must choose the expected net benefits q_i to report at the international negotiations based only on their knowledge of the distribution of the other agents' expected net benefits and the expected values that their constituencies place on the treaty. A feature of many actual treaty negotiations, including those that we discuss below, is that these political calculations must be revisited as more information becomes available to the agent and their constituencies. In some cases, particularly in the event of cheating, this can lead initially promising treaty negotiations to break down.

An interior solution to the agent's vote maximization problem (7) is characterized by the following easily derived first order necessary conditions:

$$\begin{aligned} R_{n_i} &: p(q_i) m_n p_n^{/}(V_n) \frac{\partial V_n}{\partial R_n} = p(q_i) p_n^{/}(V_n) = l, \quad n = 1, \ldots, N \\ q_i &: p^{/}(q_i)[\sum_{n=1,N} m_n p_n(V_n(B_n, R_n)) - \sum_{n=1,N} m_n p_n(0)] = -l t_i^{/}(q_i) \end{aligned} \quad (9)$$

Here, $l > 0$ represents the Lagrangian multiplier on the transfer payment constraint in (7).

Conditions (9) have useful interpretations. The first says that the agent chooses a transfer payment allocation such that the expected marginal vote benefit of transfer payments is equalized across constituencies. The second requires the agent to choose q_i such that the benefit of a marginal increase in its value is exactly offset by the marginal vote change due to the change in transfer payments that an increase in q_i entails. These conditions are important because they emphasize the underlying public choice concerns that we find in all of the treaties examined in the paper. Furthermore, the equations in (9) imply that even constituent groups highly in favor of a treaty are limited in the strength with which they can convey that message at international negotiations. At some point the transfer payments required when reporting a high q_i would be so large that they would begin to erode the agent's political support.

The international collective action problem taken together with the public choice concerns highlighted by our model allows us to make several predictions about the likelihood of success in global environmental treaties. First, the AGV mechanism emphasizes the importance of transfer payments, and how their calculation may be made difficult by a number of factors. For instance, the transfer payment scheme, as we have modeled it, relies on the net gain calculations that underlie the B_n. These calculations may be complicated in a global warming accord due to the size, nature, and uncertainty of the common-property problem. Knowledge may be limited so that benefits are only poorly understood. Similarly, the actions to be taken may be disputed and their various results unclear. Timing may be another source of ambiguity; the effects of immediate controls on behavior may not appear until far into the future, and predicting those delayed returns necessarily involves more uncertainty. Additionally, with global externalities each B_n depends upon coordinated

[17] Note the important tradeoff implied by Equations (7) and (8): reporting a high q_i. increases the probability that the treaty will be implemented ($p(q_i)$ is increasing in q_i. from (6)), but reduces the size of any transfer payments received.

restraints by all major contributors and the participation of others may be doubtful. The incentive to free ride in collective action regarding broad-based environmental problems is well understood, and groups within a country need to take the possibility of defection into account when estimating net gains. Indeed, all a transfer payment amounts to is a property right to some amount of wealth, holding other factors constant. Lack of enforcement weakens this right, thereby further diminishing the expected return from agreement.

Another result stemming from underlying public choice concerns is the effect changes in B_n have on treaty compliance. Changing conditions and/or realization of state-contingent outcomes will likely force a political recalculation, perhaps leading an agent to revise his/her country's position and report a new q_i. This is particularly likely when another country's compliance to the rules of the treaty is called into question. As a result of recalculation, the treaty may quickly unravel due to the sensitivity of the transfer payment scheme to the underlying model parameters. This is seen clearly by direct examination of Equation (7). [18]

Finally, successful collective action is most likely when each country reports an expected benefit that is large and positive (Equation (3)). In this case the sum of the reported benefits will be positive and it is efficient to implement the treaty. A country is more likely to provide a large, positive report when the benefits of the international action are viewed positively by all constituencies (Equation (7)). Hence, uncertainty and controversy both within and across countries over the aggregate gains from collective action tends to reduce the likelihood of international cooperation. We now apply this framework to the analysis of three international environmental problems.

III. The United Nations Convention on the Law of the Sea of 1982.

Examination of the Law of the Sea Treaty (LOS) negotiations provides insights into the public choice problems outlined above when there are heterogeneities across countries in expected net benefits from international agreement; when side payments are demanded by some countries as a condition for joining collective action; and when influential internal constituencies perceive losses that cannot be readily compensated by transfers (UN DOC. A/Conf.62/122 ,October 7, 1982). The LOS negotiators had many issues to address, and we focus only on the seabed mining component which illustrates the political issues involved and was key for U.S. rejection.[19]

Law of the Sea negotiations involved a series of international conferences for collective action: UNCLOS I (1958), UNCLOS II (1960), and UNCLOS III (1973). Negotiations took 24 years, and some agreements were possible. As of 1999, 196 countries or organizations had signed the LOS Convention, but fewer, 89 had actually ratified the treaty. Among major countries that had not

[18]Instances where side payments have been used successfully are often characterized by differences that are calculable. For example, Lyster (1985) details a 1911 agreement between the United States, Russia, Canada, and Japan designed to eliminate inefficiencies of harvesting seals in a common pool setting. In negotiating the agreement, side payments were used with success to entice Canada and Japan into joining. For a summary of this agreement and others where side payments were used with success, see OECD (1992).

[19] For discussion of negotiations, see Hollick and Cooper (1997, 148-9), United Nations Division for Ocean Affairs and Law of the Sea, Office of Legal Affairs (1994, 3-8), Sebenius (1984, 7), Lee (1983), Morell (1992, 190-205), and Charney (1994).

were China, Japan, the Russian Federation, the United Kingdom, and the United States.[20] At issue for seabed mining were coal-like lumps of metallic ore called manganese nodules that carpeted much of the deep ocean floor. They contained promising deposits of copper, cobalt, nickel, and manganese, and the total amounts were thought to exceed those on land. The richest grounds were outside any country's jurisdiction, and because of the size and riskiness of the investment, firms from developed countries with the technology to access the ore wanted a more definite assignment of property rights. In the early 1970s, the U.S. supported an international agreement under the United Nations to licence and regulate companies that exploited the nodules (Eckert, 1974). Developing countries, however, objected to assigning ownership to industrial countries and proposed instead the creation of an international mining consortium called "Enterprise" to be managed under the International Seabed Authority (ISA) which they would control. Technology and financing for Enterprise would come from developed countries, and although they would share in the revenues, they would bear the costs and risks of the venture. This option was not accepted by developed countries and UNCLOS III offered a compromise, a parallel mining system whereby firms from developed countries would locate two nodule sites, and the ISA would assign one to Enterprise and the other to private firms. Within the US, the mining industry strenuously opposed this arrangement, and the Reagan administration did not ratify the treaty.

In terms of inter-country disputes, developing countries saw the revenues from seabed mining as a source of equity and would not agree to a mining agreement unless these transfers were forthcoming. Many developing countries and two developed countries, Canada and Australia, also exported land-based minerals and hence wanted production controls included in the treaty to prevent a decline in prices (Sanger, 1986, 178; Morell, 1992, 108). Importers, which included most developed countries, opposed such regulations. These latter countries, including the U.S., also had the firms most likely to be involved in seabed mining. The output regulations, taxes, information sharing, and technology transfer that were part of the Law of the Sea Treaty dramatically reduced the attractiveness of seabed mining to most U.S. firms. These included Kennecott Copper, U.S. Steel, AMOCO, and Lockheed Missile and Space Company, which had formed consortiums for mining the nodules, but always viewed the exercise as extremely risky. Regardless of how it was packaged, either with Enterprise as a sole developer or under the parallel system of UNCLOS III, the mining industry, led by the American Mining Congress, found the treaty unacceptable (Morell, 1991, 44). Within the U.S., mining was the key opposing constituency, and although the maritime industry and the Navy sought the navigational provisions of the LOS, they could not construct side payments within the political system to ameliorate the concerns of the mining industry. Indeed, it is difficult to imagine what form transfers like those described in Section II might have taken. The mining industry supported unilateral actions, including H.R. 9 in the early 1970s that would have authorized the Interior Department to issue mining licenses, but these were opposed by the State Department (Eckert, 1974, 176). During the Nixon administration the Navy was able to muster political support for a draft treaty in 1970, but the mining industry ultimately prevailed under President Reagan (Morell, 1992, 45; Sebenius, 1984, 82). The Reagan administration abandoned a broad Law of the Sea Treaty and adopted unilateral and separate efforts to address continental shelf jurisdiction, fisheries management, and navigation guarantees. The deep seabed mining issue was left unresolved.

IV. The Montreal Protocol on Substances that Deplete the Ozone Layer of 1987.

[20] The final treaty was voted on Dec 1982, 117 countries signed, but not the US, UK, and other countries.

The Montreal Protocol of September 1987 on Substances that Deplete the Ozone Layer is a less complex agreement than the Law of the Sea treaty (26I.L.M. 1541, 1987). The Protocol addresses a common-property resource problem--limiting the release of gases into the atmosphere because of their apparent damaging effects on the ozone layer that shields the earth from Ultraviolet B (UVB) rays from the sun.

Concern about chlorofluorocarbons (CFCs) surfaced in 1974 when two studies hypothesized that chlorine released from the breakdown of CFCs had a destructive effect on stratospheric ozone.[21] CFCs were inexpensive chemicals used since 1931 in refrigerants, solvents, propellants, and more recently in the production and cleaning of computer components and other electronics. The U.S. accounted for from 25 to 30 percent of the world production of CFCs between 1974 and 1986, and hence had a vital interest in any international agreement to regulate or eliminate their production (Nangle, 1989, 577; European Environmental Agency, 1999; UNEP Ozone Secretariat, 1998a). Congressional hearings were conducted on the extent of ozone depletion and possible remedies, but no unilateral action was taken. In 1977 the EPA proposed regulations to prohibit manufacture, processing, and interstate distribution of CFCs. The main advocates were environmental organizations and certain groups of scientists, while the U.S. chemical industry opposed regulation.[22]

The framework outlined in Section II indicates why the U.S. did not push for international collective action on the ozone layer in the 1970s and early 1980s. There was no political coalition of sufficient influence to promote such effort. The actual atmospheric mechanisms involved were incompletely understood; the extent of ozone depletion was unclear; and substantial economic costs seemed likely from restricting an industry where the U.S. had a commercial advantage. In 1983, the EPA advised Congress that no action should be taken until the relationship between CFCs and ozone depletion was more clearly determined (Nangle,1989, 543; Hollick and Cooper,1997, 157). In 1987, Du Pont, the largest American producer of CFCs, opposed an immediate phase out, citing the high cost of alternatives, and the Chemical Manufacturers Association claimed that CFCs were "incorrectly being blamed for the alleged decreases in atmospheric ozone."[23]

In March 1988, the NASA Ozone Trends Panel released additional scientific information suggesting that the ozone "holes" were larger than previously believed and that there were tighter links between ozone layer deterioration and CFC emissions. The U.S. position on international collective action shifted, in part because the expected environmental benefit of agreement increased and because domestic political opposition to regulation had diminished. The chemical industry no longer resisted domestic CFC controls, and it lobbied for international restrictions to phase out CFC production and trade. Du Pont announced it would no longer make CFCs (Mintzer and Miller, 1987;

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[21] Stolarski and Cicerone (1974) and Molina and Roland (1974). For discussion, see Lifin (1994).

[22] See Benedict (1998, 29, 102) for discussion of the role of environmental groups, scientists, and NGOs as treaty advocates.

[23] Comments by Elwood P. Blanchard, Group Vice President for Chemicals and Pigments, Du Pont, and by the Chemical Manufacturers Association, May 1997, before the Senate Subcommittee on Stratospheric Ozone Depletion to the Committee on Environment and Public Works CIS 87-S321-26, 294-5, 274-77.

Scott, et. al, 1995). In 1987 CFCs worth some $3 billion were sold world wide, and if CFCs were tightly restricted, the replacement market would be very attractive. Du Pont had developed technology for CFC substitutes where it would have a stronger market position. Du Pont, Allied, and Pennwalt, had declining market shares in CFCs relative to European producers, such as ICI, Hoechst, Atochem, and Monetfluo, and a mandated switch to new CFC substitutes had potential to provide American firms with a competitive advantage. Most of the substitutes were HFCs, hydroflourocarbons, that did not affect the ozone layer (Scott, et. al, 1995; Benedict, 1998, 6, 26, 31). Retrofitting by refrigeration and air-conditioning industries was going to be costly, and U.S. CFC-substitute producers needed guarantees that their customers could not shift to alternative foreign sources of CFCs. An international agreement to regulate CFC trade would serve that purpose. Hence, the U.S. became an early leader in international efforts to regulate CFCs. European firms were more skeptical of the need to restrict CFCs, and the support of European governments for regulatory action generally came later. Even then there were disagreements along economic grounds between U.S. and European positions on timing and identification of the chemicals slated to be phased out (Benedict, 1998, 144).

The first international action was the 1985 Vienna Convention for the Protection of the Ozone Layer. The U.S. ratified it in August 1986.[24] The convention established broad international objectives to protect human health and to promote research on the impact of CFCs on the ozone layer. Disagreements among the parties blocked any actual CFC control measures. Major disputes were between developed and developing countries. By 1988, a political consensus for CFC emission control had emerged in most western industrial countries, but that was not the case in developing countries, where the elimination of CFCs was not seen to be beneficial (Benedict, 1998, 188, 232). CFCs did not require sophisticated technology, and developing countries had not invested in higher-cost substitutes. Additionally, developing countries objected to the costs of the trade restrictions associated with banning CFC imports and exports. Developing countries claimed that developed countries should bear the costs of the international agreement. They also demanded side payments to as a condition for coordinated action to protect the ozone layer.

In response, developed countries sought to reduce the costs of the agreement to developing countries. The Vienna Conference established a special category for developing countries that had less than .3 kilograms per capita consumption of CFCs, a provision clearly beneficial to countries with large populations like China and India. Initial international control efforts were to focus on developed countries with consumption levels above that threshold. A conference of parties (COP) was established to set the framework for further negotiations. This led to the Montreal Protocol of 1987.

The Montreal Protocol defined more precise measures to reduce consumption and production of CFCs and related substances.[25] Developed countries were the proponents of the agreement and they were the focus of international controls. Under the Protocol, developed countries were to cut production and consumption of CFCs by 20 percent of their 1986 levels by 1993 and by 50 percent by 1998. CFC trade with countries not adopting the restrictions was to be stopped. Developing countries had to be enticed into the agreement. Under the notion of "common but differentiated

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[24] Vienna Convention for the Protection of the Ozone Layer, May 2, 1985, Treaty Doc. No. 9, 99th Congress 1st Sess., 1985.

[25] Montreal Protocol on Substances that Deplete the Ozone Layer Treaty Doc No. 10, 100th Congress, 1st Sess., 1987.

responsibilities" they were allowed an extra 10-year's delay to reach reduced production targets and were authorized to exceed their 1986 levels of production by up to 10 percent to satisfy "basic domestic needs"(Benedict, 1998, 241). Even with these concessions, there was a split between the two groups of countries. 22 of the 50 countries that participated in the Montreal Protocol were considered developed, and of those, 19 (86 percent) signed the agreement. By contrast, of the 19 developing countries that participated, only 6 (34 percent) signed (Ling, 1992; United Nations Ozone Secretariat, 1998a). In 1989, just 14 developing countries had ratified the Montreal Protocol, whereas most developed countries had. Further, China and India stated they would not participate in the agreement unless technical and financial aid were forthcoming (Ling, 1992, 97).

Accordingly, a Second Meeting of the Parties to the Montreal Protocol was held in June 1990 in London to devise additional side payments. 96 nations, including 58 that were classified as developing, attended. Developed countries agreed to bear more of the costs of reducing CFC levels in the atmosphere by agreeing to end production and consumption of CFCs earlier, by the year 2000. Developing countries were to stop exporting CFCs to non-participating countries by 1993 (Nangle, 1989, 531). A Multilateral Fund was established to provide developing countries with financial assistance and CFC replacement technology was to be transferred if they agreed to the protocol (Ling, 1992, 98; Benedict, 1998, 252). Creation of a multilateral fund, however, raised new distributional concerns among donor and recipient countries. These included the size of individual contributions, the nature of penalties if donors defaulted on their assessments, the amount of money to be granted recipients, and their documentation requirements. China received the largest allocation, but India claimed that its share was insufficient to meet the costs of phasing out CFCs. The Indian request was larger than the entire Multilateral Fund (Benedict, 1998, 254-57, 294). Not all of the issues could be resolved at the second meeting, and the multilateral fund remained vague. Criteria for receipt of the financial transfers and amount to be provided each country remained to be determined. There was no resolution of what would happen if a developed country refused to pay its fund contribution and whether that action would release developing countries from compliance. There were also problems with the vagueness of provisions of technology transfer to developing countries. Companies in developed countries that had invested in the technology likely were reluctant to release the information. Only very general language stating that the parties must take "every practicable step" to control CFC emissions could be agreed to. The World Bank was to be the administrator, and $160 million was to be made available to developing countries for complying with the CFC accord. Further, the fund was to be increased by $80 million when India and China ratified the Montreal Protocol (Ling, 1992, 113). Developing countries have demanded greater allocations as a condition for them "to fulfill their commitment to phase out ozone-depleting substances" and increases in fund contributions from industrial countries as "a clear demonstration of their commitment."[26]Within developed countries politicians must convey such demands to taxpayers, and whether they support increases in international transfer payments depends on whether they perceive that the benefits outweigh the costs. But treaty benefits depend upon compliance and enforcement.

Enforcement of the Montreal Protocol, however, is voluntary as is the case with all international environmental treaties. Countries are to self-report production, consumption, and trade levels of CFCs. A 10-Member Implementation Committee was set up in London to review country compliance, but the procedure relied on the availability of credible and verifiable data provided by participating countries. Initially, enforcement was not a critical problem. With CFC production historically centralized in a few countries such as the U.S., it was possible to bring about a decline in

[26] United Nations Ozone Secretariat (1995, 15) www.unep.ch/ozone/7mpviefn.htm.

emissions shortly after the Montreal Protocol. Reported world CFC production fell by 50 percent between 1987 and 1992, and by 89 percent by 1996. The U.S. had 5 producers and 10 importers, and the EPA could monitor compliance via a paper trail (Nangle, 1989, 571). American firms had voluntarily halted CFC production. Given the observed reduction in reported world production of CFCs and the availability of alternative products in the U.S, there was no serious political opposition to enforcement of commitments under the Montreal Protocol so long as other countries complied. This situation also described western European countries.

The framework in Section II suggests that incomplete treaty compliance among developing and transitional economies will raise serious potential public choice problems for developed democracies. One reason that Du Pont and other U.S. producers supported the Montreal Protocol was a perceived market share advantage from the switch to new CFC substitutes in which Du Pont had a comparative advantage. There were focused benefits from the treaty and no organized opposition. Financial side payments to developing countries also did not bring resistance from taxpayers who had little information on such transfers and who likely valued protecting the ozone layer. Accordingly, the U.S. moved quickly to ratify and comply with the Protocol.

These conditions could change, however, and weaken the political will to enforce the treaty. Substantial cheating in other countries and demands for technology transfer for production of CFC substitutes will erode the expected benefits to U.S. producers. The "basic needs" loophole in the protocol allows CFC production in certain countries and monitoring whether these CFCs stay in domestic use or are exported clandestinely is very difficult. Of 48 countries required to submit their 1989 data on treaty compliance, only 23 complied, and of those, just 20 were considered complete (Ling, 1992, 123). And as noted in a 1999 U.S. General Accounting Office (GAO) report, these issues have remained. The GAO concluded that there are general problems in acquiring reliable data on the production of regulated CFCs, that national data often do not provide a basis for assessing compliance, and monitoring is very incomplete (GAO, 1999, 6, 12, 15, 22).

Although environmental groups might continue to back the protocol, industrial groups might see little reason for unilateral adherence and defect from the initial political coalition that supported ratification of the Montreal Protocol. U.S. firms have been very concerned about a lack of compliance, claiming that cheating in developing and transitional economies could result in more chlorine in the atmosphere, while the substitute products of U.S. firms were being restricted in order to reduce chlorine levels. In 1990, Du Pont complained before the Congressional Subcommittee on Stratospheric Ozone Depletion that developing countries were relying too much on CFCs rather than substitutes and noted that "at least six CFC plants have started up or are under construction in less-developed countries since the Montreal Protocol was available for ratification."[27]

Replacement CFC production elsewhere will continue to weaken the ozone layer without even more severe reductions in CFC substitutes produced in the U.S. and Europe (Benedict, 1998, 137). And other data for substitute chemicals, HCFCs, show increases, and these also potentially harm the ozone layer.[28] In 1997, environmental groups in the U.S. pushed for a more rapid phase out

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[27] Testimony by Dwight Bedsole, business manager, Du Pont Freon Products Division, U.S. House of Representatives Committee on Energy and Commerce, subcommittee on Stratospheric Ozone Depletion, January 25, 1990, CIS 90H361-38, 271-73.

[28] According the European Environmental Agency, while CFC production declined through 1994, HCFC production grew, exceeding CFC production. HCFCs or halogens are somewhat less destructive of the ozone layer, but their production as substitutes may suggest that the ultimately, the goal of protecting the ozone layer through ending CFC

of substitute HCFCs produced by Du Pont and other American firms in the face of the failure of developing countries to meet CFC reduction targets.[29] Environmental groups have lobbied for adoption of not-in-kind-alternatives (NIKA) and for a redirection of the Multilateral Fund allocations toward developing such technologies. Although these alternative substitutes are championed by environmental groups, their production could also displace products made by American and European firms, undermining the political support of these organizations for the treaty. These firms had been a key part of the initial political coalition for the Montreal Protocol.[30] Moreover, unregulated CFC production has limited the growth of export markets for CFC alternatives. There are reports of rising production and use of CFCs and other ozone-depleting substances in developing countries, the Russian Federation, and other transitional economies and the smuggling of CFCs into regulated areas (Benedict, 1998, 282-4, 487; Dorfman 1997, 210; Wiener, 1999, 693; Sandler, 1997, 114-5). Belarus, Bulgaria, Russia, and the Ukraine were specifically cited for noncompliance at the Seventh Meeting of the Parties to the Montreal Protocol in Vienna in December 1955.[31] Migration of CFC-intensive industries to less regulated countries also is possible, creating new competition for complying firms. CFC prices have not risen as much as they would have with full compliance. Indeed, western European chemical firms, such as ICI and Atochem, recently have complained that CFC prices have stayed relatively flat due to illegal imports from Russia and other countries. CFC imports compete with the alternative HFCs made by western firms. This competition erodes prices and profits for firms in countries that comply with the Montreal Protocol, and potentially weakens political support for the agreement.[32]

V. The Kyoto Protocol to the United Nations Framework Convention on Climate Change of 1997.

The local release of CO_2 and other greenhouse gases results in externalities similar to those from chlorofluorocarbons emissions. In this case, the problem is global warming. Following the Montreal Protocol in 1987, the United Nations established the Intergovernmental Panel on Climate Change (IPCC) to report on overall green house gas (GHG) emissions. The IPCC reported in 1990, 1992, and 1995 that emissions from human activities were substantially increasing atmospheric concentrations of GHG and that these would lead to a rise in global temperatures with possible damaging results.[33] As a result, international collective action began. In 1992, the United Nations

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production will be futile.

[29] See Green Peace, "Hijacking the Montreal Protocol," Prepared for the 9th Meeting of the Parties to the Montreal Protocol, September 1997.

[30] See Great Peace, "Money to Burn: The World Bank, Chemical Companies & Ozone Depletion," 1999, www.greanpeace.org/~ozone/mtl.

[31] United Nations Environment Program, Ozone Secretariat (1995).

[32] See, "Europeans Calling for CFC Trade Ban," Chemical Marketing Reporter, September 23, 1996, pp. 9, 40.

[33] Houghton, Jenkins, and Ephrams (1990), Houghton, Callander, Varney (1992), and Houghton, Meira Filho, Callander, Harris, Kattenberg, and Maskell (1995).

sponsored the Framework Convention on Climate Change (FCCC). The FCCC was a voluntary agreement among ratifying countries to limit the release of such gasses into the atmosphere. Over 170 nations, including the U.S., signed and ratified the treaty. The FCCC called for emission reductions by Annex 1 countries, which included developed countries in the OECD, transitional economies in Eastern Europe, and countries that were part of the former Soviet Union.[34]

The FCCC required that Annex 1 countries report on their efforts to reduce GHG emissions to 1990 levels by the year 2000. As with the Montreal Protocol, developing countries were exempted from taking direct action. The FCCC explicitly recognized that countries had "common, but differentiated responsibilities." The Conference of Parties of the FCCC held a meeting in Berlin in April 1995. Although at the Berlin meeting there was concern about whether the GHG objectives could be met by focusing only on Annex 1 countries, no new commitments were requested of developing countries in reaching emission goals.[35]

In December 1997 over 160 parties to the 1992 United Nations agreement drafted the Kyoto Protocol to the Framework Convention.[36] The protocol adopted binding emission reduction targets for Annex B or industrialized countries with total CO_2 emissions to be reduced by 5.2 percent of 1990 levels. E.U. countries were allowed to follow an inclusive or bubble reduction target of 8 percent and the U.S. a 7 percent reduction by the period, 2008-2012.[37] Progress was to be made by 2005 for reaching the targets.[38] Transition economies were allowed to use a different base year.[39]

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[34] Annex 1 countries included Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, the European Union, Estonia, Finland , France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, Turkey, Ukraine, UK; and US. Mexico and S Korea have joined the OECD but it was not determined whether they have to participate in emission reductions.

[35] FCCC Conference of the Parties 1st Sess, UN Doc FCCC/CP/1995/7/Add.1, Decision 1/CP.1, p. 4-6, June 6, 1995, Berlin Mandate.

[36] United Nations Framework Convention on Climate Change S. Treaty Doc No. 102-38 (1992), 31 ILM 849 (1992). Kyoto Protocol to the FCCC, FCCC Conference of the Parties, 3d Sess, UN Doc. FCCC/CP/1997/L.7/Add.1(Dec 10, 1997). Final version UN Doc FCCC/CP/1997/7/Add.2.

[37]HFC, PFC, SF[6] are substitutes for CFCs, but they are greenhouse gases and are now covered in Kyoto but with 1995 base year, since these controls were controversial.

[38]Article 3 of the Kyoto Protocol establishes emission targets for Annex countries except for Turkey against base year emission levels. 1990 is the base for most countries. Annex 1 countries can elect 1995 as the base for some GHG gases.

[39] Croatia, Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Ukraine, Slovenia (Transition countries in Annex B of Kyoto are similar to Annex 1 of FCCC).

Trading of emission allowances and credits arising from emission reductions were authorized as were vague credits for carbon sinks. The details of how to measure and to account for these practices were left for later discussion. Developing countries were not required to take any action. A follow up conference was held in Buenos Aires in November 1998, where180 countries met to decide how to cut emissions, but the basic structure of the Kyoto Protocol remained.

The international collective action/internal public choice problem is much more complex with the Kyoto Protocol than with the Montreal Protocol. There are many more sources of CO_2 than of CFCs, and more political constituencies will be affected. Greenhouse gases, such as CO_2, are at the heart of industrialization and intensive agriculture that are the hallmarks of economic development. Additionally, the costs and benefits of international action to control GHGs will be spread unevenly both across and within countries (Schelling, 1997; Holtz-Eakin and Selden, 1995). Current global circulation models (GCMs) indicate that some areas might benefit from moderate global warming, others might be moderately affected, and some might be harmed. Those countries vulnerable to a rise in sea levels seem to have most at stake, including small island states, Bangladesh and the Netherlands. China, Russia, other Northern European countries, and Canada might benefit through increased agricultural production. Some studies indicate a possible slight increase in agricultural production in the US.[40] In the tropics, predictions are less clear, but there may be little change. Countries and industries that use more fossil fuels will be required to engage in costly conversion to meet international targets. If economic growth is slowed by emission controls, some groups will find their aspirations dimmed. Taxpayers will be asked to fund transfer payments within countries to parties harmed by the treaty's provisions. As with the Law of the Sea and the Montreal Protocol, taxpayers in industrialized countries also will be asked to fund transfers to less developed countries as side payments for participation. These local costs are relatively immediate and apparent, and politicians will be very sensitive to them because of their constituency effects and other political tradeoffs. Variation in the costs and benefits of controlling GHG emissions will lead to correspondingly different patterns of political support for participation in international control efforts.

The results of reduced emissions come only from coordinated international actions and will be apparent only well into the future. Accordingly, no single polluting party will observe any short-term private gain from reducing fossil fuel use. In the absence of clear payoffs from individual actions, politicians will have to convince their constituencies of the public good involved in adhering to CO_2 reductions, and enforce compliance. The political will for these actions, however, will deteriorate if the local costs of regulation are high within a country and there are important uncertainties as to the linkage between current emissions and global temperatures, and the magnitude of the costs (or benefits) of a warmer planet.

There are many sources of uncertainty regarding aggregate effects of global warming, their distribution among countries negotiating a GHG treaty, and the costs of reducing GHG emissions. The magnitude of global warming remains undetermined. The scientific uncertainty comes in estimating the rate at which greenhouse gas concentrations will increase and the impact that any given rise in concentration will have on surface temperature.[41] There is also question as to the effect

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[40] Kane, Reilly, Tobey (1991) for analysis of agriculture. Mendelsohn and Neumann (1999) provide a summary of the broader impact on the U.S. economy.

[41] For summary discussion of the many issues and uncertainties involved see Paterson (1996, 9-15) and Hollick and Cooper (1997, 159-163). Houghton (1997, 1-8) seems

projected temperature increases will have. The global change models that are used to simulate possibilities are particularly imprecise about regional effects. These regional effects, however, are crucial for motivating country participation and adherence to international efforts. Scientific uncertainty regarding global warming allows politicians to chose among conflicting evidence for justifying positions with more certainty than actual understanding may merit.[42]

The necessary emission reductions to mitigate global temperature rise and the economic costs involved are similarly unclear. The magnitude of the costs depends upon the amount of the reduction required for each country and its pace. As much as 80 percent of global emissions may have to be cut by the middle of the next century to stabilize (not reduce) CO_2 concentrations in the atmosphere. Some simulations suggest that if regulations were gradually put into place, world GDP growth over the next 50 years would decline from a projected 2.3 to 2.25 percent annually. More abruptly implemented controls, however, could cost 2.5 percent of world GDP by 2043 or $2.25 trillion (Burniaux, Martin, Nicoletti, and Martins, 1992, 7; Weyant, 1993, 29, 36-8).

More to the point of the international bargaining problem is the distribution of abatement costs. The costs are the greatest for the countries that produce the most CO_2, and the U.S. is currently the largest producer. In 1996, the U.S. and Canada accounted for about 25 percent of global CO_2 emissions due to reliance on coal to generate electricity. Other leading polluters were, in order, China (with over half the US emissions), Russia, Japan, Germany, and India (U.S. DOE, 1998, Appendix H). Developing countries, such as China and India, have a much higher share of CO_2 emissions per GNP than do developed countries (Hollick and Cooper, 1997, 167). Because of subsidized reliance on coal China is projected to be the largest producer of CO_2 by 2015 with India the second largest (Burniaux, Martin, Nicoletti, and Martins, 1992; Poterba, 1993, 59). To be consistent with the IPCC s guidelines for stabilizing CO_2 levels by the middle of the century, the U.S. would have to reduce emissions to 80 percent of their 1990 level by 2020. There are many estimates of the costs of emissions controls in the U.S. with the results dependent on the assumptions made regarding timing, magnitude, and the instruments used.[43] Coal and coal-related sectors such as steel would bear the brunt of the reductions. In the U.S. coal is the source of approximately 24 percent of total energy use.

As with the Montreal Protocol and the Law of the Sea Treaty, developing countries have asserted that developed countries must bear most of the costs of collective action on equity grounds. China and India are among those that will face the greatest adjustments in reducing the release of CO_2 into the atmosphere. China could lose 10 percent of GDP by the last half of the 21st century if emissions were held to just *twice* its 1990 levels (Manne and Richels, 1991). China and India have argued that they should not participate in emissions reductions because of the feared impact on economic growth (Agarwal and Narain, 1992; Wiener, 1999, 779; Hollick and Cooper, 1997, 166).

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more confident in the consistency of the patterns. See also Nordhaus (1993, 23), Moore (1998, 21, 69-128), Schmalensee (1993, 5-6).

[42] Paterson (1996, 14). See also Johnson and Libecap (1999) discussion of the control of information in the political arena.

[43] Weyant (1993), Hollick and Cooper (1997, 165), National Academy of Sciences (1991), and Manne and Richels (1990) estimate that reducing CO2 emissions by 20 percent would cost the us between $800 billion and $3 trillion between 1990-2100 or about 5 percent of total macroeconomic consumption.

With current rates of economic development and fossil fuel use China, India, Brazil and other developing countries will surpass the emissions of industrialized countries early in the next century. Hence, there is a concern that the special exemption afforded developing countries precludes any real reduction in the accumulation of GHG. The obvious aim of the "differentiated responsibilities" is to eventually draw in developing countries into the agreement. The experience with both the LOS seabed mining provisions and the Montreal Protocol suggests that this will be neither easy nor likely effective. With differential emission controls across developed and less developed countries the growth in GHG releases from developing countries may eventually replace the cut backs from developed countries, as appears to be happening with CFCs. Under these circumstances, reaching targeted levels of GHGs in the atmosphere would require even more drastic reductions within developed countries with correspondingly greater economic adjustment costs. Greater transfers to affected parties would have to be funded from tax revenues. Political support within developed countries will be reduced as influential constituents are harmed if production, employment, and the terms of trade shift in favor of those countries that do not participate.

There are a number of problems with international compensation schemes. Since emissions from any one country have only small effects on the global externality, valuing its compliance will not be easy. If there is considerable disagreement regarding estimates of the effects of higher temperatures, agreement on the amount to pay countries to reduce aggregate emissions becomes even more complicated. But since controlling the global externality requires coordinated action, a country could behave strategically and demand transfers as a condition for not holding out. In the limit, countries that expected little harm from global warming could extract all of the expected benefits from those countries that had more dire expectations. Additionally as with the Montreal Protocol, there is no underlying enforcement mechanism within the Kyoto Protocol. Monitoring depends on annual self reports by countries using comparable methodologies. Expert review teams are authorized with voluntary country visits. No consequences of noncompliance could be agreed upon at Kyoto, and the compliance provisions that are included apply only to Annex 1 or industrialized countries (Breidenich, Magraw, Rowley, and Rubin, 1998). Absent effective enforcement, there will be incentives for countries to defect whenever the political costs become too high.[44] Trade sanctions are commonly raised as a remedy for non-compliance. But trade sanctions affect a different group of constituencies, and the internal political support for them is unclear. Further, it is hard to imagine that large countries like China, India, Brazil, Russia, and the U.S. would easily bend to other coercive pressures.

Internal public choice issues within industrialized countries will affect the success of the Kyoto Protocol and subsequent collective efforts to control GHG emissions. In terms of the framework outlined above, politicians must continually balance the demands of competing interest groups and minimize the tax consequences of transfer programs. Given the political organization of producers and associated labor unions within most developed countries, any perception of unequal restrictions would bring a sharp political response that no domestic politician could ignore. In general there are political concerns about the migration of industries and employment that might follow from differential emission controls in developed and undeveloped countries.[45] Within the U.S.

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[44] Few international environmental agreements contain substantive commitments. See Compliance with International Environmental Treaties: The Empirical Evidence, 92 American Society of International Legal Procedure 234, 1997. See also Giselle Vigneron (1998).

[45] For example fear about possible job losses in the US led the Byrd-Hagel Resolution to

opposition groups have formed, challenging the claims of treaty proponents, including the Clinton Administration, regarding benefit and cost estimates. For example, in 1998 Congressional hearings representatives of the American Petroleum Institute, the American Council for Capital Formation presented treaty cost estimates that were much higher than those presented by the administration (U.S. House, 1998e, 53-78). Other groups that fear negative effects of regulation also have mobilized, including small business and farm groups concerned about higher energy costs and utilities (U.S. House, 1998b, 4-37; 1998c, 3-40).

Internal transfer payments and other forms of subsidies for shifts to alternative energy sources will be demanded from taxpayers to compensate those parties that are differentially affected. Those groups that are harmed (including taxpayers) will have to be convinced that such costs are worth the effort. Proponents of regulation, generally environmental groups and some firms, like BP and Royal/Dutch Shell, that see a competitive advantage emerging from regulation, will have to mobilize politically and argue persuasively that there are large national net benefits from the agreement.[46] This task, however, will be formidable given the speculative estimates of the impact of global temperature increases, their delayed effects, and the level of adaptation that might take place within the economy (Nordhaus, 1993, 15; Cline, 1992; Moore, 1998; Mendelsohn and Nordhaus, 1994, 1999).

All told, global collective action seems most likely to be effective regarding GHG emission controls if the linkages between GHG and temperature increases are clear, if the effects of rising temperatures are well understood, and there is wide-spread compliance to cut backs among all relevant polluting countries. Absent, these conditions, the Kyoto Protocol may have little effect on overall GHG emissions and global temperature change.

VI. Conclusion.

Theory and research regarding collective action addressing local common-property resource problems indicates that success in controlling externalities comes when there is a consensus on the aggregate benefits to be gained, that the parties perceive positive net gains from agreement, and that they are homogeneous with respect to bargaining objectives and in the distribution of the costs and benefits to be incurred. Agreements reached under these conditions tend to be self-enforcing because it is in the interest of all parties to insure success. Collective action may also achieve its objectives if the parties are heterogeneous with respect to the net gains from cooperation, if the spread is not too great and there are agreed-to bases for constructing side payments to compensate those parties that may bear more costs or receive fewer gains. The resulting property rights structure must be secure so that the side payments are long term and predictable. This condition requires an enforcement arrangement that all parties adhere to.

Negotiating international agreements for collective action regarding the control of environmental externalities confronts the same requirements for success. But the challenges are much more formidable. Resolving the externality most likely will not impact countries or regions in the same manner. The information and distributional divisions are much greater. Within countries, different groups may be impacted in varying ways, and this condition sets up political conflict and pressures on the politicians and agencies involved in negotiating, implementing, and adhering to any

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pass 95 to 0 in July 1997 that insisted that developing countries participate in any global warming effort, 143 Congressional Record S8113-05, daily edition, July 25, 1997.

[46] For the position of some groups, see U.S. House, 1998d, 2-6. BP and Shell have large holdings of natural gas that would be in greater demand with restrictions on other fossil fuels (Chemical Week, December 3, 1997, 28; Oil and Gas Journal, October 18, 1999, 63).

international agreement. Indeed, with sovereign countries, enforcement becomes much more problematical. These problems suggest that caution is warranted in assessing the outcome of international cooperation to control global externalities.

Four implications for negotiations were drawn from the analytical framework outlined in this paper: a) Changes in internal constituent evaluation of the net benefits of international action will force a political recalculation by politicians with a possible shift in support for any treaty. This issue is especially likely to arise if other countries do not adhere to the agreement. b.) Successful collective action is most likely when each country perceives a large, positive expected net benefit. Under these circumstances international agreement is apt to be viewed as beneficial by most internal constituencies. Transfers to any harmed parties can be devised in order to facilitate action. By contrast, uncertainty and controversy within and across countries over the aggregate net gains of collection action reduce the likelihood of international cooperation. c). In negotiating international agreements, politicians must jointly resolve the demands of constituent groups for beneficial provisions or side payments. The more heterogeneous are group demands, the more complex are the public choice problems that politicians must solve in collective action. These internal pressures will affect the nature of the treaty that can be agreed to. d). Side payments may resolve distributional differences across and within countries for collective action. But sufficient side payments are possible only if the aggregate benefit of the international agreement is positive. Uncertainty regarding the nature of treaty benefits and costs, then, will make it more difficult to devise transfer payments.

In each of the three international treaties examined here, similar problems have been encountered. The benefits of cooperation have been uncertain and assessed differently by the negotiating states. With global environmental problems, the information problem is particularly severe because many of the underlying mechanisms are understood only imperfectly. Additionally, the tendency to view these problems in extremely broad terms, either as catastrophes if they are not resolved or as advancing the heritage of all if they are, tends to obscure the details. And the details are important because they affect the public choice issues encountered. The costs of agreement generally are clearer, and the net gains of agreement unevenly spread both across and within countries. Hence, there are political pressures to redistribute the benefits and costs of international action. Enforcement of treaty provisions among sovereign states is voluntary and depends upon self-reporting, peer pressure, and a political commitment within each state. But political commitments depend on interest group support, and such support varies with new information and shifts in perceived benefits and costs. Accordingly, none of the international collaborate efforts analyzed in this paper can be viewed as self-enforcing. Defection and free riding are likely, especially in light of distributional divisions between developing and developed countries. These actions, however, undermine the original objective of collective action and encourage participating countries to re-evaluate the net gains from cooperation.

In the case of the LOS, distributional demands by developing countries for transfers of revenues and technology for seabed mining were resisted by the mining industry within the U.S. and other developed countries. The LOS has not be ratified by the US and other key countries. Although the Montreal Protocol to protect the ozone layer is often held as a successful model for other international environmental efforts, such pronouncements may be premature. There is a divide as to whether developing countries should participate in international actions to control CFCs. Side payments are demanded as a condition for cooperation. Enforcement also is an issue. Cheating seems to be increasing in the face of the uneven spread of the net gains from compliance. With more cheating, the chemical industry in the U.S. and western Europe that had favored the treaty may shift their position weakening political support for it. With the Kyoto Protocol to control GHG emissions

and global warming, the coordination and compliance problems are even more severe. Fossil fuel energy-intensive countries like the U.S. will be particularly affected, and within a country, steel and other heavy industry and transportation will be faced with higher costs. Whether or not the costs are acceptable politically will depend on the magnitude and rate of adjustment required, a general perception of benefits from accepting them, and international cooperation in controlling GHG emissions. But the equity division is even more profound than existed for the LOS and Montreal Protocol because the underlying demands are so much greater. No side payment scheme as with the LOS or Montreal Protocol could be devised, so that developing countries are not required to take action under the Kyoto Protocol. Even if subsequent transfers can be agreed to, general adherence to any agreement in the face of divergent political commitments and costs will be difficult. If cheating occurs, GHG accumulations will continue to rise, perhaps along with temperatures. Constituencies in complying countries will not be willing to bear the costs of containing GHGs if there is rampant free riding elsewhere. More limited, positive actions could be taken that do not confront bargaining problems to the same degree. A primary one is to promote economic growth in developing countries. Higher levels of wealth will not only provide greater flexibility in responding the climate change, but will raise the marginal evaluation of environmental benefits within those countries. Another action is more research on the likely consequences of global warming, their regional distribution, and the nature of the adaptations that might be necessary to respond to climate change.

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