

Congleton, Roger D.

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Return to Rio: Agency problems and the political economy of environmental treaties

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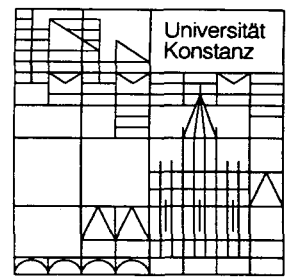
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Sonderforschungsbereich 178
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Diskussionsbeiträge

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Roger D. Congleton

**Return to Rio:
Agency Problems and the Political
Economy of Environmental Treaties**

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Return to Rio:
Agency Problems and the Political Economy of
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Roger D. Congleton

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ABSTRACT

This paper uses a political principal-agent model to analyze the process by which international environmental treaties are negotiated and ratified. To the extent that political principals hire negotiators on the basis of their negotiation skills rather than their policy preferences, negotiators will generally favor more stringent environmental regulations than their principals. Consequently, there will tend to be a greater consensus among negotiators for stringent environmental treaties than among principals. And, treaties will be greener than politically optimal. Historical and statistical evidence from the treaties negotiated at the World Summit in Rio de Janeiro is consistent with the analysis developed.

Return to Rio:

Agency Problems and the Political Economy of Environmental Treaties

June 20, 1995

Roger D. Congleton
Center for Study of Public Choice
George Mason University
and
Department of Economics
Stockholm School of Economics¹

I. Introduction and Background

It is widely recognized that the essential features of most environmental problems are a special case of the externality problem. The actions of one group of individuals impose unaccounted costs on others not directly involved in setting the activity level of interest. Consequently, Pareto excessive pollution generating activity levels are chosen. It is less widely recognized that the same logic extends to many efforts by governments to regulate externality generating activities whose effects extend beyond a single government's jurisdiction. Here, efforts by one district to regulate effluents often improve the welfare of individuals living outside their jurisdictions. The interests of citizens from other jurisdictions are not directly represented in the local political decision making process. Consequently, it is likely

¹ This research, as most of my work on environmental politics, has been supported by the International Institute at George Mason University, whose continuing support is gratefully acknowledged. Much of the work on this paper was completed while a visiting professor at the Stockholm School of Economics, whose hospitality and support made the project much easier to complete. The present draft has benefited from many thoughtful comments received during presentations in Konstanz, Wurzburg and Aarhus.

that local environmental regulations at the Nash equilibrium are less stringent than would be Pareto optimal (Hoel, 1991).

In a federal system, regulatory externality problems may be addressed by appealing to higher levels of governance. Higher levels of government may legislate laws which apply to all the districts affected, or may at least enforce any agreements reached between local governments. In the case of international regulatory externality problems between independent sovereign states, such appeals are not possible. The only feasible method of addressing international environmental regulatory problems are Coasian contracts--voluntary agreements between the affected parties.

International environmental problems have long been matters of international concern. For example, negotiations to regulate the Oresund between Denmark and Sweden and the Saint Lawrence Seaway between the U. S. and Canada were begun in the late nineteenth century. Although many nonenvironmental matters are also addressed, both treaties have addressed water quality issues from their first inception. Recently, there has been an increase in the rate at which environmental treaties have been negotiated, in the number of parties involved, and in the scope of the agreements reached.² The environmental negotiations of the Rio "Earth Summit" is, in many respects, the culmination of such trends.

The "Earth Summit" in Rio De Janeiro in 1992 differed from previous forums on international environmental matters in several ways. First, the range of parties directly involved in negotiating the treaties was substantially larger than in previous forums. The principals included government representatives from more than 160 countries and, for the first time, non-governmental organizations. Previous treaties

² Although more treaties have been signed, it is by no means obvious that these treaties actually affect domestic environmental policies. See Congleton 1994, or Sandler, 1995. We largely ignore the problematic problem of treaty enforcement in the present analysis. This is tantamount to assuming that same interests which cause a country to sign the treaty will assure that they are implemented, as would be the case if there were strong elements of reciprocity in the agreements (long term continuous mutual advantage).

were largely promoted and written by Western developed countries (see Benedict 1991). Second, partly as a consequence of the latter, the negotiations encompassed issues that are not environmental in the usual sense. Issues of foreign aid, income redistribution, children's rights, women's rights and world peace are explicitly addressed. Third, the wider agenda of these treaties implies that decisions to sign these treaties are not based entirely on the expected gains from coordinating environmental policies, as appears to have been the case for the initial CFC agreements. Fourth, several separate environmental treaties were negotiated simultaneously. In Rio, treaties on climate control, biodiversity, and sustainable forest management were considered simultaneously. Previous agreements have been negotiated one at a time. Parallel treaty negotiation provides opportunities for explicit log rolling among the treaties.

As typical of environmental treaties, especially on new problems, treaty language is often vague in both environmental and non-environmental sections of treaty documents, and little provision is made to enforce the environmental commitments of signatory nations. Evidently, continuous dealings and moral suasion are expected to be sufficient to achieve treaty aims, or the political value of unenforced symbolic agreements is considered to be sufficient to warrant negotiation expenses.

The aim of this paper is to examine incentives for signatory nations to negotiate and sign global environmental treaties like those worked on at the Earth Summit. In a previous paper, I explored differences in the incentives of dictatorships and democracies to sign environmental treaties. Democracies were more likely than dictatorships to sign the Vienna and Montreal agreements dealing with the preservation of the ozone layer. The focus of the present analysis is the agency problem that tends to arise between negotiators and their principals. This tension is

clearly indicated by the post Rio reflections of the principal negotiators included in Mintzer and Leonard (1994). Consider, for example:

"We saw throughout the negotiations, at least in the corridors, that there was often a greater affinity of interest between representatives from similar departments in different governments than between representatives of different departments on the same delegation. Thus departments of the environment, or of energy, or of finance (at least from developed countries) tended to have similar perspectives that crossed traditional national borders. (Dowdeswell and Kinley (1994, p. 115).)

or

"As much as President Bush and his closest associates may have wished this issue (climate change) simply to go away, it refused to do so." In spite of the fact that the "US got the kind of process oriented convention that it wanted," the principal negotiator for the US laments the fact that the US failed to take the leadership to advance more stringent environmental regulation. "Sparing future generations from irrevocable degradation has become a moral imperative for the world community... the US. must lead the world in finding ways to satisfy our common aspirations for economic development without risking such degradation." (Nitze, 1994 p.187, 188 and 191.)

The tension between principals and their negotiators arises at least in part for simple economic reasons. As demonstrated below, other things being equal, one can hire better qualified negotiators for a given wage if prospective negotiators care about policy and expect to have some discretion to set policy parameters. In such cases, the political interests of the principal will not be the objective function of the public "servant," but rather a constraint on what may be achieved.

A model of environmental policy preferences, is developed below to characterize the objectives of those directly participating in the negotiations. My (1992) model of propensities for dictatorships and non-dictatorships to enact environmental regulation is used to characterize the interests of political principals on environmental policies.

The analysis is organized as follows: Section II develops a model of public sector employment. The model implies that the most talented people willing to work for environmental agencies at a given wage are those who have the strongest preferences for environmental quality. Section III, applies this model to analyze settings where environmental and redistribution commitments are simultaneously negotiated, as was the case for the climate change and biodiversity agreements negotiated at Rio. Section IV, examines historical and statistical evidence to determine the relevance of the analysis. The evidence suggests that the model provides useful insight into the content and pattern of signatures on two treaties negotiated at the Rio Earth Summit. Section V summarizes the results and suggests extensions.

II. On the Policy Preferences of Bureaucrats

Economic models of labor supply generally stress the pecuniary returns of different occupations. Economic man works for a wage. Secondary features of occupations are also occasionally mentioned. Some occupations provide greater opportunities for travel, have lower levels of stress, are more exciting, offer greater opportunities to shirk, and/or yield greater status than others.³ All these aspects of employment are forms of direct compensation for employment and tend to affect money wages received in equilibrium.

Another form of direct compensation relevant for the present analysis is the discretion to use the employer's resources to pursue private interests. For example, a production manager who is a computer enthusiast, would regard opportunities to work with, purchase, or design, computer systems as a form of in-kind compensation. He might turn down offers of employment at higher wages which lacked this form of job

³ See for example Frank (1985) for a nice discussion of job-related status compensation. This of course, is an important form of remuneration in academia.

satisfaction. As one moves up the hierarchy of organizations, direct compensation often becomes increasingly important, and in many instances appears to be more important than the money component of payment for services.

The significance of direct forms of compensation is probably most evident in the public sector. Public sentiment generally limits the use of high salaries and/or performance bonuses as incentives for talented individuals to take public sector responsibilities seriously. Given, this one would expect that only relatively untalented individuals would pursue positions in the senior levels of the public bureaucracy. Yet there appears to be no shortage of talented individuals interested in such positions. In the US, senior officials often take sizable money pay cuts to accept senior public sector positions. Logically this suggests that those who take such positions are largely being paid in kind, rather than in money, for their services.⁴

One form of direct compensation available in the public sector but not in the private sector is the opportunity to affect public policy. In many cases, responsibility for developing public policies are expressly delegated to the bureaucracy by the national legislature (or ruler). In many others, the opportunity to influence public policy is the unintended result of discretion that bureaucrats necessarily exercise with respect to the interpretation of instructions from their "governments." In either case, individuals with strong policy preferences will regard opportunities to influence public policy as a significant part of their compensation for working in the public sector.

An implication of this form of direct compensation for employment is that *the most talented people willing to work in an environmental agency will tend to be those with the strongest environmental preferences.*⁵ To see this consider the following representation of an individual's decision to enter the environmental bureaucracy.

⁴ It is also often true that senior positions in the bureaucracy often yield increases in future salaries, as tax or regulatory specialists, or lobbyists. However, it is by no means obvious that all senior bureaucrats take public employment with this in mind. Opportunities for many types of senior bureaucrats are very limited in the private sector.

Suppose that opportunity cost income in the private sector is Y^p , and that the individual's utility function is defined over environmental quality and income so that utility in the private sector with the present environmental policy E^p is

$$U = u(E^p, Y^p) \quad (1)$$

Both environmental quality and income are goods in the usual sense. Each has positive marginal utility over the range of interest.

An individual will choose to work in the environmental bureaucracy at income $Y^b < Y^p$ only if he can improve environmental quality sufficiently to offset the lower public sector wage, $E^b > E^p$. Conversely, if $E^b > E^p$ can be realized by taking the public sector job, the bureaucratic wage can be as little as required to make the individual indifferent between public and private sector employment:

$$U(E^b, Y^b) - U(E^p, Y^p) = 0 \quad (2)$$

In conjunction with the implicit function theorem, equation 2 implies that the lowest income that an individual will accept for public sector employment is a function of his private sector opportunity cost and the difference that he can make on environmental quality:

$$Y^b = e(Y^p, E^b, E^p) \quad (3)$$

The implicit function differentiation rule indicates that minimum public sector income rises as private sector income rises:

$$Y^b_{Y^p} = [U_{Y^b}] / [U_{Y^p}] > 0 \quad (4.1)$$

and falls as the environmental quality that may be realized increases:

$$Y^b_{E^b} = [U_{E^b}] / [-U_{Y^b}] < 0 \quad (4.2)$$

⁵ Moreover, positions where talent is important will tend to be designed so that such officials may have significant effects on policy within the jurisdiction of interest. The ability to affect policy will be advertised as part of the job description.

The latter is of interest for the purposes of this paper. It shows that reservation wages decline as opportunities for improving environmental quality increase. Other things being equal, the greater is the marginal utility of environmental quality the faster is the decline in reservation wages for jobs where environmental quality may be improved.

To the extent that productivity in the public sector can be approximated by private sector income, equation 4.2 implies that talented individuals can be attracted from the private sector at lower wages if their influence on environmental quality is sufficient. This is most likely to be the case in senior positions, where, according to press accounts, wage differences are largest. However, even in cases where wage rates are higher in the public sector than in the private sector, the most talented individuals willing to work for a given wage will have the most intense preferences for environmental quality relative to ordinary income.

The green policy preferences of the bureaucrats modeled here are not based on ideological concerns but rather on their demand for the final output of the agency. Ideological and other factors may also affect employment choices, but the effect that an individual expects to have on environmental quality will remain in these other models as well.⁶

⁶ The asymmetry of the policy preferences of the environmental bureaucracy is partly the result of assumption that a bureaucrat's income is not affected by environmental quality. In many cases this is a good approximation of actual incentives faced by prospective government employees. However in cases where environmental quality standards are sufficient to affect bureaucratic salaries, or future salaries associated with an anticipated return to the private sector, one can not rule out income based policy preferences. Of course, such individuals may prefer jobs in other agencies, such as treasury or finance, that allow more larger or more direct impact on their future incomes.

On the other hand, it is by no means clear that including a "revolving door" where future employment opportunities are *entirely* in regulated industries would reverse the conclusions of the present analysis. The more stringent the environmental regulations adopted, the more valuable an expert on such law becomes to private firms. It may well be the case that economic and environmental interests would *reinforce* each other in a less sparse model.

Niskanen (1971) has argued that bureaucrats have an indirect interest in an agency's mission because pecuniary rewards tend to be associated with increased bureau resources. A bureaucratic policy agenda might also result if an ideological litmus test is applied by the ruling party as a condition for employment in an agency. The above analysis indicates that neither of these behaviors are necessary to explain the policy orientation of top bureaucrats in environmental agencies. The possibility of increasing environmental quality is part of the compensation for working in an environmental agency. Consequently, an environmental agency, or sub unit, that systematically hires the *most talented* individuals available at a given wage, obtains a staff that tends to be more interested in environmental quality than the the average member of the country's bureaucracy or population as a whole.

III. Negotiating Solutions to International Environmental Problems

International externality problems require international solutions. Although each affected nation may address the local ramifications of such problems, none has incentives to fully take account of the affects of its polices on other nations. Consequently, the Nash solution to the domestic environmental regulation game is likely to be Pareto suboptimal. In this respect, environmental treaties attempt to achieve an end similar to that of domestic environmental legislation where suitable changes in legal constraints are expected to generate desired changes in the effluent outputs of firms and consumers.

However in another sense, the problem addressed is fundamentally different in as much as the problem attempts to solve externality problems among governments rather than polluters. International environmental treaties only indirectly affect the behavior of private decision makers. The indirect approach is necessary because of

the sovereignty of the contracting parties, and the consequent absence of international organizations with direct enforcement authority.⁷

Negotiating multilateral treaties provides an unusually great opportunity for conflict between political principals and their agents. A negotiator who reports to his principal that "this wording is the best that can be achieved" can not be held entirely responsible for any excesses in the policy mandates of the treaty. Responsibility for the treaty is diffuse inasmuch as environmental policies are a joint product of the efforts of many parties. Consequently, it will be difficult to distinguish an individual agent's malfeasance from the success of agents from other countries. Moreover, the same jointness which gives rise to diffuse responsibilities also gives treaty proposals forwarded to principals the character of "all or nothing offers." The latter was the primary vehicle for bureaucratic manipulation of principals elaborated in Niskanen's original work on bureaucracy.

A. The Principal's Interest

The principal's interest in environmental treaties is to secure more stringent environmental policies from other countries at least cost. Suppose that the pivotal political decision maker in the country of interest, the principal, maximizes a utility function defined over personal income and environmental quality, E . Environmental

⁷ The absence of standing external enforcement mechanisms implies that treaties must establish monitoring and enforcement mechanisms if agreed to regulatory reforms are to be fully implemented. In order to give treaty obligations the force of domestic law, agreements struck by negotiators are ratified by each signatory country's respective legislative body. In many cases, implementing domestic legislation is also required. The actual enforcement of new environmental rules remains a domestic matter. Even with domestic ratification, alternative interpretations of treaty language often allow considerable discretion over how treaties are implemented. See Congleton (1994) for a discussion of domestic incentives for noncompliance continue to exist throughout the life of a given treaty. These problems are neglected in the present analysis.

International treaties are not voluntary in the usual individualistic sense. Agreement at the level of government does not assure agreement at the level of the citizenry. However, environmental treaties are one case where theoretical gains from trade are likely to exist between governments and bargains struck rather than imposed.

quality is a joint product of domestic regulations in the relevant countries, $E = \varepsilon(R_1, \dots, R_N)$. Assume that the income of the pivotal decision maker can be characterized as a constant fraction, α , of his country's national income; where national income is a decreasing function of domestic environmental regulations, and an increasing function of the country's natural resource base, N_i , $Y_i = y_i(R_i, N_i)$. In this case the principal's utility function can be written as:

$$U_i = u(E, \alpha_i Y_i(R_i, N_i)) \quad (5)$$

The environmental treaties of interest for the purposes of this paper are ones that use transfers to secure more stringent environmental regulation from developing nations.⁸ To the extent that more stringent domestic environmental commitments are solicited with higher transfer payments, domestic regulations and overall environmental quality is an increasing function of the magnitude of these transfers.

The benefits to recipients and costs to donors of money and technology transfers are approximately proportional to national income. Let t be the proportional transfer rate for donors and s be the proportional transfer received by recipients. Suppose that countries 1 through n make a positive transfer, and that countries $n+1$ through N receive a transfer. If this redistribution of income is modeled as a pure transfer, then $\sum_{i=1}^n tY_i + \sum_{i=n+1}^N sY_i = 0$ and receipts can be written as a function of the transfer rate of the donors, $s = -[\sum_{i=1}^n tY_i] / [\sum_{i=n+1}^N Y_i]$.

Principal i of donor country i now has personal income $(1-t)\alpha_i Y_i$. Principal j of recipient country j has personal income $(1+s)\alpha_j Y_j$. Environmental quality can now

⁸ Promises of financial and technological aid are given much attention in both the convention on climate control and the biodiversity treaties negotiated in Rio. For example, Article 4 sections 3-5 of the United Nations Framework Convention on Climate Change specify the transfer obligations of developed nations. The developing countries shall "provide such financial resources, including for the transfer of technology needed by the developing country Parties to meet the agreed full incremental cost of implementing measures covered in paragraph 1 of this article..." It bears noting that the environmental (regulatory) obligations of developing countries are also more limited than for the developed countries.

be written as $E = \varepsilon(R_1(t) .. R_n(t) .. R_{n+1}(s) .. R_N(s))$, or more simply as $E=e(t)$. Each principal prefers the transfer rate that maximizes his utility. This requires that the transfer rate satisfy:

$$u_E e_t - \alpha u_Y (Y - (1-t)Y_R R_t) = 0 \quad (6)$$

for each country. (I suppress the country index, to simplify typography.) Each principal's preferred transfer rate equates his subjective marginal benefit from higher environmental quality to his marginal subjective cost for the transfer including the effects of more stringent environmental regulations on personal income. Were it not for the costs of implementing stringent regulations, recipient countries would prefer that t approach its upper bound, e. g. $t_j^* = 1$.

The implicit function theorem implies that the optimal transfer rate for principal i , t_i^* , can be written as a function of the share of GNP accruing to the pivotal voter and the country's resource base:

$$t_i^* = t(\alpha_r, N_i) \quad (7.1)$$

which implies that desired environmental quality is:

$$E_i^* = e(t_i^*) \quad (7.2)$$

Since environmental quality is presumed to increase as implicit tax rate t increases, the partial derivatives of E_i^* with respect to natural resources and income share realized by the pivotal voter are determined by those of t_i^* .

The implicit function differentiation rule implies that the partial derivatives of t_i^* are:

$$t_{iN}^* = \alpha Y_N \{ u_{EY} (1-t) e_t - \alpha u_{YY} (1-t) [(Y - (1-t)Y_R R_t] - u_Y [1 - (1-t)Y_{RN} R_t / Y_N] \} / \{-U_{tt}\} \quad (8.1)$$

and

$$t^*_\alpha = \{u_{EY}(1-t)Ye_t - \alpha u_{YY}Y(1-t)[Y - (1-t)Y_R R_t] - u_Y [Y - (1-t)Y_R R_t]\} / \{-U_{tt}\} \quad (8.2)$$

neither of which can be unambiguously signed. (I again suppress the country index, to simplify typography.) The denominator of both first order conditions is the second derivative of the original utility function (with the embedded constraints) with respect to the transfer rate, t . It will be less than zero if the first order condition characterizes a utility maximum. Consequently the signs of these derivatives are determined by the numerators.

The first two terms of each numerator are greater than zero and represent the effects of increased personal income on the demand for environmental quality. The last term of each numerator is less than zero, and represents the effects of the relative price effects of higher income. As the share of income realized by the pivotal voter increases, or as the magnitude of GNP increase, the marginal cost of purchasing higher environmental quality via transfers increases. The relative price effect for t^*_N is smaller than that of t^*_α for most plausible values of Y_{RN} , Y_R , and Y_N . Generally, one expects all of these to be on the order of the same order of magnitude. In this case $[1 - (1-t)Y_{RN} R_t/Y_N] < [Y - (1-t)Y_R R_t]$.

If we assume that the relative price effect dominates for t^*_α and the income effect dominates for t^*_N , as was the case in Congleton (1992), then the greater a nation's resource endowment or the smaller the fraction of GNP realized by the pivotal decision maker's personal income, the *more* inclined will the pivotal voter be to use transfers to secure environmental quality. This case is consistent with the use of transfers from developed countries to undeveloped countries as a means of securing more stringent environmental treaties. Countries where the pivotal decision maker has a relatively high share of relatively small national income, as is in many

developing countries with authoritarian political regimes, would favor less stringent environmental agreements than democracies where the pivotal decision maker (median voter) has a relatively small share of a large national income. Side-payments from democracies to dictatorships are necessary to obtain stringent environmental agreements in the interest of all parties.

B. The Agent's Interest

Of course, the actual negotiation of environmental treaties is not done by political principals, but by their bureaucratic agents. The principals delegate the actual negotiation of treaties to agents who, as noted above, tend to be greener than their principals. The agent's environmental agenda is to obtain the environmental quality level that maximizes his own welfare, $U^b = u^b(E, Y^b)$, subject to the constraint that the treaty can make the principal no worse off, $U = u(E, \alpha(1-t)Y) \geq U^o = u(E^o, \alpha Y)$. Negotiators have to secure their principal's assent in the end, so they can not entirely neglect the environmental goals of their principals.

The first order conditions that characterize the solution to this constrained optimization problem are:

$$\text{and } u^b_E e_t - \lambda \{u_E e_t - \alpha u_Y [Y - (1-t)Y_R R_t]\} \leq 0 \quad (9.1)$$

$$u(E, \alpha(1-t)Y) \geq U^o. \quad (9.2)$$

Selecting the principal's optimal transfer, t^* , will be an interior solution to the agent's optimization problem only in the case where the agent is policy neutral, $u^b_E e_t = 0$. Here, setting $u_E e_t - \alpha u_Y (Y - (1-t)Y_R R_t) = 0$ satisfies both equations 9.1 and 6. In the case of interest here, $u^b_E e_t > 0$, and the agent will attempt to realize a greener than optimal treaty from the principal's perspective.

Green agents favor the negotiation outcome that *maximizes* environmental quality given the principal's political constraints. In the case where environmental

quality is an increasing function of transfer rate t , the constraint will be satisfied as an equality. Here, the preferred transfer rate of the i^{th} negotiator is t_i^* such that $u_i(E, \alpha_i (1-t_i^*)Y_i) = u_i(E^0, \alpha_i Y_i)$.

In either case, the implicit function theorem implies that the i^{th} country's negotiator's preferred environmental policy can be summarized as:

$$t_i^* = a_i(Y_i^b, \alpha, N_i) \quad (10)$$

In the case of green agents, in addition to describing the negotiator's constrained policy optimum, this function describes the *most generous transfer rate* that developed country i would be willing to support, and the *least generous transfer rate* that developing country j would support.

C. Who Signs the Agreement?

To this point, we have discussed the range in which increased transfers increase domestic environmental regulations for all countries involved in the negotiations. However, one implication of the principal-agent model of ideal environmental treaties is that nations will disagree about the extent to which environmental quality should be pursued. As proposed transfer rates, t^{**} , vary, *different* countries may be willing to sign an agreement. Treaty agreements are, after all, voluntary, in that only signatories have even a nominal obligation to abide by treaty terms.⁹

In the case where green agents are used as negotiators, equation 10 characterizes a country's willingness to sign an environmental treaty. Developed

⁹ Many environmental treaties nominally proceed at two levels. At the original signatory level, there is a requirement for unanimous agreement. At the latter implementation stage some form of majority rule often applies. For example, section one of Article 23 notes that the convention "enters into force on the 19th day after the deposit of the fiftieth instrument of ratification, acceptance or accession." However, since implementation is ultimately a matter of domestic national policies, even the latter stage depends ultimately on the continuing mutual interests of signatories. Section 2, notes that states are bound by the convention after 50 states have accepted the convention *and* a state or regional organization of which the state is a member files its own acceptance, ratification or accession.

country i , $\{i \in 1..n\}$, signs a treaty only if the specified transfer rate is no more than t_i^* . Undeveloped country j , $\{j \in n+1 ..N\}$, signs only if the transfer rate is above t_j^* . In the case where $\max(t_j^*) < \min(t_i^*)$, there is a range where mutual gains to trade exist and increasing transfer rates lead to increased environmental quality. This range has been the focus of the analysis to this point. Outside this range, the environmental impact of increased transfers depends on which countries sign the treaties.

For example, a treaty with a low transfer rate and high environmental standard, will attract the interest of relatively wealthy democracies. Such programs allow increased environmental quality to be secured at a low cost to the median voter. Poor autocracies are less interested in environmental quality and would not sign such treaties without compensating side-payments. Treaties that use high transfer rates to secure very small improvements in environmental quality only attract the signatures of relatively poor autocracies.

Left to their own devices, green negotiators are inclined to select the transfer rate that maximizes environmental quality. The greenest feasible environmental treaty accounts for the effects of transfer rates on the subset of countries willing to sign the treaty, and on the extent to which environmental quality is improved by having specific countries included. If the "green" treaty lies within the intermediate range then t^{**} will be set such that $\sum e_{R_i} R_i = 0$. In the case where the greenest treaty that can be reached lies outside the range of mutual advantage, the treaty will be designed to secure the signatures of the countries whose regulatory coordination jointly assures the greatest improvement in environmental quality.

In either case, the document that emerges for signing is likely to be somewhat greener than that which maximizes the joint interest of the political principals. In the latter case, it will have somewhat fewer signatures than a treaty that stayed in the range of mutual advantage. The marginal signatory nation in this case signs a treaty

that is more green than it wishes. But, this is a consequence of the all or nothing nature of treaty agreements, rather than the marginal country's own agency problem. The *identity* of the marginal country is a consequence of the agency problem rather than its principal's state of indifference.

IV. Empirical Evidence from Rio

The above model has three empirical implications about the negotiation and signing of environmental treaties. (1) Negotiators tend to be more interested in environmental quality than their political principals. (2) Negotiators are constrained by their principals. Ultimately whether a nation signs and/or ratifies a treaty is determined by the principal's demand for environmental quality acquired with side-payments. Equations 7.2, 8.1 and 8.2 suggest that these inclinations decrease as either national resources decline or the fraction of national income accruing to the pivotal decision makers within a polity increases. (3) To the extent that negotiation is dominated by green interests, the treaty will maximize environmental quality, rather than the net advantage for political principals. Evidence from the Climate Control Convention negotiated in 1992 is largely consistent with the model's implications.

A. Historical Evidence

Historical evidence on points 1 and 3 is found within Mintzer and Leonard (1994), which is a collection of the post-Rio reflections of many prominent negotiators. These reflections are uniformly sympathetic to the agenda of the Earth Summit. Most regret not achieving more. None express opposition to the fast track that these treaties take. None express any doubts about the urgency of their task.

Although all the contributors seem to be aware of the limitations of current macro meteorological models, all draw green conclusions from the evidence amassed. For example, in their introduction Mintzer and Leonard note on page 9 that, "Human

emissions are still small compared to the natural flux of greenhouse gases into the atmosphere," and later on page 11 that "scientists now have compelling geological evidence that climates have changed rapidly in the past and could do so again in the future." However, rather than concluding that the future pattern of weather variation may have little to do with human activities, or that ecosystems which have survived rapid climate changes in the past must be fairly adaptable to temperature variation, they emphasize the potential for disaster (pg. 13). "Thus, the continuing and pervasive scientific uncertainty about future manifestations of the greenhouse effect will make it impossible to predict the value of mitigating or avoiding the regional impacts of global warming. *Even if none of the anticipated events [disasters] occur,* the continuing uncertainty about the timing and severity of their next possible occurrence will itself impose a significant cost on human societies." (Italics added.)

Borione and Ropert, negotiators from France, also draw attention to scientific uncertainties (pg. 81), but they none the less conclude that the "final agreement seems to us to have a sound basis" (pg. 78). Similarly, Nitze, the principal negotiator for the U. S. notes (pg. 189) that "serious uncertainties remain about the extent, timing and distribution of that warming and the associated changes in climate. With the possible exception of emissions from the burning of fossil fuels in the industrialized countries we do not yet have reliable inventories of greenhouse gas sources and sinks. Data concerning developing countries or economies in transition are sketchy or unreliable; there is no credible baseline against which to measure compliance with agreed targets and timetables." However, on the same page, Nitze concludes that "none of these arguments justify the U. S. refusal to agree to a *binding short term* stabilization target." (Italics added.)¹⁰

¹⁰ By the time Nitze wrote his piece, he had left government and was president of the Alliance to Save Energy in Washington D. C..

These quotes are not meant to indicate a conspiracy among negotiators and green organizations. As noted above, there is a simple economic explanation: the most capable individuals willing to accept government employment in areas focused on environmental policy issues are likely to have strong preferences (high marginal utility) for environmental quality. Their impact on the content of the final wording and intent of the convention is evident, and part of the reason they have accepted their positions as negotiators.

On the other hand, much of the negotiators' sense that less was accomplished than should have been is attributed to the desire that the U.S. be a party to the agreement. Nitze (on page 188) notes that "The U. S. success in achieving its major negotiating goals resulted from the unwillingness of either the other OECD countries or the major developing countries to sign an agreement without the participation of the US." The U. S. is the largest user of fossil fuels in the world, and consequently is a principle anthropogenic source of green house gases. As the marginal party whose agreement could most advance the aims of the treaty, it was important that the U. S. be a signatory nation. In the end, (Borione and Ripert, pg. 78), 156 signatures were obtained out of the more than 200 member nations of the United Nations.

B. Statistical Evidence

Although there are many environmental treaties, few have quantifiable environmental targets and side payments. Consequently, the agency cost part of the above analysis is not readily amenable to statistical tests. However, although agency problems may affect the content of environmental treaties, and thereby the number of signatories that such agreements obtain, they do not directly affect the propensities of principals to sign treaties.¹¹ Consequently, the model of principal interests is amenable to statistical appraisal.

¹¹ Of course, their advice and analysis might have such effects in a more elaborate model of the principal-agent problem. For example, environmental bureaucrats may

The first matter of interest is the extent to which the variables focused on in the analysis account for a significant portion of the variation in propensities to sign and ratify the treaties. Congleton (1992) used regime type to approximate the share of GNP accruing to the pivotal decision makers of the polities of interest. This proxy is also used in the present analysis. It provides useful evidence of the importance of political institutions as filters of citizen interest. Second, the assumed dominance of the relative price effects and income effects can be tested. The assumed relative price dominance for t^*_α implies that propensities to sign environmental treaties with side payments are higher for democracies than for dictatorships adjusted for regime type. The assumed dominance of the income effect for t^*_N implies that for a given regime type, wealthier nations will be more inclined to sign environmental treaties. The results reported below are consistent with both of these hypotheses.

Data on the number of countries who have signed and ratified the Climate Control Convention and the Biodiversity Convention are obtained from United Nations publications. Data on regime type is from *Freedom in the World* 1993-1994. Countries ranked in the two highest classes for civil and political liberties are classified as democracies for the purposes of this paper.

Data for fossil fuel resources are also collected. Data on coal reserves are obtained from "Recoverable Reserves" from International Coal, 1994 edition (1993 data, zeros are used for countries without listed reserves.) Data on proven oil and natural gas reserves are obtained from the World Bank. Unfortunately, natural resource data is fairly limited. Complete fossil fuel data are available for only 75 countries. In order to have a more complete sample, I also used country's surface area as a proxy for a country's natural resource base.¹² Another indicator of a country's

influence the principal's perspective on environmental issues by providing them with biased information about the costs or benefits of treaty obligations and accomplishments.

¹² Natural resources are more or less scattered at random on the earth. Given this, sample size, e. g. area, will be directly correlated with a nation's natural resource base.

resource base is its output. Data for per capita GNP are also taken from *Freedom in the World*.¹³ Although relatively extensive data are available for all of these variables, in no case are data available for more than 155 countries including 143 Climate Control Convention signatory countries, 43 of which have ratified, or acceded to the requirements of the Climate Control Convention. A few more of these countries have signed the Biodiversity Convention, 147, although fewer have ratified or acceded to the treaty requirements, 38.

The willingness of principals to sign international environment matters is characterized by equation 7.2. Linear forms of equation 7.2 are estimated using *ratification* of the Convention on Climate Change and the Biodiversity agreements as dependent variables. The estimates are reported below in tables 1 and 2. Table 1 reports direct estimates of the equation 7.2. Table 2 reports estimates which account for fossil fuel endowments and per capita income levels. The upper number reported in each cell is a coefficient estimate. The number reported below in parentheses is the t-statistic for the hypothesis that the coefficient value could have been zero. A single asterisk indicates that the null hypothesis can be rejected at the ten percent level of significance, two asterisks imply rejection at a five percent significance level, three at the one percent level.

The coefficient estimates for natural resources and regime type are fairly stable across model specification and the consequent sample variation required to accommodate data limitations. Together these suggest that the model results are not accidental consequences of the subset of countries focused on.

The results reported in table 1 are consistent with the proposition that a country's propensity to sign treaties is affected by its political institutions. Regime type has the posited sign and is statistically significant at the five percent level. In columns

¹³ Per capita GNP data for 1993 were also obtained from the World Tables, 1994. The results obtained are not significantly different than those reported below.

3 and 4, area is used as a proxy for national resource base. Area has the posited sign but in neither case, is the coefficient for area statistically significant.

Variable/Method	CC-Ratified (logit)	BD-Ratified (logit)	CC - Ratified (logit)	BD - Ratified (logit)
C	-1.359 (-5.28)***	-1.649 (-5.84)***	-1.47 (-5.37)***	-1.688 (-5.70)***
Democracy (0-1)	0.832 (2.26)**	1.121 (2.90)**	0.908 (2.44)**	1.180 (3.04)***
Area			2.38E-07 (1.33)	8.76E-08 (0.47)
Log likelihood	-87.974	-81.975	-86.133	-80.925
Obs with Dep=1	42	38	42	38
Obs with Dep=0	113	117	111	115

The models reported below in table 2 classify a somewhat greater fraction of signatures than the models reported in table 1, albeit at a cost of smaller sample sizes. Columns one and two report estimates of the basic models with reserves of fossil fuels included. Columns three and four use per capital income directly rather than the resource base. Although per capita income is an endogenous variable in the model, it may be argued that a direct measure of national income is preferable to the resource based estimates of the previous two sets of estimates, even with the associated simultaneous equation bias. Of the resource base variables included, only natural gas has a statistically significant coefficient, but it has the wrong sign. Political institutions are evidently a more important determinant of treaty ratification than fossil fuel resource endowments.

Table 2

Variable/Method	CC Ratified (logit)	BD Ratified (logit)	CC Ratified (logit)	BD Ratified (logit)
C	-1.723 (-3.79)***	-1.798 (-3.69)***	-1.18 (-4.27)***	-1.354 (-4.58)***
Democracy (0-1)	1.373 (2.35)**	1.476 (2.45)**	-0.026 (-0.06)	0.772 (1.74)*
GNP/Pop			6.58E-05 (2.61)**	8.58E-06 (0.36)
Oil Reserves	1.30E-09 (0.12)	7.78E-09 (0.55)		
Natural Gas Reserves	-5.32E-06 (1.81)*	-1.43E-05 (-1.10)		
Coal Reserves	1.98E-05 (1.27)	3.45E-07 (0.37)		
Area	5.08E-07 (1.09)	5.55E-07 (1.33)		
Log likelihood	-37.598	-36.366	-76.392	-75.278
Obs with Dep=1	23	19	41	37
Obs with Dep=0	52	56	89	93

The overall fit of the model is improved by using per capita income directly. The coefficient for per capita income has the posited sign in both estimates, but the correlation between per capita income and regime type is sufficiently high that the coefficient for regime type is no longer statistically significant in the climate control model. The improved fit generated by the per capita income variable suggests that other determinants of national income affect the pivotal decision maker's income level and thereby his marginal cost and benefits of environmental regulation.

Over all, the pattern of ratification is largely consistent with the political regime model developed in Congleton (1992). The model provides statistically

significant explanations of the pattern of ratification observed to this date. As in my previous study of the CFC agreements, democracies are more likely to have ratified or acceded to treaty demands than other countries, even though treaty terms are generally more stringent for developed countries than for undeveloped countries. However, the results also suggest that country differences outside the range of the present analysis affect propensities to sign and ratify environmental agreements.

V. Conclusion

This paper has examined some implications of the hypothesis that negotiators matter. If negotiators can affect national and international environmental policies, more talented individuals will compete for these positions than one would anticipate from the salaries associated with them. To the extent that the pool of potential negotiators regards environmental quality as a good, environmental policy staffs, assembled strictly on the basis of talent, will more environmentally oriented than staffs in other agencies or in the population as a whole. This may color the advice politicians receive, the policies recommended, and the content of environmental treaties negotiated. Moreover, negotiators of environmental treaties will exhibit a greater degree of common purpose than the nations that they represent. Anecdotal evidence from Rio suggests an almost uniformly green perspective on global warming issues, and a greater level of consensus on global warming than within even a single country.

This common outlook makes stringent environmental treaties easier to negotiate, but yields treaties which are at or near the limit of what is politically feasible to implement. Evidence from the treaties negotiated at Rio is largely consistent with this analysis. Negotiators were able to reach fairly stringent agreements about targets which thus far have not been implemented.¹⁴ Borione and

Ripert (pg. 96) note that "The implementation of a tax on CO₂ and energy in the European Community is proving difficult to achieve." Similarly, the carbon tax proposal by the Clinton administration in 1993 was never implemented because there was no domestic political consensus for such policies.

In retrospect, the treaties negotiated at Rio may have been even greener than optimal for the negotiators. In negotiating the greenest treaty that principals would sign, negotiators may have specified commitments that are not politically feasible. Whether this is the case or not, depends on the course of future legislation in the signatory countries. To this point, less than a third of the signatory countries have even ratified the climate control or biodiversity agreements. Far fewer have taken steps to implement their obligations under the treaties. The ultimate impact of the Rio treaties on signatory environmental and foreign policies will not be known for many years.

¹⁴ Article 4 Section 2a of the Climate Control Convention requires that each Party "shall adopt national policies and take corresponding measures on the mitigation of climate change by limiting its anthropogenic emissions of greenhouse gases and enhancing its greenhouse gas sinks and reservoirs." In Section 2b it is specified that these policies be "with the aim of returning individually or jointly to their 1990 levels of these anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol."

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Workshop 1995

Environmental Policy in Open Economies

June 5-7, 1995
Waldhaus Jakob, Eichhornstrasse 84, D-78464 Konstanz

Monday, June 5, 1995

19.00 - 21.00 Welcome Reception.

Tuesday, June 6, 1995

Chairman: Heinrich Ursprung.

9.00 - 9.45 *Opening Address:* Hans-Jürgen Vosgerau (Speaker of the SFB 178, Konstanz).

Introduction: Bernd Genser (SFB 178, Konstanz).

9.45 - 10.30 Coffee Break.

10.30 - 12.00 James R. Markusen (University of Colorado, Boulder):
Costly Pollution Abatement, Competitiveness, and Plant Location Decisions.

Discussant: Ulrich Landwehr (University of Mannheim).

Gunter Stephan (University of Bern):

*Laissez-Faire, International Cooperation or National Greenhouse Policy:
A CGE Study.*

Discussant: Andreas Haufler (University of Konstanz).

12.00 - 14.00 Lunch Break.

14.00 - 15.30 Roger D. Congleton (George Mason University):
Return to Rio: On the Political Economy of Environmental Treaties.

Discussant: Hans Peter Grüner (University of Konstanz).

Rolf Bommer (SFB 178, Konstanz):

*Endogenous Environmental Policy and Trade Liberalization - A Signaling
Approach.*

Discussant: Ronald Jones (University of Rochester).

15.30 - 16.00 Coffee Break.

- 16.00 - 17.30 Michael Rauscher (University of Kiel):
Protectionists, Environmentalists, and the Formation of Environmental Policy in an Open Economy.
Discussant: John S. Chipman (University of Minnesota).
Achim Körber (SFB 178, Konstanz):
Raising Rivals' Costs with Environmental Policy - A Lobbying Approach.
Discussant: Hans Gersbach (University of Basel).

Wednesday, June 7, 1995

Chairman: Bernd Genser.

- 9.00 - 10.30 Ernst Mohr (University of Kiel, Hochschule St. Gallen):
Sustainable Development and International Distribution: Theory and Application to Rainforests as Carbon Sinks.
Discussant: Carsten Schmidt (University of Konstanz).
Sebastian Killinger (SFB 178, Konstanz):
Decentralized Internalization of International Externalities.
Discussant: Lucas Bretschger (University of Zürich).
- 10.30 - 11.00 Coffee Break.
- 11.00 - 12.30 Ronnie Schöb (University of München):
Choosing the Right Instrument: Environmental Policy in the Presence of a Double Dividend.
Discussant: Frank Hettich (SFB 178, Konstanz).
Günther Schulze and Rolf Bommer (SFB 178, Konstanz):
Economic Integration and Economic Policy. Does NAFTA Increase Pollution?
Discussant: Sven Arndt (McKenna College).
- 12.30 - 14.30 Lunch Break.
- 14.30 - 16.00 Albert Schweinberger (SFB 178, Konstanz):
Environmental and Commercial Policies in More or Less Populous Open Economies.
Discussant: James R. Markusen (University of Colorado, Boulder).
Ruud de Mooij (Ministry of Economic Affairs, The Hague) and
Lans A. Bovenberg (University of Tilburg):
Environmental Taxation and the Double Dividend: The Role of Factor Substitution and Capital Mobility.
Discussant: Gebhard Kirchgässner (University of St. Gallen).
- 16.00 Closing Address: Heinrich Ursprung (SFB 178, Konstanz).