

Major Powers and Membership in International Environmental Agreements*

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Abstract

States form international agreements to solve problems that cannot be solved by unilateral action, and explaining the variety in the forms of international institutions that are created is a growing theme within the field of international relations. Because states actively design cooperative agreements to achieve their goals, the power of the parties to any specific arrangement is an important determinant of its structure. To overcome the hurdles that international cooperation poses, scholars suggest that the presence of powerful actors with an incentive to provide international institutions and enforce cooperation among the members is beneficial. These arguments have been applied to the fields of international conflict and international trade, and this paper extends previous examinations of the role of power in designing international institutions to the field of international environmental cooperation. Specifically, we argue that major power involvement in multilateral environmental treaties will increase the size of their membership because powerful actors can contribute resources to enforce compliance with environmental agreements and provide side payments that encourage other actors to participate. We also examine the tension between bilateral and multilateral approaches to address environmental concerns. On the one hand, great powers' activist foreign policy and leadership role makes them more likely to resort to multilateralism, but on the other hand great powers may prefer to take advantage of asymmetric relations in dyadic contexts, and therefore, be more likely to prefer bilateralism in their international interactions. Utilizing data from Mitchell's (2003) International Environmental Agreements Database, we explore whether environmental problems are more likely to be addressed in multilateral fashion or through networks of bilateral treaties when powerful actors are present. Our research contributes to scholars' understanding of why and how nation-states form international institutions to achieve their goals.

Introduction

International cooperation between nation-states can solve problems that cannot be remedied by unilateral action. Within the study of international cooperation generally, and in specific issue areas of cooperation like the international economy and international security, scholars were initially concerned with explaining how cooperation could be achieved in a world of anarchy. However, explaining the variety in the forms of international institutions that are created is a growing theme within the field of international relations. In other words, attention has shifted from how cooperation is possible to investigations of what form cooperation, if it occurs, is likely to take.

We investigate international environmental cooperation from this institutionalist perspective.¹ We agree that states design international institutions with the purpose of achieving their aims, and focus on the characteristics of the actors that are likely to determine the structure of international environmental agreements. Specifically, we review arguments that suggest the power of the parties to a cooperative endeavor will affect the likelihood of successful cooperation. Applying these arguments to environmental cooperation suggests to us that multilateral environmental agreements (MEAs) are likely to attract more members when major powers are involved in the agreement. Powerful actors have can contribute resources to enforce compliance with environmental agreements and provide side payments that encourage other actors to participate. We also consider arguments about the merits of bilateral or multilateral bargaining for major powers. Because we can draw no firm conclusions from the literature on

¹See the special issue of *International Organization* edited by Koromenos, Lipson, and Snidal (2001) for an overview.

multilateralism versus bilateralism about how powerful actors will pursue environmental cooperation, we appeal to the data by examining whether bilateral environmental agreements (BEA) or multilateral environmental agreements (MEAs) are more likely to contain major powers as members.

Empirically, we utilize data from Mitchell's (2003) International Environmental Agreements (IEAs) database to explore the size of membership in environmental treaties and whether problems are more likely to be addressed in multilateral fashion or through networks of bilateral treaties by major powers. To do so, we assess the average size of MEAs that include at least one major power perform cross-tabulations on the number of MEAs and BEAs that have at least one major power as a member. We find that major powers are more likely to be parties to MEAs than BEAs, and the result is statistically significant. While our analysis does not control for other factors that may contribute to whether environmental cooperation takes a multilateral or bilateral form, it appears that major powers choose multilateral forms of environmental institutions (treaties) over bilateral forms. Further, we find that MEAs where at least one member is classified as a major power are likely to have a higher average number of members. Also, MEAs with major power members are likely to have more parties to the agreement than the median number. Both results are statistically significant at conventional levels.

Our research contributes to scholars' understanding of why and how nation-states form international institutions to achieve their goals. The results suggest that when more powerful states are involved in environmental cooperation, the membership of the IEA increases. We interpret this evidence as support for claims by scholars that larger states are capable of supplying the resources to monitor and enforce cooperative environmental agreements. Future research

should investigate the influence that major power participation has on membership in MEAs more rigorously. In particular, statistical analysis that controls for the scope of the environmental problem and the ‘situation structure’ (i.e. upstream/downstream issues v. global commons issues) is a necessary improvement on our efforts in this paper.

The paper proceeds with a short review of the problems affecting international cooperation. The third section argues that many environmental problems are multilateral in nature and considers the effect of major power participation on resolving cooperation problems. Next, we present a review of the literature on multilateral versus bilateral approaches to cooperation. Then, we discuss the IEA database and present analysis of the membership size of MEAs and the propensity of major powers to participate in multilateral or bilateral environmental agreements. Finally, we conclude with observations on our initial findings and suggest possibilities for future research.

Problems in International Environmental Cooperation

Cooperation between nation-states over environmental issues is plagued by many of the same problems that bedevil international cooperation over other issues. According to Keohane (1984), cooperation requires that “actors adjust their behavior to the actual or anticipated preferences of others, through a process of policy coordination” (51). In the anarchical structure of the modern nation-state system, actors pursue cooperative arrangements with the knowledge that no central authority exists to enforce agreements that stipulate policy coordination. Cooperation broadly considered, and international environmental cooperation specifically, occurs

under the condition of anarchy.

Traditionally, scholars identify two broad types of cooperation problems (Snidal 1985; Stein 1982). The first is called a collaboration, or mixed-motive problem. The Prisoner's Dilemma (PD) game is a widely used analytical tool that is a collaboration game. In PD games, the actors individual strategies are dominated by the choice not to cooperate, but by doing so the equilibrium outcome is inferior to a situation in which the actors cooperate. Enforcing an agreement that pledges the actors to cooperate is a major hurdle in international cooperation, and international environmental cooperation is likely to evince the difficulty of getting parties to an agreement to live up to their end of the bargain. An international environmental agreement that requires states to reduce their harvesting of fish populations is one example of a collaboration problem.

The second cooperation problem is labeled a coordination game in which multiple solutions are possible, but there is no clear criteria for reaching one particular solution over another. The challenge for nation-states in these situations is to coordinate their behavior, but once policies are coordinated and an equilibrium is reached, the agreement should be more or less self-enforcing (i.e., parties have little incentive to cheat or renege on the deal). When the multiple resolutions to coordination problems involve different sets of distributional consequences, coordination games may also be difficult to solve (e.g., Krasner 1991), but enforcing an agreement is not a major impediment to successful cooperation. International environmental cooperation sometimes reflects a coordination game, such as the harmonization of environmental policies by European Union (EU) members to facilitate international trade between the EU as a whole and non-EU states.

Beyond delineating the structural impediments to cooperation, international relations scholars have articulated a number of arguments explaining how states sustain cooperation in the face of an anarchic interstate system. Foremost among these is the recognition that actors may often expect to interact with one another again in the future, and the ‘shadow of the future’ can induce cooperation when combined with a strategy of reciprocity that defectors with defection and rewards cooperation with cooperation (Axelrod 1984). In other words, as long as actors value future payoffs highly enough and will have opportunities to cooperate again collaboration/enforcement problems can be overcome without a central government that enforces agreements. Further, Ostrom (1990) argues that management of common pool resources (the ‘commons’) can take on a variety of forms beyond assignment of individual property rights over parcels of common goods or a central enforcer.

However, some collaboration problems may require institutions that provide strong mechanisms of surveillance and enforcement. If information about members compliance with cooperative agreements is hard to acquire more elaborate institutional mechanisms may be necessary to avoid undetected cheating (Milgrom, North, and Weingast 1990; Keohane 1984; Axelrod and Keohane 1985). Monitoring and enforcement institutions can be required especially in international environmental cooperation, where reciprocity is a limited strategy because punishment consists of reducing an actor’s own provision of a public good like protecting the environment (Barrett 2003; Mitchell 1994).

While coordination games may appear easier to resolve than collaboration games because the enforcement problem is less severe, scholars recognize that negotiation over an agreement and subsequent enforcement are not unrelated (Morrow 1994). In coordination games, actors

need to decide on one of multiple solutions that may have different distributional consequences. In such cases, states face a bargaining problem that may be exacerbated by a long shadow of the future because members to any potential agreement can bargain harder for their most preferred solution if the agreement reached will be self-enforcing (Fearon 1998). Institutions/regimes may contribute to successful cooperation in these instances by establishing focal points and principles that evolve within repeated bargaining in a regime (Schelling 1960).

Major Powers and Multilateral International Environmental Cooperation

International environmental issues are said to require a multilateral approach because of their collective and transnational character. Unlike other international issues, environmental issues perfectly match the definition of “collective goods” ---or better, collective “bads.” That is, they have the characteristics of non-rivalry and non-excludability. States cannot privatize the environmental, economic, and social damages resulting from pollution, deforestation, desertification, depletion of the ozone layer, etc. On the one hand, many of the most severe environmental problems affect portions of the international system that are considered *res communes* under international law ---e.g., the high seas. On the other hand, states cannot seal their borders from the effects of a thinning ozone layer or growing levels of carbon dioxide. Most important, regardless of intention and capabilities, no state can single-handedly bring about a solution to such problems. Individual efforts to manage or solve environmental problems are said to be better than no effort at all. However, environmental problems require at the least multilateral coordination and, in most instances, full-fledged multilateral cooperation.

So, how does the power of the members to any MEA affect the prospects of cooperation?

In collaboration games, enforcement must be strong enough to overcome the incentives that actors have to free-ride on the public goods contributions of others (Olson 1965). Many environmental problems exhibit the characteristics of public goods and major power involvement is likely to effect environmental cooperation in two ways when collaboration problems exist. First, because of their additional resources major powers can contribute to the establishment of the institutions necessary to monitor compliance. Cooperation should be more likely to succeed if major powers supply the ‘commitment’ institutions to ensure compliant behavior by members. Second, when monitoring compliance is difficult more centralized international institutions, with a single entity performing enforcement tasks, are likely to emerge (Koromenos, Lipson, and Snidal 2001). States are naturally reluctant to cede sovereignty to international institutions, and major powers may obviate the need for such centralization. When powerful states are party to a cooperative endeavor they can coerce/induce members to comply or conduct surveillance of members conduct on their own (Mitchell and Keilbach 2001).

For coordination problems in multilateral settings, Martin (1992) suggests that major power preferences offer a visible solution to which other potential members to an agreement can accede. Likewise, where distributional conflicts occur that necessitate bargaining over a set of possible solutions, major powers may facilitate cooperation by providing side payments to compensate members who lose out in the distribution of costs and benefits to cooperation. Also, because major powers often are major contributors to global environmental problems, without their presence the effectiveness of any solution is less than optimal.

As a result, one effect of major power involvement in environmental cooperation should be that participation in multilateral agreements by states grows. Because major powers have the

resources to pay transaction costs like gathering information to monitor compliance, more states should be willing to be members of multilateral environmental agreements when a major power is party to the agreement. Whether major powers supply the resources for centralized institutions, coercion members to comply in more decentralized cooperation, induce potential members to an agreement to accept their preferences for a solution (i.e. establish a focal point), compensate 'losers' in environmental cooperation, or encourage participation in solving global environmental problems by their own participation because they are the largest contributors to the problem, the result should be a larger membership in a multilateral environmental agreement.

At this point, our argument focuses on the effects that major powers have on multilateral environmental cooperation. However, international relations scholars also investigate whether cooperation is conducted on a multilateral or bilateral basis. In the next section, we address the issue of whether major powers are more likely to pursue environmental cooperation at the multilateral or bilateral level.

Multilateralism v. Bilateralism in International Environmental Agreements

While the terms coordination and cooperation are common currency in public debates and expert scholarship on environmental issues, the accompanying adjective ---"multilateral"--- has been interpreted in different ways in the literature. In particular, two interpretations have emerged. One interpretation stresses the quantitative dimension of multilateralism. Keohane (1990, 731) specifically refers to multilateralism as "the practice of co-ordinating national policies in groups of three or more states." This approach stresses the challenges and the costs involved in communicating, planning, and synchronizing action among numerous actors. The

content and quality of the policies being coordinated are, to some extent, a lesser concern. Conversely, an alternative interpretation of multilateralism focuses on the quality of the relations among the actors involved in a multilateral initiative. Martin (1992) suggests that multilateralism and multilateral institutions need not be the same thing. According to Ruggie (1992) and Caporaso (1992) the trademark of multilateralism is that participants conduct relations among themselves on the basis of some generalized principle of conduct. Ruggie's definition concerns "principles which specify appropriate conduct for a class of actions, without regard to the particularistic interests of the parties or the strategic exigencies that may exist in a specific occurrence" (1992, 571). From this perspective, the GATT's and World Trade Organization's Most Favored Nation (MFN) principle is a clear example of multilateralism at work. Two factors are of special importance for a qualitative interpretation of multilateralism. First, the behavior regulated by the "generalized" principle must be indivisible among the group's members. Second, for multilateralism to be successful, the cooperative behavior must be preserved over time and interpreted by the parties as a form of diffuse reciprocity (Ruggie 1992, 571). Thus, the challenge of multilateralism is to preserve the symmetry of such relations in policy areas where actors of different size and with different motivations face the incentive to exploit such differences. It is important to stress that these two perspectives are not mutually exclusive, and some scholars have offered a view of multilateralism that falls somewhere in between (see, again, Ruggie 1992).

Regardless of the definition of multilateralism they employ, scholars of international regimes have focused on the number of actors as the key determinant of the success of multilateral initiatives. The general view is that the higher the number of parties involved, the

less successful policy coordination and the establishment of a generalized principle of conduct are likely to be. Purely multilateral legal regimes with many actors find strength in numbers. Their policy impact is likely to be significant. However, a high number of participants increases transaction costs and complicates the task of monitoring, identifying, and punishing defectors. Two solutions have been offered to prevent the devolution of collective initiatives into bilateralism: hegemonic leadership or delegation of the coordinating activities to groups involving fewer states. The advantages of the first solution have been extensively addressed in the literature on international cooperation (see, for instance, Keohane and Nye 1977). Hegemons may individually shoulder the costs of providing solutions to collective problems. Alternatively, they may want to assume the leadership in pursuing multilateral solutions because multilateralism allows them to spread the costs involved in addressing a collective problem.

Delegation to small-size groups ---the second solution mentioned above--- has been explored thoroughly by Kahler (1992) who discusses the difference between multilateralism with large number of participants and multilateralism in small groups ---or “minilateralism.” Minilateralism can still meet the qualitative and quantitative parameters of multilateralism while reducing collective action problems. When fewer actors are involved, they tend to be more similar to one another both in their traits and in their policy positions. Convergence of interests makes it easier to act on a particular policy problem. By minimizing collective action problems, minilateralism makes it easier to detect and effectively sanction defectors. This, in turn, facilitates compliance. On the other hand, the impact of coordination among a few actors can be limited and inadequate for problems that affect the international community as a whole. As Oye (1986, 21) states, minilateralism “generally diminishes the gain from cooperation, while

increasing the likelihood and robustness of cooperation.”

Kahler (1992) has suggested that some of the most enduring regimes of the post-WWII era were not fully multilateral. Rather, they were minilateral regimes guided by major power leadership. He analyzes post-1945 regimes in the area of free trade, management of the high seas and their resources, and international environment. Major power leadership was essential to the creation of these regime. However, as the number of participants grew, the value of cooperation for major power states began to decline due to free-riding by the smaller states and increased costs of policy coordination. Kahler (1992) suggests that, although none of these regimes can be said to have fully succeeded, the most effective ones were those where participants devised institutions that could accommodate the needs of both major power states and smaller members. According to Kahler (1992), voting systems, representation mechanisms, delegation rules, and the nesting of minilateral structures within multilateral framework can all be manipulated to ensure the participation of large numbers while preserving the hierarchical relations required by major power states.

Indeed, multilateralism presents major power states with an interesting puzzle. On the one hand, multilateralism appeals to great powers for a variety of reasons. To the extent that they reflect the status quo prevailing at the time in the international system, multilateral institutions offer great power states the opportunity to “crystallize” the existing, favorable hierarchical relations. Equally important, multilateralism is a cost-saving device for major powers. It allows them to spread the costs involved in the provision or preservation of collective goods. Finally, multilateralism provides legitimacy to actions that may otherwise be perceived by the rest of the international community as motivated by narrow self-interest. On the other hand, as Kahler

(1992) points out, multilateralism becomes less and less appealing to major power states as the number of participants increases. Multilateral institutions with many actors are slow and cumbersome. The time and energy necessary to achieve consensus first and to implement agreements later are often inadequate for immediate international crises (Weber 1992). Yet, major powers are expected to provide continuous leadership during the process. Because they tend to produce “least common denominator” agreements, multilateral institutions tend to dilute the influence and status of major power states. Finally, in multilateral agreements major powers are often expected to act as monitors and enforcers while unilaterally shouldering the costs of these additional functions. Thus, the “generalized principles” of multilateral arrangements --- e.g., non-discrimination, legal equality, equality in representation--- are not in harmony with the role, status, and contingent interests of major power states.

Great powers, then, are consistently faced with the temptation to abandon multilateralism in favor of bilateralism or unilateralism. For major power states, bilateral relations have the advantage of asymmetry. Unless they are dealing with their peers, major power states start from an advantageous bargaining position and can coerce smaller, recalcitrant partners into less-than-favorable agreements. Quite often the time and costs of required to negotiate numerous bilateral deals far surpasses the costs and time of reaching a collective bargain agreement. However, the asymmetric distribution of benefits or externalities in bilateral deals allows major powers to recover, at least in part, the upfront costs of this strategy. Bilateral institutions simplify decision-making processes and are more expedient, while decreasing the costs of detection and punishment of defectors (Weber 1992). Bilateralism eases the legal constraints placed on major powers. Bilateral agreements are easier to renegotiate and renounce if the status quo or a great

power's interest change. For major power states, bilateralism reduces the costs of monitoring and enforcement, while increasing the effectiveness of direct reciprocity (Weber 1992). Finally, although in some issue-areas bilateral arrangements do not carry the same “weight” as multilateral ones, they still provide an aura of legitimacy to major powers' self-interested actions.

In addition to bilateralism, great powers also have the option to resort to unilateralism. Because of their capabilities and status, major power states can ---sometimes--- unilaterally provide collective goods for the community of states as a whole or act individually against the will of the majority of members of the international system. Both benign hegemonism and selfish unilateralism are expensive. However, they offer high returns in terms of expediency and “power of initiative.” Unilateral action allows major power states to curtail the negotiation processes involved in bilateralism and multilateralism. Unilateralism also means that major power states can take the initiative and seize windows of opportunity generally unavailable to other states. Unilateral initiatives mean that major power states can present the international community with *faits accomplis* to which other states can only adjust. It also means that major powers can set the rules of the game on specific issues or in broader issue-areas before other countries have had opportunity to act. The effects of unilateralism are not only strategic but also legal, as unilateral actions by major power states can: determine the emergence of new customary rules; prevent customary rules from crystallizing; and, finally, change existing custom.

The tension between multilateralism and other options ---i.e., bilateralism and unilateralism--- is stronger in some issue areas than others. For example, it emerges quite evidently in international environmental affairs. As stated earlier, most international environmental issues are, by definition, collective good issues. Neither can the consequences of

environmental problems be privatized nor is privatization the solution to such issues.

Multilateral action is required to tackle environmental concerns, and major powers' leadership is deemed necessary for multilateral initiatives to emerge and be successful. Major power states face strong incentives to provide such a leadership on environmental issues. First, because of their size and magnitude of their activities, they are often the ones facing the most severe environmental damage ---e.g., Russia, China, and the US. Second, to the extent that environmental degradation promotes political instability and insecurity (Homer-Dixon 1991), major power states have a vested interest in preserving a status quo that largely favors them.

However, major power states face equally strong, countervailing incentives to pursue bilateral options on environmental issues. First and foremost, major power states are the biggest contributors to some of the most pressing international environmental problems. The international community expects both their leadership and participation in multilateral initiatives. However, major powers are expected to both shoulder the costs of such initiatives while making the biggest sacrifices in containing the consequences of their anti-environmental actions. Second, major power states are likely to fall victims to the “old” realist relative gains-logic. They fear free-riding on the part of developing states and emerging powers and erosion of their relative advantages.

While not opposed by definition to the solution of environmental problems, major power states have numerous reasons for preferring a bilateral approach to such issues. As stated earlier, bilateralism allows them to strike advantageous deals with smaller states, whereby the major power will either: (1) make less burdensome sacrifices than it would face in a multilateral context; or (2) coerce a less powerful actor into accepting agreements in which the environmental

externalities of economic actions are distributed asymmetrically. A less noted, but equally important incentive is that, in the case of environmental issues, bilateralism allows major power states to assert themselves against the emerging trend of looking at the preservation of the environment as “instant custom” or even as an emerging rule of *jus cogens* (Cassese 2005). That is, bilateralism does not only allow major power states to gain the upper hand politically and economically, but also legally.

Consequently, in the next section we explore the relationship between membership size in IEAs and the power status of the members. We conduct a preliminary analysis that seeks to determine whether the size (number of members) of MEAs is greater when a major power is one of the parties to the agreement. Second, we evaluate the propensity of major powers to conduct environmental cooperation through MEAs or BEAs. As we argue above, the literature on multilateralism does not suggest a definitive expectation regarding major powers behavior in international environmental agreements. We appeal to the data for evidence supporting either multilateralism or bilateralism as the most common approach in international environmental politics.

Research Design

The arguments above suggest that environmental cooperation (in the form of environmental agreements) is plagued by many of the standard problems facing states in international relations. The participation of major power states may relieve some of the difficulties to cooperation, encouraging other states to participate, but major powers also have incentives to manage environmental cooperation on a bilateral basis. Therefore, we explore the

propositions raised in the preceding section using data from Mitchell (2003). Mitchell's International Environmental Agreements Database project collects data on more than 900 multilateral agreements and 1,500 bilateral agreements concluded during the 19th and 20th century.²

Mitchell (2003) collects “multilateral agreements (MEAs) of three or more member countries and ... bilateral treaties, conventions, protocols, and amendments (BEAs) designed to protect the environment” (430). Many of these agreements concern similar or even identical environmental issues or problems. Thus, Mitchell (2003) uses the term lineage “to refer to one or more legally linked instruments. A lineage is any set of agreements, protocols, and amendments that modify, extend, replace, or explicitly derive from one or more original agreements.” We agree that recognizing lineages is an important part of the study of international environmental cooperation. However, our research question concerns the membership size of IEAs and, technically, the decision by states to become members of an agreement. Even if linked through a lineage, we assume that distinct agreements require the assent of the parties to the new terms and can be considered independent for our analysis. In other words, we consider protocols and amendments to pre-existing treaties as separate observations. While this choice may create potential problems with dependence across observations, both international legal theory and observed state behavior indicate that consent to and membership in successor-agreements cannot be taken for granted and suggest that we treat successor-agreements as separate cases.

²A handful of these agreements, mostly bilateral, were concluded before the 1800s. The data are available at <http://iea.uoregon.edu/>.

Therefore, we employ all of the bilateral agreements available from Mitchell's (2003) data and a subset of the multilateral agreements —specifically, the multilateral treaties for which membership information was available.³ There were 287 multilateral treaties and 1530 bilateral treaties in the data. Because our argument focuses on major power states' preferences for bilateralism or multilateralism and on their role in international environmental legal regimes, we are interested in two key treaty characteristics: whether a treaty is multilateral or bilateral, and the number of members of a multilateral agreement. For each treaty, we essentially have two dependent variables. The first dependent variable is dichotomous, and it concerns whether a treaty is bilateral or multilateral. The second dependent variable concerns the number of member states in each treaty.

It is important that we clarify further our conceptualization of “treaty membership.” States can take a variety of actions with regard to any environmental agreement, and agreements vary considerably with regard to the actions they require of states. In fact, after they have negotiated a treaty, states must sign and often ratify the agreement. Different mechanisms by which agreements enter into force, signature and ratification have different effects depending on the treaty. As a result, entry into force can be considered as a separate action in some treaties. Instances of later accession to a treaty and instances of state succession constitute a further conceptual challenge. Given the nature of our research question, and given our theoretical argument, we are less interested in entry into force or compliance with a treaty than in states' expressions of consent with an environmental agreement. Traditional international legal theory

³We are indebted to Ron Mitchell for generously sharing his data about state membership in international environmental agreements.

suggests that consent with an agreement is the crucial determinant of states' legal obligations, regardless of how it is communicated. Thus, we estimate each treaty's membership on the basis of the first state action that expresses *consent* with the treaty. In most cases, that is the act of signature. In cases of states' later entry into a pre-existing agreement, that is the act of accession or acceptance of a treaty. Finally, in cases of new states coming into existence and inheriting their predecessors' legal commitments, that is the act of succession. To be as inclusive as possible in our analysis, we require only signature by a state to consider it a member of an IEA.

The key independent variable of interest here is the presence of a major power state as a member of an environmental agreement. To determine whether a major power participant affects the membership size of MEAs and the type of cooperation (bilateral v. multilateral), we code a dichotomous variable one if the agreement contains at least one major power participant (zero otherwise). The Correlates of War(COW) project has identified the following states as possessing major power status at some point during the analytical time frame of interest:⁴

[Table 1 approximately here]

Beyond major power status, we can surmise that other factors will affect the membership size or other characteristics of environmental agreements. Koremenos (2005) finds that the subject-matter of a treaty affects the likelihood that member states will adopt a finite duration for the treaty due to differences in uncertainty across different issue-areas. It is also possible to

⁴ Data on major power status are from the EUGene program (Bennett and Stam 2000) and based on system membership classification rules from Small and Singer (1982).

argue that the environmental problem with which each treaty deals may have an impact on its institutional design. Unfortunately, a classification scheme that would allow us to sort environmental treaties into neat categories based on their topic is not currently available for all agreements in our data set. In addition, the available theoretical framework is such that we cannot develop theoretically-informed expectations about which environmental issues may lead toward a bilateral institutional design or toward a multilateral one. Therefore, at this stage of the project we are limited to a univariate analysis of the data. We conduct this exploratory investigation with a variety of techniques: cross-tabulations; t-tests for difference in means; and analysis of variance. The results are presented in the following section.

Results

A preliminary, descriptive analysis of the environmental agreements in the data set indicates that, of 1,530 bilateral agreements, approximately half of them have a major power state as a member. Specifically, 776 (50.76 percent) of the bilateral agreements are between minor powers only, 614 (40.13 percent) are between a major power state and a minor power, and only 140 (9.15 percent) are between two major power states.

With regard to the multilateral environmental agreements, the smallest multilateral agreements have, of course, 3 members. The largest multilateral agreement—the 1994 Convention to Combat Desertification—has 187 members. On average, a multilateral environmental treaty has 26 parties (25.98, to be exact) with a standard deviation of 36.53. The median membership is 13. The fact that the median is much smaller than the means suggests a skewed distribution, with large-membership multilateral agreements outnumbering small-

membership agreements. This, in itself, is telling of states' preference for dealing with environmental issues in large numbers. 201 (70.03 percent) of the 288 available treaties have at least one major power state as member. Only 9 multilateral agreements have all of the major power states as members. These agreements are: the aforementioned 1994 Convention to Combat Desertification; the 1991 Protocol On Environmental Protection To The Antarctic Treaty; the 1992 United Nations Framework Convention On Climate Change; the 1992 Convention On Biological Diversity; the 1972 Convention On The Prohibition Of The Development, Production And Stockpiling Of Bacteriological (Biological) And Toxin Weapons, And On Their Destruction; the 1994 Convention On Nuclear Safety; the 1996 Comprehensive Nuclear Test Ban Treaty; the 1997 Protocol To The United Nations Framework Convention On Climate Change; and the 2001 Convention On Persistent Organic Pollutants. Overall, the average membership in multilateral treaties where a major power is present is 33.14 parties, while the average membership for non-major power multilateral treaties is 9.52 parties.

Beyond descriptive statistics, our first proposition concerned the tendency of major power states to prefer bilateral arrangements or multilateral arrangements in regard to environmental issues. We test the significance of the association between the presence of a major power in a treaty and multilateralism with a simple cross-tabulation. As Table 2 below indicates, the association between major power status and multilateralism is strongly significant (chi-squared 41.74, $p = 0.000$) and in the expected direction (Tau-b = 0.15). We can conclude that major power states display a marked tendency to deal with environmental issues multilaterally despite the countervailing opportunity to act bilaterally.

[Table 2 approximately here]

We further test the relationship between presence of a major power state and institutional design by looking the number of states who are parties to a treaty. Recall that we expect that, on average, the size of a multilateral treaty should increase with the presence of a major power state. With divide multilateral treaties into two groups depending on whether a treaty is above the median in terms of membership or not. We then look at whether the presence of one or more major power states is associated with being above the median. The outcome of the resulting cross-tabulation is displayed in Table 3.

[Table 3 approximately here]

Again, we see evidence that major power states are not only more likely to take part in multilateral treaties, but that the multilateral treaties to which they are parties have a significantly higher membership than the treaties who do not have a major power among their members (Chi-squared = 39.49 and Tau-b = 0.37). We conduct two final tests of the hypothesis linking presence of a major power state and membership seize by looking at the mean membership between treaties with a major power among their members and treaties without a major power. First, we use a t-test for difference in means to see whether the means are significantly different from one another. Then, we replicate the test using an analysis of variance (ANOVA). The results, as shown in Table 4 and 5, indicate that the presence of a major power does indeed make a significant difference.

[Tables 4 and 5 approximately here]

Conclusion

Our research indicates that the power of the members in environmental treaties is an important factor contributing to their overall size in terms of total members. However, the results are preliminary and do not control for other factors that may also increase the average size of a multilateral treaty or whether the agreement is multilateral or bilateral. Specifically, we anticipate that the scope of the environmental problem a treaty attempts to resolve, the nature of the cooperation problem, and what Mitchell and Keilbach (2001) describe as the situation structure are likely to be important factors. For example, transboundary pollution of rivers and waterways isolated to two, or a few, states that share water basins versus global climate change that affects all states are likely to give rise to different forms of cooperation.

Furthermore, this study is limited by its evaluation of the size of multilateral treaties. Environmental cooperation in the form of agreements signed is not equivalent to successful cooperation in reducing or reversing environmental damage. While major powers may be adept at cajoling or encouraging minor powers to sign IEAs, compliance with agreements is another issue entirely. The results of this analysis are encouraging in terms of policy outputs (treaties), but do not speak to the role that major powers are able to play in creating favorable policy outcomes.

Table 1. Major power status, 1816-1992.

Austria-Hungary	1816-1918
China	1950-present
France	1816-1940, 1945-present
Germany/Prussia	1816-1918, 1925-1945, 1991-present
Italy	1860-1943
Japan	1895-1945
Russia/USSR	1816-1917, 1922-present
United Kingdom	1816-present
United States	1899-present

Source: Singer (1987) and <http://www.correlatesofwar.org/>

Table 2. Major power status and environmental treaties' design

	Bilateral	Multilateral	
Non-major power	776	86	862
Major power	754	201	955
	1530	287	

Chi-squared = 41.74 Pr = 0.000

Tau-b = 0.15

Table 3. Major power status and multilateral environmental treaties' membership size

	Membership size		
	Below the median	Above the median	
Non-major power	68	78	146
Major power	18	124	142
	86	202	288

Chi-squared = 39.49 Pr = 0.000

Tau-b = 0.37

Table 4. Major power status and mean treaty membership (test for difference in means)

	Observations	Mean	Standard Error	Standard Deviation
Major power treaties	288	33.14	1.03e-07	1.75e-6
Non-major power treaties	288	9.52	0	0
Difference	288	23.61	1.03e-07	1.75e-6

t = 2.38+08

P > t = 0.000

Table 5. ANOVA analysis of major power status and mean treaty membership

	Partial SS	df	MS	F	Prob > F
Model	33217.4795	1	33217.4795	27.16	0.000
Major power treaties	33217.4795	1	1223.07494	27.16	0.000
Residual	349799.434	286	1223.07494		
Total	383016.93	287	1334.5537		

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