International Entanglement and Contingent Behavior as Determinants of International Cooperation

Explaining Global Environmental Treaty Ratifications, 1950-2000

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In this paper we shed light on the extent to and forms in which linkages of states with their external environment influence international cooperation, controlling for domestic factors such as income and democracy. The existing empirical literature emphasizes domestic determinants and has, surprisingly, paid much less attention to international factors. We define external linkages in terms of involvement of states in international organizations and the world economy, and in terms of behavior that is contingent on what other countries do. To assess the effects of these factors relative to domestic determinants we study global environmental commitments in the form of ratification behavior by 180 countries vis-à-vis 340 treaties in the time-period 1950-2000. With the exception of integration into the world economy, which affects cooperative behavior negatively, the results show that international factors have a stronger, and positive, impact on cooperation than domestic factors. The main implication is that at least in the short to medium term it might be more efficient to foster global environmental cooperation by "entangling" reticent countries in international institutions and increasing incentives for contingent behavior, rather than promoting cooperation through democratization, socio-economic development, and trade.

Keywords: international cooperation, institutions, contingent behavior, environment, globalization, trade, democracy.

1. Introduction

In this paper, we shed new light on the old, yet fundamental question of what conditions promote international cooperation. Empirically, we are interested in the factors that motivate countries to join international environmental agreements. Environmental issues have over the past three decades moved from the realm of low politics into the mainstream of the global policy agenda. This development is, for example, reflected in the portfolios of virtually all institutional heavyweights in the international system – from the World Trade Organization and the World Bank to the OECD and the European Union. It is also reflected in increasing mass media attention to international environmental problems, such as climate change.

The international environmental politics literature has grown enormously, with ever more detailed and sophisticated case study work illuminating the causes of environmental problems, the problem solving mechanisms, and the determinants of success or failure in solving these problems.[1] While the (single or comparative, small-N) case study work, which thus far dominates the field, is highly insightful and important we submit that we also need more macro-level, quantitative research that examines the "large picture".

The existing literature shows that international environmental institutions vary in the extent to which they are effective in terms of problem solving.[2] Most observers will agree, however, that international agreements are usually a necessary (though not sufficient, as variation in effectiveness suggests) condition for solving the environmental problems humanity faces. Surprisingly, only very few studies have examined the factors that motivate countries to enter into legally binding commitments at the international level.[3] Most work of this kind concentrates on specific international agreements. Von Stein studies the Framework Convention on Climate Change and the Kyoto Protocol and the challenge of designing mechanisms that "deter defection without deterring participation".[4] She finds that with harder to meet obligations countries become more selective about ratification. Her results also suggest that flexibility mechanisms may to some extent help in addressing this dilemma, and that domes-

[1] For example, see Mitchell 2002.
[2] Haas et al. 1993; Bernauer 1995; Young 1999; Helm and Sprinz 2000; and Mitchell 1994.
[3] For example, see Neumayer 2002a,b; Roberts et al. 2004; and von Stein 2008.
[4] Von Stein 2008, 243.

tic and international networks have fostered ratification of the Framework Convention, but not the Kyoto Protocol.

Neumayer examines ratification behavior with respect to several international environmental treaties, postulating that trade openness promotes multilateral environmental cooperation.[5] He finds some, albeit weak evidence in support of this hypothesis, suggesting that ratification depends on how the respective agreement affects specific interests in exporting countries. In a closely related paper, he studies whether democracies exhibit stronger international environmental commitment than non-democracies.[6] Focusing on treaties for endangered species, biodiversity, and ozone layer protection, he finds evidence that democracies join more multilateral environmental agreements and environmental intergovernmental organizations, and that they perform better with respect to reporting requirements under the Convention on International Trade in Endangered Species of Fauna and Flora. He concludes that "... a spread of democracy around the world will lead to enhanced environmental commitment worldwide".[7] Congleton, and Fredriksson and Gaston examine the Montreal Protocol and the Framework Convention on Climate Change respectively and find that democracies are more likely to ratify these agreements.[8] Similarly, Fredriksson and Ujhelyi observe that democracy and environmental lobby groups have a positive effect on the ratification of international environmental agreements.[9]

Roberts et al. carry out a cross-sectional study of the determinants of ratification rates of 22 international environmental treaties by 177 countries in 1946-1999.[10] They find that most variance in environmental treaty ratifications is explained by "disadvantaged insertion into the world economy" (defined in terms of a narrow export base)[11], voice and accountability through their domestic institutions, and civil society pressure (number of NGOs in the country) – all three variables have a positive effect. The authors conclude that "...the number of NGOs in a nation appears virtually synonymous with its likelihood to participate in environmental treaties".[12]

[5] Neumayer 2002a.
[6] Neumayer 2002b.
[7] Neumayer 2002b, 139.
[8] Congleton 1992; and Fredriksson and Gaston 2000.
[9] Fredriksson and Ujhelyi 2006.
[10] Roberts et al. 2004.
[11] Roberts et al. 2004, 43.
[12] Roberts et al. 2004, 39.

Finally, Zilbauer uses a proportional hazard model to study ratification delays in five environmental agreements as a function of democracy and presence of environmental lobby groups.[13] He finds that "democracy as well as environmental pressure group strength tend to reduce ratification delay in four out of five agreements [...] However, one treaty exhibits reverse effects, indicating that the relationship cannot be generalized on all international environmental problems alike".[14]

These studies of international environmental commitments offer important insights. But their findings remain vulnerable to criticism for several reasons. First, they are based on very small samples of international environmental treaties or individual treaties (the most extensive study, the one by Roberts et al.[15], covers 22 treaties). Second, their empirical design is (with the exception of von Stein and Zilbauer[16]) cross-sectional and does not consider important temporal dynamics (how long it takes a country to ratify an agreement). Third, the driving forces examined are largely domestic, whereas the recent literature on international cooperation[17] has alerted us to the fact that cooperation is likely to be shaped also by linkages of states with their external environment.

In this paper we build and expand on the existing work in three directions. First, we examine the effects of international linkages alongside domestic determinants. Second, we use a much larger sample to test our hypotheses than previous work. Third, we use an empirical design (treaty-country pairs over time) that permits analysis of the spatial and temporal evolution of international environmental cooperation (most existing work is cross-sectional).

We are particularly interested in the effects of integration into international political institutions and the world economy, and of contingent behavior on the probability that a country ratifies an environmental treaty. We derive several hypotheses on such effects and test their empirical relevance using a binary-times-series-cross-sectional (BTSCS) approach with a cubic time polynomial to model temporal dependence as proposed by Carter and Signorino.[18] Our dataset (whose unit of analysis is the treaty-country pair in a given year) covers global environmental treaty ratifications in the time-period 1950-2000 (approximately 180 countries and 340 global environmental agreements over 50 years).

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[13] Zilbauer 2005.
[14] Zilbauer 2005, 5.
[15] Roberts et al. 2004.
[16] Von Stein 2008; and Zilbauer 2005.
[17] Jahn 2008; Ward 2006; and Simmons and Elkins 2004.
[18] Carter and Signorino 2007.

With the exception of integration into the world economy, which affects cooperative behavior negatively, the results show that international factors have a stronger and positive impact on cooperation than domestic factors. Democracy, for instance, has only a weak, though positive effect on global environmental commitment. The main implication for IR theory and public policy is that at least in the short to medium term it might be more efficient to foster global environmental cooperation by "entangling" reticent countries in international institutions and increasing incentives for contingent behavior, rather than promoting cooperation through democratization, socio-economic development, and trade.

It is very likely that the fundamental driving forces of international commitment in the environmental realm, which are examined in this paper, are also at work in other policy areas, such as human rights, trade policy, or arms control. We have chosen to concentrate on environmental commitments in this paper because the empirical design we employ is, in and of itself, very demanding in terms of data collection and analysis. However, we submit that the application of our theoretical and empirical approach to other policy areas is straightforward. We are confident that insights drawn from global environmental cooperation are also relevant to other policy domains and that our research offers a template for carrying out similar studies on other global policy areas.

The following section discusses the theoretical arguments and hypotheses to be tested. Section 3 describes the data and methods used, and presents the results of the empirical analysis.

2. Theory

We are primarily interested in the extent to and forms in which linkages of states with their external environment influence international cooperation, controlling for domestic factors such as income and democracy. The existing empirical literature emphasizes domestic determinants and has, surprisingly, paid much less attention to international factors.[19] Consequently, this section begins by outlining arguments concerning the effects of political and economic integration as well as contingent behavior and ends with a discussion of control variables. While our arguments on the effects of integration into the international system relate to relatively amorphous influences that result from being part of the "international

[19]Exceptions include for example, Jahn 2008; Ward 2006; and Beron et al. 2003.

community", contingent behavior views state behavior as being influenced by the behavior of specific other states in the same issue-area.

2.1 Linkages of States With Their External Environment

Although the term globalization has been prominent in public discourse since the early 1990s, its connotations vary very much across scientific disciplines and individual studies. For instance, while many economists define globalization somewhat narrowly as the international integration of markets in goods, services, and capital, others stress cultural homogeneity[20] and the "harmonization of economic institutions"[21]. IPE scholars in particular devote much attention to institutionalized efforts to increase international cooperation among states in issue areas ranging from economic (e.g., trade) to social (e.g., illicit human trafficking) to security (e.g., terrorism) to environmental (e.g., climate chance) matters. And states often commit to a particular course of action by joining international treaties on a variety of issues that signal some convergence in economic, social, and environmental thinking and practice. That is, the very fact that states are to an increasing extent seeking and implementing international or even global solutions to transboundary problems is an indicator of globalization. Consequently, in this paper we define globalization broadly as involving both political integration into the international system as well as economic openness.

Involvement in international organizations

We assume that, with regard to international political integration, countries that are already "entangled" in a larger network of international cooperation are likely to behave more cooperatively when facing the choice of whether or not to participate in an additional international agreement. As noted by Ward the existing literature has paid only scant attention to such effects, even though "the overall effects of the system of regimes are more relevant. First, regimes are connected because they often share institutional architecture, deal with different aspects of the same problem, frame issues using similar legal and policy principles, and are subject to attempts to coordinate across issues by groups of nations, NGOs and in-

[20] Drezner 1998.
[21] Sachs 1998.

ternational agencies."[22] Ward's analysis focuses on whether countries that are more central to the network of international environmental regimes are better caretakers of their domestic natural environment.[23] Our application of this argument to international environmental commitments builds on standard institutionalist assumptions. To simplify the analysis we focus on membership in international organizations to capture the "entanglement" effect.[24]

Rational choice institutionalism posits that under conditions of interdependence, uncertainty, and high transaction costs, states establish international organizations (IOs) to facilitate cooperation. That is, IOs, by increasing information and decreasing transaction costs and uncertainty, facilitate international negotiations on new agreements or revision of existing ones, and they reduce the risk of opportunism in implementing international commitments.[25] More generally, IOs are assumed to move states away from pursuing relative gains and towards positive-sum outcomes, help them overcome collective action problems, and promote shared interests.[26] In addition, they assist states in solving complex technical problems in more efficient ways.[27][28] Membership in IOs thus signals a government's willingness to cooperate internationally and adopt rules and regulations that benefit other countries as well. Although rational states choose to participate in international environmental agreements only when they estimate that the benefits accrued to them by implementing a particular treaty will be higher than unilateral efforts, failure to ratify a treaty could lead to reciprocal actions by other states that would undermine the collective effort.[29] Moreover, signing an environmental treaty and then failing to ratify it may entail "audience costs" in terms of credibility loss (reputation) at home and abroad; as Simmons notes, credibility has become essential to

[22] Ward 2006, 149.
[23] Another study along the same lines by Ruoff (2008) shows that low- and middle-income countries that are more political integrated (measured by membership in international organizations) are better providers of environmental quality than otherwise expected given their levels of income.
[24] Another option would be to identify the position of countries in the network of global agreements (environmental and other) and use a network centrality indicator instead of IO membership. The network centrality data of Ward (2006) is cross-sectional (for one year) and developing a panel dataset for network centrality of 180 countries over the past 50 years would be a major research project on its own.
[25] Haas et al. 1993; and Mitchell 1994.
[26] Young 1994 and 1999.
[27] Mittrany 1966; and Haas 1964.
[28] Abbott and Snidal (2000) and Simmons (2000) also view international treaties as functional solutions to efficiency problems.
[29] Axelrod 1984.

successful resolution of some of the most important issues states face today, such as environmental degradation.[30]

In other words, the "entanglement" argument relies both on rationalist and on what one might call sociological assumptions. Greater involvement in international organizations fosters cooperative behavior by reducing transactions costs and creating opportunities for diffuse reciprocity. It also has a "socialization" effect in terms of creating norms of appropriateness.

H1: Countries that are more involved in international organizations are more likely to join international environmental agreements.

Integration in the world economy

The impact of trade on the environment has been the subject of an extensive and controversial debate in both political and academic circles. Moreover, it is amenable to relatively coherent theoretical argumentation and empirical testing. This is why, in examining the effects of countries' integration into the world economy, we focus on trade effects.[31]

Trade affects the domestic economy and therefore also environmental behavior, but its impact on the environment is theoretically ambiguous because it is associated with several, potentially offsetting effects. It may change the composition of domestic economic activity, notably by leading to a relocation of more polluting production to other countries. As a result, the domestic economy becomes cleaner because it specializes in such production, whereas imports of goods whose production imposes a greater burden on the environment elsewhere may increase (pollution haven or risk-shifting effect). Increasing trade is also likely to stimulate domestic production, which increases the environmental burden (scale effect). Finally, more trade tends to have a positive effect on (average) national income, which according to the environmental Kuznets curve (EKC) argument (for a description of the EKC see below), has a non-linear effect on pollution: at lower levels of income, pollution tends to increase with growing income and, from some point that may vary across types of environmental degradation, it decreases with growing income.

[30] Simmons 1993.

[31] We are aware that international economic integration is not limited to international trade, and that capital and labor mobility might be as important; but we leave their analysis to future research.

Against the backdrop of such different effects, it comes as no surprise that the existing empirical literature offers contradictory results. Antweiler et al., and Frankel and Rose observe for SO_2 emissions and less so for particulate matter and NO_2 that the net effect of trade is to reduce pollution levels.[32] Cole and Neumayer, and Bin and Harriss show that a substantial part of pollution reduction in rich countries may in fact stem from relocation of "dirty" production to poorer countries.[33] That is, while trade openness may reduce domestic pollution in rich countries, this may not lead to a reduction of pollution at the global level. Bernauer and Kuhn find that bilateral trade increases transboundary water pollution in some instances and has no significant effect in others.[34] Baettig and Bernauer observe that the effects of trade openness on greenhouse gas emissions (trends and levels) as well as political commitments in the Kyoto process are very small.[35]

Neumayer, relying mainly on arguments commonly associated with the "liberal peace" and arguments pertaining to reputation, coercion, and signaling, posits that trade openness promotes participation in multilateral environmental agreements (MEAs).[36] However, his empirical findings provide only weak statistical support for this hypothesis and he partly retracts by stating that "[...] countries' willingness to cooperate in MEAs depends on whether the MEA under consideration is likely to threaten or accommodate the interests of exporters".[37] Prakash and Potoski examine participation rates in ISO 14001, a widely used environmental certification system under which firms can voluntarily subscribe to certain standards of good behavior.[38] They find "that trade linkages encourage ISO 14001 adoption if countries' major export markets have adopted this voluntary regulation".[39] In contrast, Beron et al. find no such effect for ratification of the Montreal Protocol and conclude that "with respect to the Montreal Protocol, most nations acted without regard for the actions of other nations".[40]

Studies such as these offer important insights into whether and how economic integration affects environmental policy. But these insights remain vulnerable to two types of criticism.

[32] Antweiler et al. 2001; and Frankel and Rose 2002.
[33] Cole and Neumayer 2008; and Bin and Harriss 2007.
[34] Bernauer and Kuhn 2008.
[35] Baettig and Bernauer 2008.
[36] Neumayer 2002a.
[37] Neumayer 2002a, 831.
[38] Prakash and Potoski 2006.
[39] Prakash and Potoski 2006, 350.
[40] Beron et al. 2003, 286.

First, virtually all studies focus on one or very few environmental policy areas; thus it remains open whether their findings can be generalized across a wider range of environmental policy issues. Second, the positive effect of trade observed for ISO 14001 is closely connected to the trading-up argument.[41] This argument holds that greener jurisdictions can "export" their preferences and standards to other countries via trade relationships. However, the trading-up effect is likely to materialize only under quite narrowly defined conditions. In a country-to-country context, the principal trading-up mechanism – market access restrictions for polluting goods imposed by the importing country – operates primarily with respect to the environmental properties of products (e.g., cars with or without catalytic converters; that is, product regulation), but to a much lesser extent with respect to production processes.[42] Many international environmental issues, e.g. climate change mitigation or marine oil pollution, concern production processes rather than the properties of internationally traded products. We posit that a closer look at conventional trade theory is necessary, and that this should make us rather skeptical about optimistic (trading-up) views on the effect of trade on international environmental cooperation.

According to standard trade theory (H-O), trade leads to more production of goods that are intensive in the factor that is abundant in the country concerned. Consequently, comparative advantage derives from the distribution of world endowments of the factors of production (the factor endowment theory). If this assumption is correct, *developed* countries, which are more capital abundant, may become 'dirtier' with free trade because capital-intensive production tends to cause more pollution. Therefore, controlling for other influences (e.g., income, democracy) they will be more reluctant to participate in international environmental agreements that hamper their comparative advantage in the production of polluting goods (regulatory chill effect). If, however, the comparative advantage derives from policy related differences across countries in tolerance of pollution (the pollution haven or risk shifting hypothesis), then the *less* developed countries, which tend to be more labor than capital abundant, are likely to be more reluctant to engage in international environmental cooperation. That is, we should then expect poorer countries to engage in more polluting production as a function of growing international trade due to the pollution haven effect; hence they should also be more reluctant to ratify environmental agreements that hurt their comparative advantage which derives from laxer environmental regulation.

[41] Vogel 1997.
[42] Bernauer and Caduff 2004.

Depending on whether the factor endowment or pollution haven effect dominates, richer or poorer countries will, for competitiveness reasons, be more reluctant to join international environmental agreements. While the effects of trade openness on countries' willingness to ratify international environmental agreements may thus vary across types of countries (rich and poor, democratic and non-democratic[43]) we expect negative trade effects on average because both the factor endowments and the pollution haven effect push in this direction. In other words, the more open an economy is, the greater the loss from a reduction in trade. Environmental regulation increases the costs of producing exportables. It thus reduces exports (i.e., it acts like a tax on exports). Consequently, the trade-off between gains from a cleaner environment and losses from lower exports is more adverse for more open economies.

H2: Countries that are more open to international trade are less likely to join international environmental agreements.

Contingent behavior

Decisions by countries on whether or not to ratify international agreements are most probably influenced by what other countries do in the respective policy area. In view of the large game theoretic and institutionalist literature on international cooperation this claim may sound almost trivial. Surprisingly, however, large-N empirical research on international cooperation has – perhaps because it is so obvious – not paid much attention to contingent behavior.

Recent research has started to explore the role of contingent behavior more systematically, primarily under the label of policy diffusion.[44] Simmons, Dobbin and Garett define the latter as follows: "International policy diffusion occurs when government policy decisions in a given country are systematically conditioned by prior policy choices made in other countries (sometimes mediated by the behavior of international organizations or even private actors or organizations)."[45][46] Most studies take several diffusion mechanisms into account. For exam-

[43] We will argue further below that democratic governments may be more susceptible to the regulatory chill effect emanating from trade openness.
[44] For example, see Elkins et al. 2006; Simmons et al. 2006; Meseguer 2005, 2006; Levi-Faur 2005; Elkins and Simmons 2005; Henisz et al. 2005; and Simmons and Elkins 2004.
[45] Simmons, Dobbin and Garett 2006, 6.
[46] Simmons et al. (2006: 9) note that a key challenge for studies on policy diffusion is to show that „(...) domestic political and economic factors cannot alone predict when governments adopt new policies, and to develop and test hypotheses that distinguish among the several possible mechanisms of diffusion. We argue that government decision making in

ple, Elkins et al. find that coercion and competition play a role in the spread of bilateral trade agreements.[47] Simmons and Elkins report that both competition and learning matter for economic liberalization.[48] Henisz et al. observe that coercion, common norms and competition contribute to spread of market-oriented reforms.[49] Meyer et al. find that both developing and developed countries sign human rights treaties to show their commitment to global norms.[50] Beron et al. investigate whether ratification of the Montreal Protocol by a given country is influenced by whether its largest trading partners ratify but they find no such effect.[51] Simmons finds evidence that countries are more likely to make and honor a legal agreement such as the IMF's Article VIII[52] if their neighboring countries are doing so.[53]

Even though all of the above mentioned mechanisms may play a role in motivating states to ratify international environmental treaties, we suspect that most of them are quite highly correlated and also shaped by other factors that we regard as determinants of ratification behavior (e.g., trade openness, democracy, income). We believe that it is reasonable to assume that all of the aforementioned mechanisms are at work more prominently in cases where countries share some common characteristics, such as same level of economic development and location in the same geographic region. In other words, we argue that any given country's ratification behavior is influenced by ratification behavior in its "peer group". Our hypotheses identify this peer group effect in three forms.

H3a: The propensity of a country to join an international environmental agreement increases with the number of other countries that have joined this agreement.

H3b: The propensity of a country to join an international environmental agreement increases with the share of other countries in the same geographic region that have joined this agreement.

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these critical areas has in fact been highly interdependent and that the mechanisms of diffusion can be teased out in empirical analyses."

[47] Elkins et al. 2006.
[48] Simmons and Elkins 2004.
[49] Henisz et al. 2004.
[50] Meyer et al. 1997.
[51] Beron et al. 2003.
[52] Article VIII prohibits restrictions on a country's current account (Simmons, 2000: 820).
[53] Simmons 2000.

H3c: The propensity of a country to join an international environmental agreement increases with the share of other countries in the same income bracket that have joined this agreement.

2.2 Domestic Factors

Most of the recent literature on international cooperation and international environmental politics in particular views both income and democracy as factors that promote cooperation. Hence we conceptualize these two variables as the two domestic factors in reference to which we assess the effects of international linkages and relegate other variables to the status of control variables.

Income

The existing environmental politics and economics literature concentrates on the effect of income on environmental quality (pollution) rather than treaty ratification behavior. Translation of its arguments on the income-pollution relationship to ratification behavior is straightforward, however, because we can assume that countries that are more willing to improve their environmental quality are also more willing to join international treaties in this realm.

The large body of theoretical and empirical literature that focuses on economic determinants of environmental quality has led to the identification of an important empirical pattern, the so-called environmental Kuznets curve.[54] Many (but not all) forms of environmental degradation first become worse and then improve as income per capita increases. The turning points of the curve vary considerably across pollutants and countries. The standard interpretation of this pattern is that environmental quality is a luxury good in the initial stages of socio-economic development. Poor countries facing a trade-off between protecting the environment and improving material living standards opt for the latter. Once significant gains have been made in living standards, the opportunity cost of stricter environmental policies becomes (relatively) smaller and constituencies are prepared to accept lower economic or personal income growth (the two may not be identical) in order to obtain less pollution. That is, environmental quality becomes a 'normal' good. Assuming that this pattern applies not

[54] Selden and Song 1994; and Grossman and Krueger 1995.

only to local, but also to transboundary environmental goods, and that international treaties are a necessary (though not sufficient) condition for achieving improvements in environmental quality, we expect that a country's willingness to ratify an international environmental treaty is positively correlated with income. The empirical analysis will examine both linear and non-linear income effects.

Democracy

Fearon, Gaubatz, Leeds, Martin, Mansfied et al, and other authors have argued that democratic countries are more likely to make credible international policy commitments than their non-democratic counterparts.[55] The reasons are that democratic institutions are stronger but (compared to non-democracies) less flexible, democratic decision-makers are more accountable vis-à-vis their electorate, audience costs in democracies are higher, and so is transparency. This implies that democratic dyads are more likely to be able to solve transboundary problems through mutual international commitments.[56] We cannot directly deduce from this argument, however, that (in a monadic sense) democratic countries are more likely to join international agreements. We submit, nonetheless, that democracy is likely to have a positive effect on participation in international environmental agreements, but the reasons are somewhat different from the aforementioned ones. Arguments relating democracy and international environmental commitment can be grouped into demand and supply side arguments.

As to the demand side, democratic political systems offer a much higher degree of civil liberties, such as freedom of speech, press and association.[57] Such liberties imply that citizens are better informed by independent mass media and other sources (e.g., NGOs) about environmental problems and government policies. They also have more opportunities to express freely their opinions and organize around alternative political views, and thus they can impose higher audience costs on policy-makers who renege on promises.[58] Consequently, at any given level of (objective) environmental risk exposure and/or income, public demand by the median voter and/or politically influential interest groups for risk mitigation is thus likely to be stronger in democracies than in non-democracies. That is, our expectation is that the

[55] Fearon 1994; Gaubatz 1996; Leeds 1999; Martin 2000; and Mansfied et al 2002.
[56] Kalbhenn (2007), for example, shows that democratic pairs of countries tend to cooperate more in transboundary river management issues compared to non-democratic or mixed dyads.
[57] Payne 1995.
[58] Slantchev 2006.

higher the level of civil liberties, the higher the probability that a country ratifies an environmental treaty.

As to the supply side, many authors have argued that non-democratic political systems are likely to under-provide public goods, including environmental quality.[59] They are typically governed by small elites that use the resources of their country to generate personal wealth and funnel income from the population into their own pockets. If the costs of stricter environmental policies mandated by an international environmental treaty fall disproportionately on the governing elites in the sense of opportunity costs from spending tax revenue on environmental protection instead of accumulating rents while the benefits are uniformly dispersed throughout the population (e.g., cleaner air), then these elites would have little incentive to ratify this treaty. Conversely, the median voter in a democracy incurs lower opportunity costs from environmental policies relative to the economic and political elite in non-democracies.

Congelton argues, however, that a short time horizon of policy makers can lead to less stringent environmental regulation.[60] Many forms of environmental degradation in fact develop slowly and over long periods of time (e.g. climate change, biodiversity loss, air and water pollution). Hence their mitigation requires a long time horizon. Assuming that authoritarian rulers tend to have a shorter time horizon[61], we can conclude that democracies enact stricter environmental regulation than non-democracies. But quite the reverse, one might also argue that elected governments have shorter planning horizons than non-elected governments because of political myopia (maximizing votes at the next election). Since the social costs of current economic behavior and political choices often materialize only over the long term and burden future generations and future politicians, democratic leaders may refrain from ratifying international environmental treaties that impose high short-term costs. Their autocratic counterparts, in contrast, do not face democratic elections and can take more costly decisions (stricter environmental policies) with longer term benefits without fear of been punished by myopic voters. Consequently, democracies might be less willing to ratify international environmental treaties. Overall, public demand for environmental risk mitigation is

[59] For example, see Congleton 1992; Olson 1993; McGuire and Olson 1996; Niskanen 1997; Lake and Baum 2001; and Bueno de Mesquita et al 2003.
[60] Congelton 1992.
[61] Bueno de Mesquita et al (2003) empirically show that once autocratic leaders succeed in surviving in office during the initial years of seizing power then they survive in office longer than their democratic counterparts (chapter 7).

likely to be stronger in democracies than in non-democracies (demand side). Whether democratic political elites are more inclined to satisfy such demand than non-democratic elites remains an empirical question. The existing literature has, thus far, found mainly positive effects.[62] Even though these studies concentrate on one or very few international environmental agreements, we follow those findings and expect (albeit with caution) that more democratic countries are more likely to ratify international environmental agreements.

2.3 Control Variables

Power

We expect that power, defined in terms of a country's economic size and/or population, has a significant although theoretically ambiguous effect on ratification behavior. Neumayer, for instance, argues that powerful states are more likely to participate in multilateral environmental agreements "...in order to demonstrate their importance in world politics, of which the environment represents one part. In other words, important countries want to be seen as good citizens and leaders in world environmental affairs."[63] This is only one possibility, and even in this case we suspect that participation is likely to be motivated primarily by countries' concerns for their own safety and well-being, rather than the desire to be seen as good world citizens by someone else. The other, not so glamorous possibility is that more powerful states may have greater incentives to free-ride because they are likely to get away with such behavior at lower cost. In other words, the effect of power is theoretically ambiguous, but potentially important. We control for this effect without a prior assumption concerning its direction.

Domestic environmental quality

Countries' willingness to participate in international environmental agreements may reflect the degree to which environmental degradation impinges upon their national welfare. Sprinz and Vaahtoranta, for example, argue that "the worse the state of the environment, the greater

[62] For example, see Neumayer 2002b; von Stein 2008; Bättig and Bernauer 2008; and Zilbauer 2005.
[63] Neumayer 2002b, 150.

the incentives to reduce the ecological vulnerability of the state."[64] If we subscribe to this argument, we should expect that countries with bigger domestic pollution problems are more likely to join international environmental agreements because there is greater public demand for more stringent environmental policies, and/or because the government seeks to tie its hands through international commitments in order to be able to impose stricter policies on opposing domestic interests. However, more polluted countries also face higher abatement costs; hence we may also expect that states whose environmental quality is improving or has improved as the result of strict domestic environmental regulation are likely to face lower domestic political and economic hurdles in ratifying international environmental commitments. Consequently, we expect domestic environmental quality to have an ambiguous effect on ratification behavior.

Geographic region

Whereas hypothesis H3b focuses on the effect of regional ratification behavior in terms of contingent behavior, we also include regional dummy variables to capture any effects that the geographical location of a country might have on its propensity to ratify an agreement. For the empirical analysis, we select from the very large number of international environmental agreements only those that are, in principle, open to all countries on Earth. However, some agreements may, because of the very nature of the issue they deal with, attract more countries from some regions than from others. African countries might be less eager to join agreements to protect arctic seals and polar bears, whereas many Western European countries may be less interested in efforts to cope with desertification.

3. Empirical Analysis

We test the above hypotheses on a new panel dataset covering 180 countries' attitudes (ratification[65]: yes/no) towards international environmental treaties from 1950 to 2000. The unit of analysis is the treaty-country pair per year. Each treaty enters the dataset at the moment

[64] Sprinz and Vaahtoranta 1994, 79.

[65] In this paper, we use the term „ratification" to indicate any form of binding commitment (as opposed to signature). Depending on the specific legal context, this commitment can also be expressed by adhesion, accession, etc.

when it becomes open for ratification and each treaty-country pair stays in the dataset until the year when the respective country ratifies the treaty. For each year we estimate the probability of a particular country ratifying a treaty, as described in section 3.2. This approach allows us to include both country and treaty specific characteristics.[66] We proceed by first defining the variables used in the analysis and then discussing the statistical method. The empirical part concludes with the discussion of the results.

3.1 Variables

Dependent variable

The dependent variable is defined in terms of the ratification of a multilateral environmental treaty. We coded ratification in binary form. For each year in which a treaty is not ratified by a particular country the respective treaty-country pair is coded as zero (0). The dependent variable takes the value one (1) in the year the country ratifies the treaty, whereupon this particular treaty-country pair leaves the dataset. The latter approach is necessary because leaving the treaty-country pair with code 1 in the dataset after ratification would indicate that the respective country ratified the treaty again in each subsequent year until 2000. The data on ratifications was retrieved from the environmental treaties dataset by CIESIN and Mitchell[67], and was re-coded to fit the particular format used for this analysis. Our dataset includes only those multilateral treaties that are, in principle, open to any country on Earth. Whether particular treaties are not only in principle but also de facto open to any country is not entirely clear in some cases. We will thus assess the robustness of our statistical findings with alternative sample compositions. Even though we have treaty ratification data up to 2005 we end the analysis in 2000 because there are too many missing values for some independent variables in the years after 2000.

Independent variables[68]

Involvement in international organizations: IGO membership

[66] In this paper, the term treaty specific characteristics relates to any condition that varies across treaties, but not across countries.
[67] CIESIN 2006; and Mitchell 2002-2008.
[68] The correlation coefficients are shown in Appendix I.

Membership in international governmental organizations (IGO) is measured by the number of IGOs of which a country is a member in any given year. The data is taken from the Correlates of War project.[69] This project's IGO dataset offers three distinct variables differentiated according to whether a state has full, associated or observer membership. In our principal models we use the most inclusive (or least "stringent") variable, the one that includes full, associated and observer membership. We check the robustness of the results by using both the most narrowly defined variable, which includes only full membership, and the variable that includes full membership and observer status.

Integration in the world economy: trade openness

We measure a country's trade openness by the ratio of the sum of exports and imports to GDP.[70]

Contingent behavior

To test contingent behavior effects we have created several variables. Concerning hypothesis H3a, a variable measuring the total number of states in the international system that have already ratified the particular treaty is included. Similarly, two variables measuring the percentage of countries from the same geographical group (region) and the percentage of countries from the same income group that have already ratified the treaty are incorporated in the model (hypotheses H3b and H3c). Geographic regions are defined according to the IIASA world population program[71]. Following World Bank standards, we categorize countries into three income groups: low-income countries with a GDP per capita below 3,273 USD, middle-income countries with a GDP between 3,273 and 11,115 USD per capita, and high-income countries with a GDP per capita above the latter amount. We use a one-year lagged value of all contingency variables. We also include dummy variables for (from an economic and/or population viewpoint) the most powerful countries in the system.

Income: log of GDP per capita

[69] Pevehouse et al. 2004.
[70] Gleditsch, 2002; and Heston et al. 2006.
[71] http://www.iiasa.ac.at/Research/POP/proj01/countries.html
The regions are: Centrally Planned Asia, Central Asia, North Africa, Middle East, Sub Saharan Africa, Latin America, Western Europe, Eastern Europe, North America, Pacific OECD, South Asia, Former Soviet Union, Pacific Asia.

A country's wealth is measured by the log of GDP per capita.[72] As discussed in the theory section, income may also have a non-linear effect on the likelihood of joining international environmental treaties. We thus include also the squared value of the log of GDP per capita.

Democracy (demand side): civil liberties

We use the civil liberties component of the Freedom House Index to test whether more civil liberties increase the likelihood of ratifying global environmental treaties. The Freedom House organization rates all countries of the world on dimensions of political and civil rights. The civil liberties part of the index measures constraints, among other things, on: association and organizational rights (freedom of assembly, demonstration, political or quasi-political organizations including ad hoc issue groups, and free trade unions and farmers organizations); the rule of law and human rights (existence of an independent judiciary, and freedom from extreme government indifference and corruption); and personal autonomy and economic rights (secured property rights, personal social freedoms, and equality of opportunity including freedom from exploitation by or dependency on employers, union leaders or bureaucrats). Freedom House rates countries on a 1 to 7 scale. In countries with a rating of 1, law is unshaken and there is freedom of expression, assembly, and association. Increasing numbers indicate that laws and traditions impinge increasingly on such freedoms until, in states ranked as 7, citizens have no rights vis-à-vis the state and "…an overwhelming and justified fear of repression characterizes these societies".[73] Instead of working with the original variable, we transform it so that a higher value of the new variable means a higher level of civil liberties (7 now represents the highest level of civil liberties).[74]

Democracy (supply side): institutional features of democracy

Institutional features of democracy are measured with an index capturing the extent of democratic participation in government. We use a composite index from the POLITY IV data set that includes the following elements: presence of competitive political participation, guarantees of openness and competitiveness of executive recruitment, and existence of institutionalized constraints on the exercise of executive power. This index, *Polity*, ranges from –

[72] Gleditsch 2002.
[73] Freedom House 2008.
[74] This is an innocuous change that does not affect the results. It is made for reasons of consistency with the other variables (where higher means more) and in order to eliminate a possible source of confusion in interpreting the statistical results.

10 (most autocratic) to 10 (most democratic).[75] We check the robustness of our results by using Vanhanen's democracy index[76] as well as Freedom House's Political Rights Index[77][78].

Control variables

Power: log of population, log of GDP

To control for the effect of power we use two variables: the log value of the population of a country, for which the data is taken from the Correlates of War data set of national military capabilities[79]; and the log value of GDP, that is the economic size of a country[80]. Since both variables are highly correlated we include only one of them in any model and use the other for a robustness check.

Domestic environmental quality: log of SO_2 emissions per capita

Because there exists no composite index of domestic environmental quality for many countries and years we rely on the log of SO_2 emissions per capita as a proxy.[81] We use this admittedly crude proxy because SO_2 emissions are, arguably, the most common form of air pollution and a very common target of environmental policy in most countries.

Region

We include dummy variables for world regions to control for specific features of environmental treaties that may attract countries from one region more than others. The regions are Eastern Asia, Western Asia, Africa, Latin America, Europe, and North America.[82]

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[75] See Marshall and Jaggers 2002.
[76] Vanhanen 2000.
[77] The political rights element of the Freedom House Index, which is very close to the Polity IV measure of democracy, captures mainly the fairness and freedom of elections, that is, whether a government came to power by election or by non-democratic means; whether elections, if any, are free and fair; and whether an opposition exists and has the opportunity to take power with the consent of the electorate.
[78] Freedom House 2006.
[79] Singer et al. 1972, version 3.02.
[80] Gleditsch 2002.
[81] Stern 2005.
[82] We have used a more differentiated definition of regions to assess contingency effects (see above). The regional dummies are defined in broader terms because their main goal is to control for any remaining effects on treaty ratification that may emanate from a less clearly defined set of geographic or ecological factors.

3.2 Statistical Method

The unit of analysis is the country-treaty pair per year. That is, for each year in which a given treaty is open for ratification, it is paired with all potential member countries, so that each observation is formed by a particular treaty, the country that may or may not have ratified the treaty, and the year this action did or did not take place. A treaty-country pair leaves the dataset in the year after the country has ratified the treaty, i.e. after the dependent variable has changed from zero to one.

We are dealing with a binary outcome variable (ratification; yes/no), and various panel logit models thus appear appropriate. However, because several of our key independent variables do not vary across treaties (e.g., the number of countries that have ratified the treaty), we cannot use panel logit models with treaty specific fixed effects. Similarly, we refrain from using country fixed effects.[83] Instead we rely on the approach proposed by Carter and Signorino[84], which is similar to the binary-time-series-cross-sectional (BTSCS) approach described in Beck et al.[85]. This approach views BTSCS data as grouped duration data in which the interval of observing the data is fixed to one year. To model temporal dependence, time as well as its squared and cubic term (t, t^2 and t^3) are included in the models. The use of t, t^2 and t^3 (cubic time polynomial) instead of cubic splines (which is recommended by Beck et al.[86]) has the advantage of a more straightforward interpretation of the baseline hazard, whereas the approximation of the baseline hazard is at least as good as with cubic splines.[87] To assess the robustness of our results we also use different statistical techniques, as described in the section on robustness checks below.

The timeframe of our analysis ranges from 1950 to 2000. Although we have treaty ratification data for the time-period before 1950 and after 2000 this is not the case for most independent variables. In some models that include variables such as the civil liberties index of Freedom House the time-period is reduced further.

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[83] The problem of time invariant or very slowly changing variables is of special importance in our case since each country enters our dataset not only each year but several times each year combined with all treaties that are open for ratification at this point in time.
[84] Carter and Signorino 2007.
[85] Beck et al. 1998.
[86] Beck et al. 1998.
[87] Carter and Signorino, 2007.

3.3 Results

Table 1 reports the results from the regression of treaty ratification on the explanatory variables described above.

Insert Table 1 about here

The first column in Table 1 shows the results of our principal explanatory model.[88] The evidence supports hypotheses H1 and H2: IGO membership has a positive, and trade has a statistically significant negative effect on ratification behavior. As to the hypothesized contingent behavior effects, our results show that the number of countries that previously ratified a given treaty significantly increases the likelihood that the country of concern will also ratify that treaty (hypothesis H3a). The same holds for the share of countries in a given country's region that previously ratified the treaty (hypothesis H3b). In contrast, the share of countries in a given country's income group that previously ratified the treaty has no statistically significant effect (hypothesis H3c). The latter result suggests that geographically defined contingency effects are stronger than income-related contingency effects. The last column in Table 1 shows the results of a model that includes dummy variables indicating whether important countries have already ratified a given treaty. It indicates that prior ratification by countries such as China, Germany, and the UK has a positive effect. The effect is most pronounced for the UK, and least important and insignificant for France and the USA.[89]

Most of the control variables influence treaty ratification in the expected way. Democracy has a positive effect. Power has a negative effect: the more powerful a nation is – measured in terms of GDP – the less likely it is to ratify a treaty. The effect of income is positive. Although the squared term of the log value of GDP per capita does not have a statistically significant effect, results from a likelihood ratio test suggest that we should leave both variables

[88] All models were estimated using robust standard errors clustered by countries to control for the fact that observations for the same country may be more similar than observations across different countries.

[89] We also tested the effect of ratification by important countries with a dummy variable indicating whether the particular country is a major power (based on the Correlates of War data). This variable has no significant effects in our models – see Table 5, column 3.

in the model.[90] To visualize the effect of income, Figure 1 shows the effect of the log of GDP per capita on the likelihood of treaty ratification while all other variables are kept at their mean levels. It indicates that countries with a higher GDP per capita are more likely to ratify international environmental treaties, but it also shows that the overall effect of GDP per capita is rather small.

Insert Figure 1 about here

In contrast to our expectation the influence of the domestic environmental quality variable, proxied by SO_2 emissions per capita, is negative. The higher the SO_2 emissions per capita – the coefficient is statistically significant and positive – the more likely a country is to ratify global environmental agreements. This result should not be over-interpreted because the proxy we used is a very crude one. However, there are two potential interpretations that could be examined in more detail in future research. One is that governments of "dirtier" countries use global environmental agreements to tie their hands vis-à-vis reluctant domestic constituencies. The other is that governments of such countries use global environmental agreements to purchase international good will and improve their reputation.

In column 2 of Table 1 the principal model is extended to include regional dummy variables. Compared to the base category, which is Europe, countries located in any of the other regions are less likely to ratify global environmental treaties. In column 3 and 4 of Table 1 we evaluate the effect of democracy in more detail. If we use the civil and political rights variables from Freedom House (see column 3), we obtain a different picture from the one shown in column 1 in which we used the Polity IV index to measure democracy. We observe that more civil liberties increase the probability of joining a global treaty. But in contrast to our expectations and in contrast to the results in column 1, more political rights decrease a country's propensity to ratify. If both civil and political rights are combined the positive effect prevails – see column 4 in Table 1.[91]

[90] The likelihood ratio test statistics are: LR chi2(1) = 13.11; Prob > chi2 = 0.0003.
If we leave out the squared term, the effect of the log of GDP per capita remains statistically significant.

[91] Political rights and civil liberties are highly correlated. This does not cast doubt on our findings, because multicollinearity does not bias the results but is likely to increase standard errors and decrease significance.

The statistical approach used also allows us to obtain an estimate of time dependence[92] underlying treaty ratification behavior in our sample. Figures 2 and 3 indicate the likelihood of treaty ratification as a function of t, t^2 and t^3, while all other variables are kept at their mean levels or are set to zero. The results show that the baseline hazard is strongly decreasing with time. That is, the probability of ratification by any given country is higher shortly after a treaty is opened for ratification; this probability then decreases over time.

Insert Figures 2 and 3 about here

To obtain a better intuition of the estimated relationships between our main independent variables and the propensity of treaty ratification we simulated predicted probabilities.[93] The results are shown in Table 2. They are based on the principal model shown in Table 1, column 1.

Insert Table 2 about here

The first column of Table 2 shows changes in probabilities of treaty ratification if the explanatory variable concerned changes its value from the mean to the maximum. Columns 2 and 3 indicate changes in the propensity of treaty ratification for changes of the explanatory variable from the minimum to the mean and from the minimum to the maximum. Interestingly, the effects of the contingent behavior variables, except for the ratification share in the same income group, are much stronger than the effects of democracy and income. For example, a change from full autocracy (Polity IV value of -10) to full democracy (Polity IV value of 10) increases the probability of ratification by 0.2%. In contrast, if the share of ratifiers in a country's region changes from the mean to the maximum, this increases the probability of ratification by 7.6%. Similarly, a change from the mean number of IGO member-

[92] Using a likelihood ratio test we examined whether there is time dependence in our model. The test clearly rejected the model without t, t^2, t^3 (LR chi2(3) = 7977.55; Prob > chi2 = 0.00).

[93] The simulation results were obtained using CLARIFY (Tomz et al. 2003; and King et al. 2003).

ships, which is 50, to the maximum number of 134 produces an increase in the ratification probability of 0.6%.

For purposes of illustration, we calculated predicted probabilities for specific country characteristics, using the USA, China, Switzerland, Morocco, and Costa Rica as examples. All country specific variables such as trade openness or democracy were set to the value the particular variable took in the year 2000 for the respective country. All treaty specific variables such as the number of countries that had already ratified the treaty were set to their mean values. Table 3 shows the predicted probabilities as well as the values for which they were calculated. For example, the probability that the USA would ratify a given treaty turns out to be 1.4%, whereas for Switzerland this probability is 0.7%, and for China, Morocco, and Costa Rica it is between 0.4% and 0.5%.

Insert Table 3 about here

In absolute terms, the probabilities shown in Tables 2 and 3 appear to be very small. But it needs to be borne in mind that treaty ratifications are rare events (only 0.64% of all observations are coded as 1), so that probabilities of treaty ratification estimated by any statistical model are automatically very small. In other words, the effects of IGO membership and the contingent behavior variables, which are proxies for linkages of countries with their external environment, are in fact very substantial.

We have checked the robustness of our results in various ways. For a start, we have examined whether particular specifications of the main explanatory variables affect the results. Various measures for IGO membership, democracy, and power are used to that end. The effect of IGO membership is independent of whether we define the IGO variable as full, associated, or observer membership. For the results shown above the most comprehensive IGO membership definition was used. The results for the more narrow definitions of the IGO variable are shown in Table 4, columns 2 and 3. Similarly, the results do not change if we use Vanhanen's democracy index instead of the Polity IV index (see Table 4, column 1) and population instead of GDP (see column 4 in Table 4).

Insert Table 4 about here

To assess whether our results are sensitive to the estimation method, we also estimated the models using cubic splines as proposed by Beck et al. to control for temporal dependence.[94] The results, which are shown in Table 5, column 1, are very similar to those obtained when using t, t^2 and t^3. The only difference to the latter specification is that ratification behavior of the income-related peer group turns out to be positive and significant when using cubic splines.

The particular structure of our dataset implies that the events of interest, namely ratifications of global environmental agreements, are rare events. As noted above, only 0.64% of the observations in our dataset are coded as 1. To assess whether this influences our results we also used the rare events logit estimator proposed by Tomz et al..[95] Since the results did not change when controlling for rare events – see Table 5, column 2 – we decided to use the standard logit approach for the principal model.

Insert Table 5 about here

We have also evaluated whether the inclusion of further control variables changes the results. In column 4 of Table 5 we include a dummy variable that indicates the period after the 1972 UN Conference on the Human Environment that took place in Stockholm. This conference is a widely acknowledged milestone in the field of global environmental cooperation, whereupon the importance of environmental issues at the international level should have increased. However, in contrast to our expectations, the likelihood of treaty ratification is smaller in the post-Stockholm period. The same holds true when we include a dummy variable characterizing the period after the UN Conference on Environment and Development in Rio de Janeiro in 1992, another milestone in global environmental cooperation (column 4 of Table 5). When both dummies are included in the statistical model, as shown in column 5 of Table 5, both effects are negative and statistically significant.

Our principal dataset includes all multilateral environmental treaties that were identified as such by CIESIN and Mitchell.[96] Hence our definition of what is to be considered a multilat-

[94] Beck et al. 1998.
[95] Tomz et al. 1999; see also King and Zeng 1999a,b.
[96] CIESIN 2006; and Mitchell 2002-2008.

eral environmental treaty follows from the coding decisions of these two sources. We then decided to exclude treaties that, although having an environmental component, were designed for entirely different purposes. One example is the "Constitution of the UN Educational Scientific and Cultural Organization". That is, the dataset on which the principal models are based includes the merged (and restructured) data from the two sources mentioned, but was purged from agreements of marginal environmental relevance before we ran the regressions. The dataset for the principal models thus includes 338 of the around 450 multilateral environmental agreements in the original dataset.

All of the 338 agreements are de jure open to all countries on Earth. But de facto there are still some agreements in our dataset that appear more relevant to particular regions or countries. We have sought to control for such effects by using region dummies that capture geographic or climatic characteristics that may make a treaty particularly relevant for the countries in the given region. Because the sample boundaries are obviously not very firm, we have carried out two additional robustness checks that focus on sample composition. First, we have implemented the models for a sub-sample that includes only those treaties that have no obvious regional focus. This sub-sample contains 203 instead of 338 treaties and excludes treaties such as for example the "Cooperation Agreement for the Protection of the Coasts and Waters of the North-East Atlantic against Pollution". Table 6, column 1 shows that the results do not differ much from those obtained for the principal models. The most relevant difference is that the effect of GDP per capita is now insignificant in the sub-sample. Second, we reduced the original sample to the 22 treaties that Roberts et al.[97] included in their analysis. Except for trade openness and two of the control variables – stringency of domestic environmental quality and GDP per capita – which become insignificant, all of our main results survive – see column 2 in Table 6.

Insert Table 6 about here

Since all treaty-country pairs in which the given country has not yet ratified the treaty by the year 2000 (the year our dataset ends) are included in the dataset, our data is right-censored. Although Beck et al. note that right-censored data "[…] are not a problem for grouped dura-

[97] Roberts et al. 2004.

tion logit analysis"[98] we implemented our principal models for a subsample that excludes all treaties that entered the original dataset after 1994. The idea is that all countries in the subsample have had at least six years to ratify a particular treaty; this should reduce the potential problem of right-censoring very much. The results, which are shown in column 3 of Table 6, are almost identical to the results presented for the principal models.

We revisited the results for the trade variable to examine whether they might be disproportionately influenced by those countries that trade heavily or only very little. Column 4 of Table 6 reports results for a sub-sample that excludes those 5% of the countries in our full sample that trade the least, whereas the results reported in column 5 (Table 6) are based on a sub-sample that excludes those 5% that trade the most. The results from our principal models survive very well.

Finally, to illustrate the time dynamics of treaty ratification we have graphed the (cumulated) number of ratifications over time for 11 of the 22 treaties analyzed by Roberts et al..[99] These graphs can be found in Appendix II.

4. Conclusion

In this paper we have examined the extent to which linkages of countries with their external environment affect international cooperation, relative to domestic level determinants. We conceptualized such linkages in terms of a country's involvement in international institutions, its integration into the world economy, and contingent behavior. The empirical focus is on global environmental cooperation. We hypothesized that involvement in international institutions and contingency variables have a positive effect on global environmental cooperation, and that economic integration into the world economy has a negative effect. The empirical testing was done on a sample of 180 countries and approximately 340 multilateral environmental treaties over 50 years (1950-2000). The most important empirical finding is that, overall, international factors have a stronger effect on cooperative behavior (in the form of treaty ratification) than domestic factors, such as income and democracy.

The main implication of our findings for research on international cooperation and institutions is that linkages of states with their external environment should receive greater atten-

[98] Beck et al. 1998, 1772.
[99] Roberts et al. 2004.

tion, both at the theoretical and empirical level. Explanatory models of cooperative behavior of states in the international realm have become increasingly sophisticated in specifying the domestic drivers of such behavior. But they have paid rather little attention to the fact that international cooperation is a complex process in which any given country's behavior is also shaped by the extent to which it is embedded in the international system, and by how specific other countries behave. Our results demonstrate that explanatory models of international cooperation that ignore international linkages may be misspecified. This conclusion, in general terms, is very much in line with conclusions that have recently emerged from the literature on policy-diffusion and international networks.[100]

The empirical results reported in this paper are based on the analysis of global environmental cooperation. We are quite confident, however, that the analysis of international cooperative behavior (as indicated by treaty ratifications) in other policy areas is likely to produce similar findings. Our empirical approach may serve as a useful template for such research. Further research could also move beyond the rather simple IGO membership variable and focus on more sophisticated indicators for the position of countries in international political/institutional networks. And it could include more detailed control variables pertaining to treaty characteristics.

The main policy implication is that the existing literature may be too optimistic about the cooperation-promoting effects of wealth, democracy, and globalization. Countries' decisions on whether or not to participate in international cooperative efforts may be influenced in larger measure by their general involvement in international institutions, and by what other countries do in the same policy area. This conclusion is in fact quite encouraging. It implies that cooperative solutions to international problems requiring the cooperation of less democratic and poorer countries is possible without major changes in democracy or income in these countries. In the short to medium term at least it might be more efficient to foster international cooperation by "entangling" reticent countries in international institutions and increasing incentives for contingent behavior, rather than promoting cooperation through democratization, socio-economic development, and trade.

[100] For example, Dorussen and Ward 2008; Braun and Gilardi 2006; and Ward 2006.

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Table 1: Principal Models

	(1)	(2)	(3)	(4)	(5)
IGO membership	0.01*** (0.00)	0.01** (0.00)	0.01 (0.00)	0.01 (0.00)	0.01*** (0.00)
Trade openness	-0.14** (0.05)	-0.13** (0.05)	-0.09 (0.06)	-0.10 (0.06)	-0.16*** (0.05)
# of other countries that ratified	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.01*** (0.00)
% of same income group that ratified	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.01* (0.00)
% of countries in region that ratified	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
Democracy (Polity)	0.02*** (0.01)	0.01* (0.01)			0.01* (0.01)
Political rights			-0.09** (0.03)		
Civil liberties			0.19*** (0.04)		
Mean of civil lib. + political rights				0.08*** (0.02)	
GDP p.c.	1.05* (0.58)	0.82 (0.63)	0.96* (0.54)	0.75 (0.57)	0.38 (0.63)
GDP p.c. ^2	-0.04 (0.04)	-0.03 (0.04)	-0.05 (0.03)	-0.03 (0.03)	-0.00 (0.04)
SO_2 p.c.	0.13*** (0.03)	0.10*** (0.03)	0.12*** (0.04)	0.10*** (0.03)	0.11*** (0.04)
GDP	-0.11* (0.06)	-0.07 (0.07)	0.02 (0.07)	-0.00 (0.07)	-0.06 (0.07)
Africa		-0.53*** (0.15)	-0.48*** (0.14)	-0.47*** (0.14)	-0.50*** (0.14)
North America		-0.56*** (0.15)	-0.77*** (0.21)	-0.70*** (0.21)	-0.64*** (0.17)
Latin America		-0.55*** (0.13)	-0.50*** (0.12)	-0.49*** (0.12)	-0.53*** (0.13)
East Asia		-0.51*** (0.14)	-0.57*** (0.14)	-0.54*** (0.15)	-0.49*** (0.14)
West Asia		-0.80*** (0.15)	-0.70*** (0.15)	-0.73*** (0.15)	-0.79*** (0.15)
UK					0.48*** (0.13)
USA					0.14 (0.09)
Germany					0.42*** (0.14)
Spain					0.22* (0.13)
France					0.22 (0.15)
Russia					0.35*** (0.04)
Brazil					0.33*** (0.10)
China					0.34*** (0.10)

India					0.31*** (0.07)
t	-0.31*** (0.02)	-0.32*** (0.02)	-0.30*** (0.02)	-0.30*** (0.02)	-0.42*** (0.02)
t^2	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
t^3	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
Constant	-10.25*** (2.61)	-9.27*** (3.06)	-11.17*** (2.52)	-9.96*** (2.71)	-8.75*** (3.05)
Observations	747061	747061	745118	745118	747061
BTSCS logit regressions with robust standard errors in parentheses, clustered by country; *** p<0.01, ** p<0.05, * p<0.1					

Table 2: Simulated Probabilities, Principal Model

Simulated Probability Pr(ratification=1)	Mean to Max	Min to Mean	Min to Max
IGO membership	0.006 (0.003)	0.002 (0.000)	0.008 (0.003)
Trade openness	-0.001 (0.000)	-0.005 (0.003)	-0.006 (0.003)
# of other countries that ratified	0.138 (0.052)	0.001 (0.000)	0.139 (0.053)
% of same income group that ratified	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.001)
% of countries in region that ratified	0.076 (0.016)	0.001 (0.000)	0.077 (0.016)
Democracy (Polity)	0.001 (0.000)	0.001 (0.000)	0.002 (0.001)
Robust standard errors in parentheses; all other variables are kept at their mean values			

Table 3: Simulated Probabilities, country examples

Country	Simulated probability Pr(ratification=1)	Democracy	Ln(trade openness)	IGO mem-bership	GDP p.c.	SO2 p.c.	GDP (in hundred thousands)
USA	0.014 (0.002)	10	-15.34	93	33 292.92	7 420.49	9 169 648
Switzerland	0.007 (0.001)	10	-13.96	93	26 413.75	9.00	189 755
Morocco	0.005 (0.000)	-6	-15.52	84	3 716.70	140.82	106 350
China	0.005 (0.001)	-7	-15.77	74	3 747.30	9 975.51	4 706 662
Costa Rica	0.004 (0.001)	10	-14.34	76	5 861.85	1.79	22 348
Robust standard errors in parentheses; all other variables are kept at their mean values							

Table 4: Principal model, using alternative and additional indicators

	(1) Democracy (Vanhanen)	(2) Full IGO membership	(3) Full and associate IGO membership	(4) Population
IGO membership (full, assoc., obs.)	0.01 (0.00)			0.01** (0.00)
IGO membership (full)		0.01** (0.00)		
IGO membership (full and associate)			0.01** (0.00)	
Trade openness	-0.12** (0.05)	-0.13*** (0.05)	-0.14*** (0.05)	-0.13** (0.05)
# of other countries that ratified	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
% of same income group that ratified	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
% of countries in region that ratified	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
Democracy (Polity)		0.01* (0.01)	0.01* (0.01)	0.01* (0.01)
Democracy (Vanhanen)	0.01*** (0.00)			
GDP p.c.	0.91 (0.57)	0.82 (0.63)	0.84 (0.63)	0.76 (0.64)
GDP p.c. ^2	-0.04 (0.03)	-0.03 (0.04)	-0.03 (0.04)	-0.03 (0.04)
SO_2 p.c.	0.07*** (0.03)	0.10*** (0.03)	0.10*** (0.03)	0.10*** (0.03)
GDP	0.01 (0.07)	-0.07 (0.07)	-0.07 (0.07)	
Population				-0.07 (0.07)
Africa	-0.33** (0.14)	-0.54*** (0.15)	-0.54*** (0.15)	-0.53*** (0.15)
North America	-0.48** (0.15)	-0.56*** (0.16)	-0.56*** (0.15)	-0.56*** (0.15)
Latin America	-0.37*** (0.11)	-0.55*** (0.13)	-0.55*** (0.13)	-0.55*** (0.13)
East Asia	-0.48*** (0.13)	-0.50*** (0.14)	-0.50*** (0.14)	-0.51*** (0.14)
West Asia	-0.67*** (0.14)	-0.80*** (0.15)	-0.80*** (0.15)	-0.80*** (0.15)
t	-0.32*** (0.02)	-0.32*** (0.02)	-0.32*** (0.02)	-0.32*** (0.02)
t^2	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
t^3	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
Constant	-11.13*** (2.71)	-9.26*** (3.08)	-9.34*** (3.08)	-9.73*** (2.90)
Observations	799741	747061	747061	747061
Robust Standard errors in parentheses, clustered by country; *** p<0.01, ** p<0.05, * p<0.1				

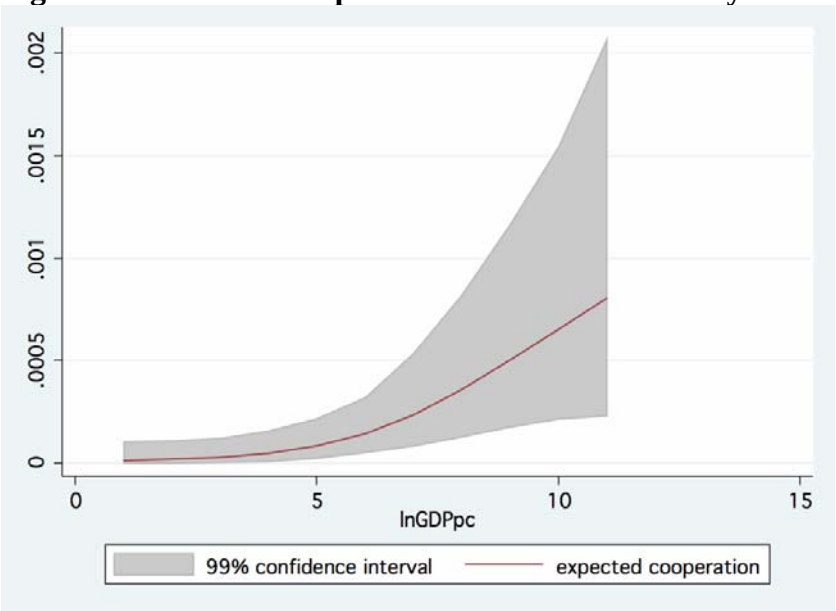
Table 5: Robustness Checks of Principal Model

	(1) Splines	(2) Rare events logit	(3) Major power	(4) Stockholm	(5) Rio	(6) Stockholm + Rio
IGO membership	0.02*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
Trade openness	-0.15*** (0.04)	-0.14** (0.05)	-0.13** (0.05)	-0.11* (0.06)	-0.09* (0.05)	-0.07 (0.06)
# of other countries that ratified	0.01*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.02)	0.03*** (0.00)
% of same income group that ratified	0.02*** (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
% of countries in region that ratified	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
Democracy (Polity)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)
GDP p.c.	1.03* (0.54)	1.05* (0.58)	1.14* (0.59)	1.09* (0.57)	1.15** (0.56)	1.18** (0.56)
GDP p.c. ^2	-0.05 (0.03)	-0.04 (0.04)	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.03)	-0.05 (0.03)
SO_2 p.c.	0.11*** (0.03)	0.13*** (0.03)	0.13*** (0.03)	0.12*** (0.03)	0.11*** (0.03)	0.11*** (0.03)
GDP	-0.09* (0.05)	-0.11* (0.06)	-0.11* (0.06)	-0.10 (0.06)	-0.09 (0.06)	-0.08 (0.06)
Major power			0.11 (0.17)			
After Stockholm				-0.16* (0.09)		-0.13 (0.09)
After Rio					-0.30*** (0.07)	-0.29*** (0.07)
Spline 1	0.02*** (0.00)					
Spline 2	-0.01*** (0.00)					
Spline 3	0.00*** (0.00)					
t		-0.31*** (0.02)	-0.31*** (0.02)	-0.31*** (0.02)	-0.32*** (0.02)	-0.32*** (0.02)
t^2		0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
t^3		-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
Constant	-10.98*** (2.36)	-10.23*** (2.61)	-10.41*** (2.62)	-10.04*** (2.61)	-10.11*** (2.54)	-9.94*** (2.55)
Observations	747061	747061	747061	747061	747061	747061
Robust Standard errors in parentheses, clustered by country; *** p<0.01, ** p<0.05, * p<0.1						

Table 6: Robustness Checks of Principal Model

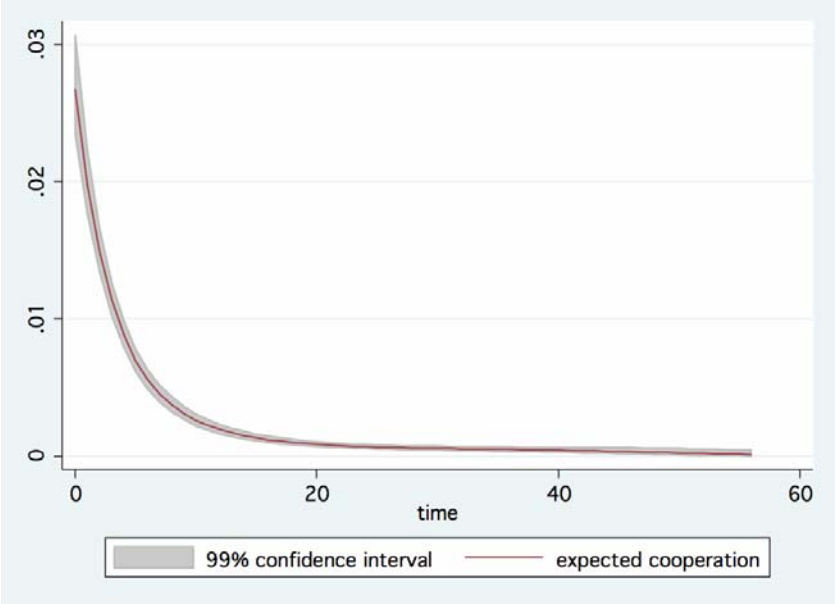
	(1) Excluding regional treaties	(2) Roberts	(3) Truncation	(4) Excluding small traders	(5) Excluding big traders
IGO membership	0.01***	0.02***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Trade openness	-0.12**	-0.03	-0.14**	-0.16***	-0.12**
	(0.05)	(0.07)	(0.05)	(0.06)	(0.06)
# of other countries that ratified	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% of same income group that ratified	-0.00	-0.01	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% of countries in region that ratified	0.02***	0.02***	0.03***	0.03***	0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Democracy (Polity)	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
GDP p.c.	0.95	0.97	1.15**	0.99*	0.94
	(0.61)	(0.63)	(0.58)	(0.59)	(0.59)
GDP p.c. ^2	-0.04	-0.06	-0.05	-0.04	-0.03
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
SO_2 p.c.	0.12***	0.02	0.14***	0.13***	0.14***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
GDP	-0.07	-0.02	-0.10*	-0.11*	-0.12*
	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)
t	-0.27***	-0.22***	-0.32***	-0.31***	-0.31***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
t^2	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
t^3	-0.00***	-0.00*	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-10.05***	-8.24***	-10.73***	-10.29***	-9.35***
	(2.60)	(3.04)	(2.62)	(2.63)	(2.68)
Observations	351033	45599	721904	718953	716151
Robust Standard errors in parentheses, clustered by country; *** p<0.01, ** p<0.05, * p<0.1.					

Figure 1: Effect of GDP p.c. on the likelihood of treaty ratification



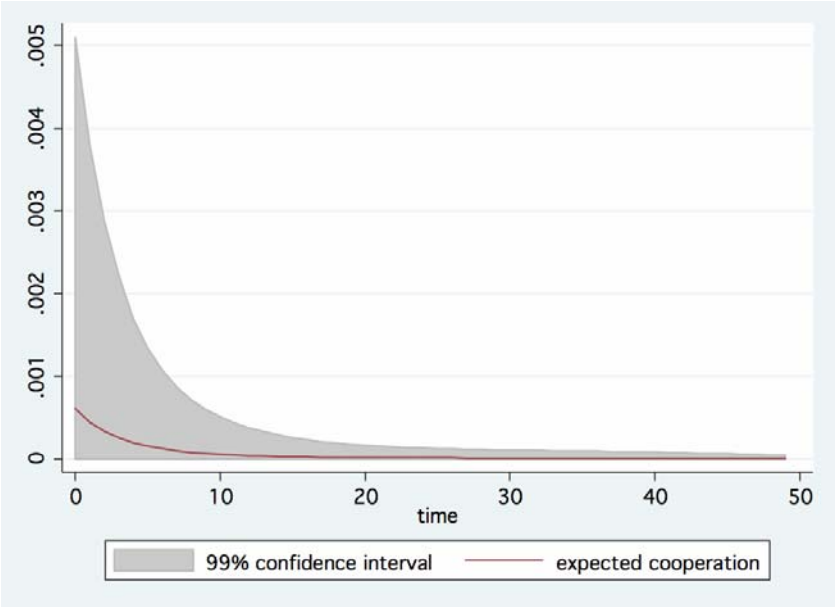
Note: all other variables are kept at their means.

Figure 2: Effect of t, t^2 and t^3 on the likelihood of treaty ratification



Note: all other variables are kept at their means.

Figure 3: Effect of t, t^2 and t^3 on the likelihood of treaty ratification

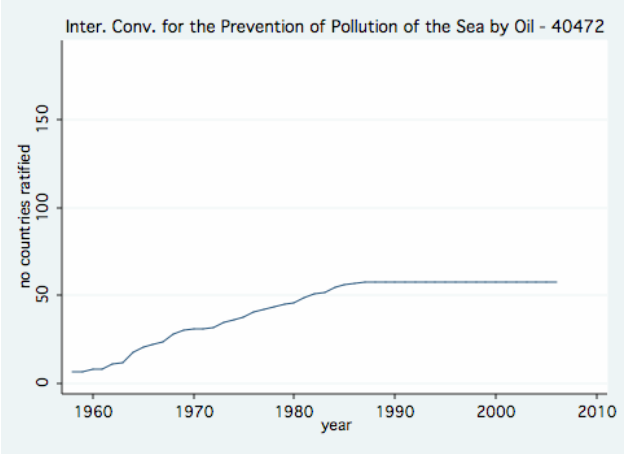


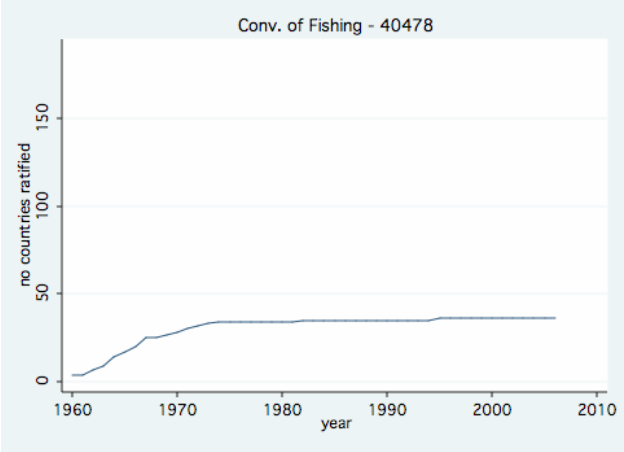
Note: all other variables set to zero.

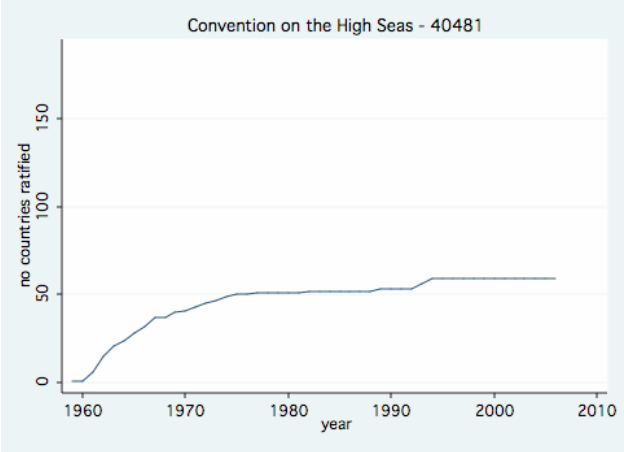
Appendix I: Correlation Coefficients

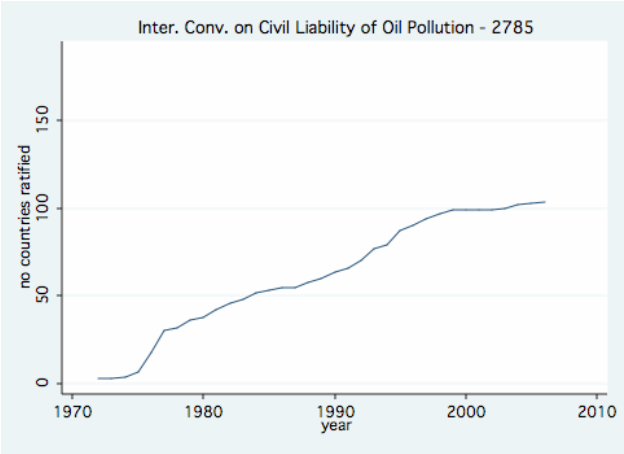
	trade open-ness	Polity	Civil liber-ties	Politi-cal rights	IGO memb.	ln GDP per capita	ln GDP per capita^2	ln SO2 per capita	# of coun-tries	% in-come	% re-gion	age of treaty
GDP	0.03	0.35	0.34	0.37	0.54	0.57	0.57	0.83	-0.01	0.10	0.05	0.00
age of treaty	0.07	0.04	0.00	0.01	0.06	-0.01	-0.01	-0.02	0.25	0.15	0.12	1.00
% re-gion	0.08	0.10	0.10	0.10	0.10	0.10	0.11	0.02	0.65	0.65	1.00	
% in-come	0.10	0.03	0.05	0.05	0.05	0.16	0.17	0.08	0.74	1.00		
# of coun-tries	0.01	0.04	0.07	0.06	0.06	0.07	0.07	0.06	1.00			
ln SO2 per capita	0.04	0.21	0.20	0.22	0.39	0.43	0.43	1.00				
ln GDP per capita^2	0.52	0.42	0.56	0.53	0.39	0.99	1.00					
ln GDP per capita	0.51	0.42	0.55	0.53	0.38	1.00						
IGO mem-bership	0.30	0.44	0.46	0.44	1.00							
Politi-cal rights	0.28	0.90	0.92	1.00								
Civil liber-ties	0.31	0.84	1.00									
Polity	0.21	1.00										
trade open-ness	1.00											

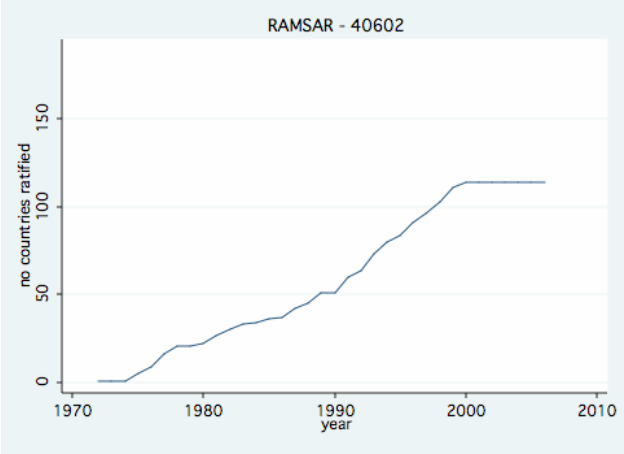
Appendix II: Illustration of Treaty Ratification Trajectories

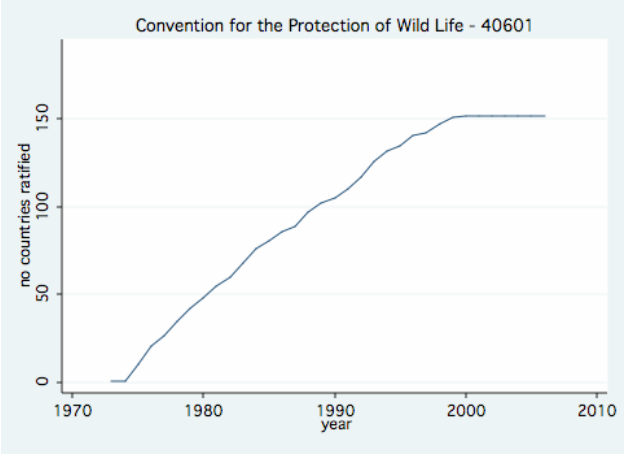


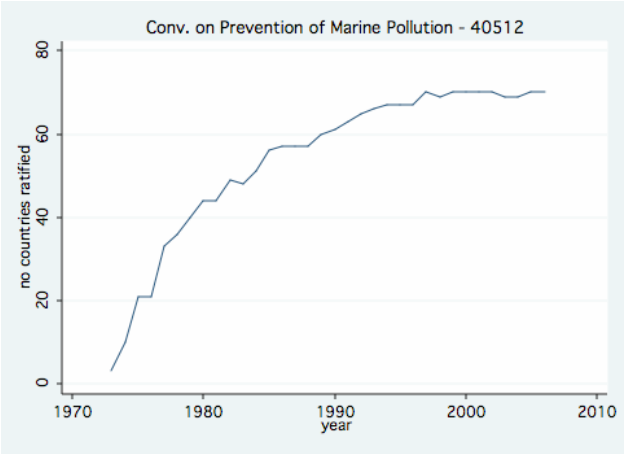


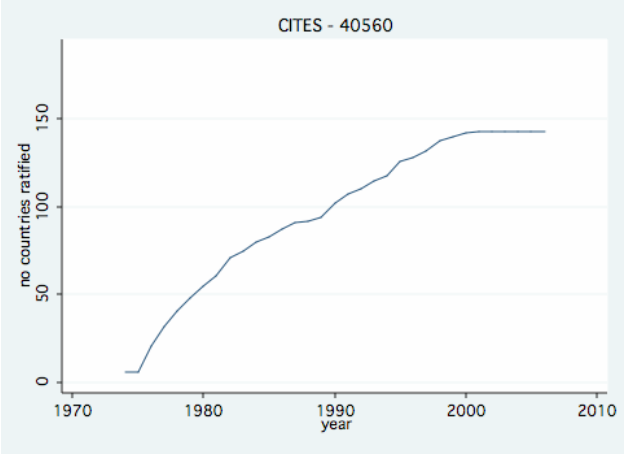


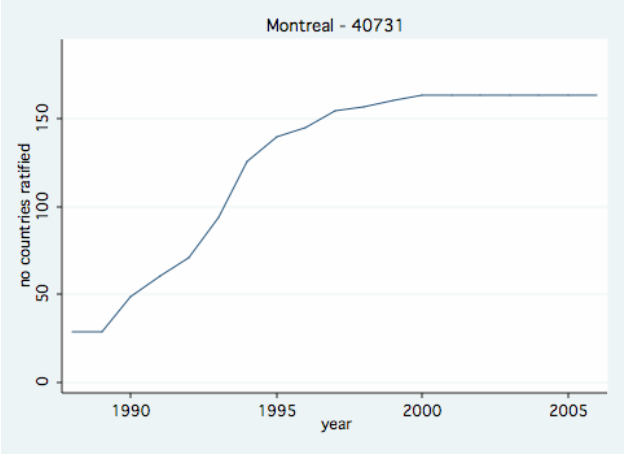

Inter. Conv. on Civil Liability of Oil Pollution - 2785
no countries ratified
0
50
100
150
1970
1980
1990
2000
2010
year

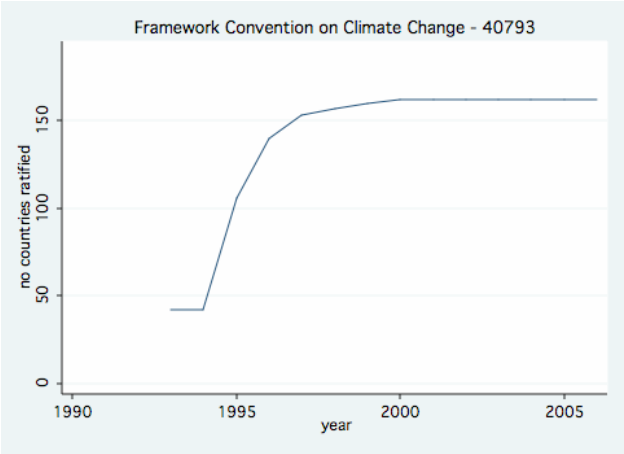

RAMSAR - 40602
no countries ratified
0
50
100
150
1970
1980
1990
2000
2010
year

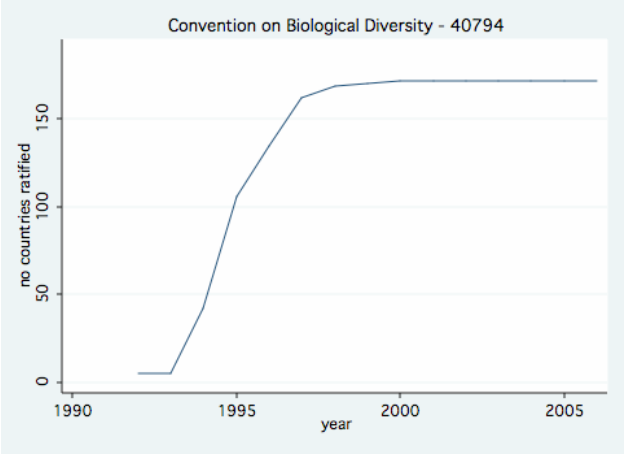

Convention for the Protection of Wild Life - 40601
no countries ratified
0
50
100
150
1970
1980
1990
2000
2010
year

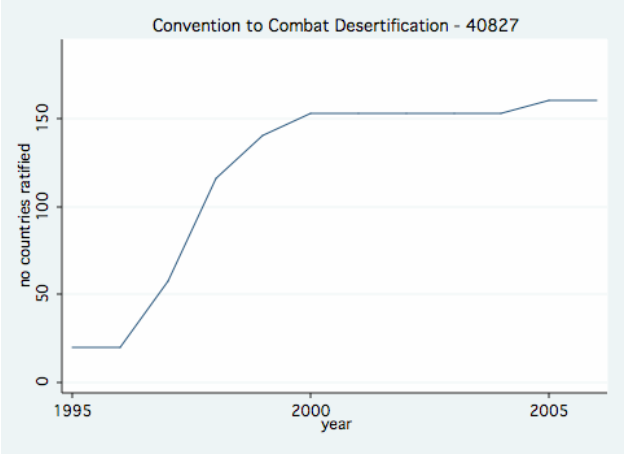

Conv. on Prevention of Marine Pollution - 40512
no countries ratified
0
20
40
60
80
1970
1980
1990
2000
2010
year


CITES - 40560
no countries ratified
0
50
100
150
1970
1980
1990
2000
2010
year


Montreal - 40731
no countries ratified
0
50
100
150
1990
1995
2000
2005
year


Framework Convention on Climate Change - 40793
no countries ratified
0
50
100
150
1990
1995
2000
2005
year


Convention on Biological Diversity - 40794
no countries ratified
0
50
100
150
1990
1995
2000
2005
year


Convention to Combat Desertification - 40827
no countries ratified
0
50
100
150
1995
2000
2005
year