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ORIGINAL PAPER

A contingency theory of policy innovation: how different theories explain the ratification of the UNFCCC and Kyoto Protocol

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Abstract This article tests theories, elaborated by rationalists, constructivists, and network theorists, that explain the ratification of international environmental treaties. Rationalists argue that countries' material self-interest and political and economic conditions affect the likelihood of countries ratifying treaties. Constructivists argue that countries are influenced by exposure to world society. Structural embeddedness theory argues that countries are influenced by neighboring countries, religion, language, and economic peers, and those whom they have network ties to via diplomatic relations and IGO memberships. The article is a study of how these factors affected the ratification of two environmental treaties: United Nations Framework Convention on Climate Change and the Kyoto Protocol. The results show that political and economic factors, peer behavior, and network ties were more important in explaining the ratification of the Kyoto Protocol than the UNFCCC. Similar to von Stein (J Conflict Resolut 52:243–268, 2008), it found that exposure to world society was important in the UNFCCC. The authors suggested that the differences were due to the demands which the Kyoto Protocol placed on countries in contrast to the "softness" of the UNFCCC. They also discussed how social influence—based on a variety of inter-governmental relations and affiliations—may signal a change in the structure of the global environmental regime and how it conducts its business.

Keywords Social networks · International organization · Kyoto Protocol · UNFCCC

1 Introduction

The rationalist, constructivist, and structural embeddedness perspectives have been major forces shaping the field of international relations. Rationalists argue that the decision to

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adopt policy innovations is determined by domestic political and economic conditions. The constructivist framework argues that being integrated into world society and exposed to new ideas should increase the odds of adoption. Structural embeddedness theory focuses on the various communities of interest that exist around the world and how countries' adoption of public policies is influenced by the behavior of other countries within their communities. Simmons and Elkins (2004: 172) label this "clustered policy making."

All three theories have merit, but it is unclear when one theory explains the ratification treaties better than another. This paper offers a contingency theory of treaty ratification where the effects of different variables on ratification are contingent on the treaty's institutional design, particularly its "hardness" and "softness." It draws on papers by von Stein (2008), Bernauer et al. (2011), and others which discuss the ways that environmental treaties are structured. It then tests whether rationalist, constructivist, or structural embeddedness theories offer better explanations for the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP).

2 Theories of policy adoption

Rationalist theory explains nations' adoption of international policies by examining their power, interests, and domestic political or economic conditions. It assumes that nations' preferences are fairly stable over time and that decisions are driven by incentives and relative costs (Downs 2000). Interaction (including cooperation) does not influence or change actors' utility functions or identities (Hasenclever et al. 1997). Typically, analysts apply game theory and/or quantitative analysis to explain inter-governmental behavior.

The rationalist tradition has identified several factors that explain the ratification of environmental treaties. These include democratic freedoms because citizens have a keener taste for collective goods and the means to achieve them (Congleton 1992; Murdoch and Sandler 1997; Fredriksson and Gaston 2000; Neumayer 2002; Fredriksson et al. 2007; Fredriksson and Jim 2007; Bättig and Bernaurer 2009), population size because small countries can free ride on larger nations' efforts (Frank 1999; Fredriksson et al. 2007), GDP per capita because the costs of compliance for poorer countries can stymie growth (Fredriksson et al. 2007; von Stein 2008), the presence of lobby groups which can pressure governments to pursue policies favorable to them (Fredriksson et al. 2007; von Stein 2008), and the demands which treaties place on countries (von Stein 2008).

Constructivist theory argues that policy adoption is a function of countries' exposure to the culture of world society. In the environmental realm, Meyer et al. (1997) observed that in some environmental agreements, the interest and power of countries no longer seemed significant, rather countries were buying into the *idea* that international cooperation was needed to address global environmental problems. Constructivists emphasize the role of global institutions to the point where they "believe that institutions can reconstruct states' identities and their underlying value structures by relying on the transforming power of a variety of social processes (Downs 2000: 26)." Meyer et al. (1997) argued that the legitimation of scientific discourse and associations, the activism of international NGOs, international treaties, and the rise of IGOs all contributed to the international environmental regime. Frank (1999) found that countries' affiliations with IGOs or exposure to international environmental NGOs significantly increased the odds of ratifying environmental treaties. Previous experience with environmental treaties should also lead to countries ratifying new agreements.

The structural embeddedness approach views nations as situated in networks of ties to other nation-states and that these ties affect their adoption of public policies. Two relational processes seem to underlie these network effects. Simmons and Elkins (2004) and Cao (2010) argued that countries use their networks and structural positions to extract information and advice from peers who have adopted the policy already. Alternatively, countries imitate peers to maintain their standing in their groups. Weiss and Jacobson (1998) highlighted the role of psychological pressure and fear of being viewed as a laggard by peers in the international arena. Ward (2006) argued that once nations were embedded in a maze of inter-governmental ties, they were less likely to free ride on environmental matters. They feared losing their reputation for trustworthiness and being a team player and did not want to be seen as deviant.

Economic and cultural peers clearly influence countries' adoption of international policies. Simmons and Elkins (2004) found that countries which were situated in a comparable market position globally either adopted or rejected neo-liberal economic policies depending on what competitors did. Economic peers monitor and imitate one another (see also Cao 2010). Simmons and Elkins (2004: 187) also found that "values common to a particular religious tradition may shape attitudes toward risk, individualism, equality, and materialism generally" resulting in the adoption of similar policies. These shared values and beliefs reflect countries' similar historical experiences, particularly invasions, missionary activities, and colonialism, and residual legal, educational, scientific, and medical institutions that shape nations' views on nature, the environment, and public policy. History among countries also gives rise to elite networks, study abroad opportunities for young people, and immigration flows that produce similar world views.[1]

Clustered policy making is also the result of co-memberships in inter-governmental organizations. Until the 1990s, IGOs were regarded as ways to ensure that dominant countries could protect the status quo. In the 1990s, Jacobson (2000) argued these organizations took on different meanings and a "new institutionalism" emerged based on cooperation, new international identities, and collective problem-solving. Torfason and Ingram (2010) found that affiliations through these IGOs influenced the diffusion of democratic forms of governance, and Cao (2010) discovered that proximity in IGO networks affected countries' adoption of capital tax policies.

The exchange of diplomats could be another conduit through which public policies diffuse. Diplomatic representation is among the best indicators of how important one country is to another (Singer and Small 1966). In addition to the factors we already cited, it may reflect similarity in diplomatic objectives, geographical proximity, trade relations, communication between countries, migration and tourism, mutual defense agreements, economic aid, and so on. Research on the effects of diplomatic relations on policy diffusion is limited; however, Dinar et al. (2010) found that diplomatic relations supported environmental treaty cooperation.

3 Toward a contingency theory of treaty ratifications

Despite the empirical support for these theories, it is fair to ask whether the explanatory power of a theory is contingent on the features of the policy innovation in question.

[1] We would like to thank Gary Goertz for this insight.

Arguing that there is no one best theory of policy adoption, but rather the usefulness of each is contingent on the situation presents a considerable challenge theoretically and empirically. It is difficult to imagine that we could identify all of the possible contingencies or that we could collect enough information on enough policies to make the case empirically.

Even if we just focus on the institutional design of treaties, there are numerous ways that they differ. Abbott and Snidal (2000) distinguished between hard and soft treaty law. They defined hard law as "legally binding obligations that are precise and delegate authority for interpreting and implementing the law." Downs et al. (1996) and others argued that countries would shy away from hard treaties and be more attracted to soft treaties. Bernauer et al. (2011) challenged the premise that "deeper" (or more complex) treaties will elicit less participation than "shallower" treaties. Focusing on treaties' institutional design, they argued and showed in their analysis of environmental treaties that some design features lowered participation (e.g., specificity of obligations), while others increased it (e.g., assistance and dispute settlement procedures). Some had no effect on the likelihood of countries ratifying treaties (e.g., monitoring and enforcement provisions). They argued that obligations, monitoring, and enforcement provisions can disincentivize countries because of the financial costs and the loss of sovereignty, but legalization can reduce transaction costs, clarify goals and means, and reduce uncertainty. On the other hand, dispute settlement procedures, financial and technical assistance, and a secretariat can bring direct benefits to countries and will make institutionally complex treaties more attractive.

This paper argues that the institutional design of treaties could explain whether countries' own characteristics, ties to world society, or peers affect ratification behavior. If costs or threats to sovereignty are high, then domestic conditions should be important. There are real political and economic costs that the treaty imposes on countries, and interest groups within the country will mobilize political opposition to and/or support for ratification. Similarly, if there are benefits such as financial and technical assistance, then domestic factors should again be important. For example, smaller and poorer countries may view the treaty as a way to procure financial aid and new technology.

In contrast, where obligations, monitoring, and enforcement provisions are unspecified or irrelevant, or there are no material benefits attached to treaty ratification, then exposure to world society should be more important in explaining which countries ratify and which do not. More specifically, if the country has participated in more environmental treaties, has branch offices or affiliates of international ENGOs, belongs to the international scientific community, or belongs to more IGOs, they are more likely to go along with global environmental movements. Because ratification makes little difference to the countries, domestic interest groups and entrepreneurial governments should be indifferent.

It is less clear when embedded ties influence ratification behavior. On the one hand, the more specific the institutional design of the treaty, the less countries need to seek out the advice or counsel of peers. As noted above, things are clear cut, obligations are spelled out, there are ways to resolve conflicts, and uncertainty is much lower. On the other hand, countries are situated in international arenas where peers are both allies and competitors. As Simmons and Elkins (2004) noted, countries need to ensure that they are on par with their competition. If a country's competitors are not willing to incur the financial burdens and lose of sovereignty which a demanding treaty requires, then a country can ill afford to ratify. At the same time, Ward (2006) adds that not ratifying a treaty when others are, especially if it is costly or threatens sovereignty, can result in being viewed as a deviant or

a 'difficult' case by peers. Thus, when the treaty means something, there are reputational consequences of doing something different than one's peers.

4 Hypotheses

To test these ideas, we will do an exploratory analysis of two prominent environmental treaties, the United National Framework Climate Control Convention (UNFCCC) and its protocol, the Kyoto Protocol (KP). These treaties are attractive, because there has been a great deal written on them and there is empirical work on how to classify these treaties. Most researchers agree that KP is harder than the UNFCCC, because it has quantified emissions targets and imposes a legally binding commitment on Annex I countries to reduce green house gas emissions by a set percentage of base year emissions (von Stein 2008: 247). The debate is over their relative hardness/softness.

Karlsson-Vinkhuyzen and Vihma (2009) defined both the UNFCCC and the KP as hard law. The UNFCCC is a more typical framework convention, and compared to the APP, G8 Dialogue, and MEM, the Convention has fairly precise features such as the reporting system (Article 12) and a carefully constructed overall objective (Article 2). In contrast, Von Stein (2008) characterized the UNFCCC a "soft" treaty. The UNFCCC only required that "Parties assume two core obligations: to prepare national action plans for controlling emissions and to create national emissions inventories. Neither obligation requires improvements in states' emission levels (von Stein 2008: 246)." Furthermore, neither obligation is legally binding. She also notes that the UNFCCC is imprecise as to its goals because it does not specify quantitative targets. The UNFCCC delegates monitoring to a conference of parties (COP) that will monitor countries' communications and emissions reports, but the body is made up of member states.

There is also debate about the "hardness" of the KP. The KP has incentives which "soften" the treaty particularly for Annex I countries. KP's flexibility provisions enabled countries to gain emissions credits by reducing greenhouse gases (International Emission Trading) or by sponsoring programs to reduce emissions abroad (clean development mechanism) (von Stein 2008). Also the KP leaves the responsibility for monitoring countries' emissions and compliance and the governance of the flexibility system to the COP. In this way, it made the treaty less uncertain and risky for Annex I countries.

Bernauer et al.'s (2011) schema shows that the two treaties were similar in many ways. The UNFCCC's obligations were "softer," but there were still obligations (which makes UNFCCC "harder") and non-Annex I countries under KP had really no obligations (which makes KP "softer"). There were monitoring and compliance procedures in both treaties, but in both treaties they were delegated to the COP and not an independent third party. There is no enforcement mechanism set for the UNFCCC (though an enforcement branch was created but has no legal binding). Article 18 of Kyoto Protocol refers to a compliance mechanism. It was established to apply punitive "consequences" to countries that fail to comply with their Kyoto obligations. However, Hovi, Froyn, and Bang (2007) noted that the compliance system relies heavily on "self-punishment," implementation of the punitive consequences requires cooperation by the non-compliant country, and it postpones implementation of the punishment to a later commitment period. Also the system is not legally binding and any party is entitled to withdraw from the KP with 12 months' notice (see also Finus 2008).

We argue that domestic, economic, and political conditions should matter for a hard treaty such as the Kyoto Protocol but not for the UNFCCC. Annex I countries should be less likely to ratify KP (von Stein 2008) and other variables from the rationalist tradition

should matter as well. In contrast, the ratification of soft but not hard treaties should depend on countries' exposure to world society; exposure should not matter for KP (von Stein 2008). Thus, we hypothesize:

H1: The likelihood of a country ratifying a "hard" international environmental treaty (for instance, the Kyoto Protocol) is greater if the demands upon the country are less (i.e., the country is not listed as an Annex I country), the country is larger, wealthier, has more political freedoms, many pro-environmental NGOs, and a weak industrial lobby.

H2: The likelihood of a country ratifying a "soft" international environmental treaty (for instance, the UNFCCC) is greater if countries are more exposed to scientific discourse, international environmental organizations, and inter-governmental organizations and have ratified a greater proportion of environmental treaties previously.

It is less clear when peer influences should matter. While there were no reasons why countries should imitate peers when treaties were soft, such as the UNFCCC, there were reasons why peer influence may or may not matter for hard treaties such as the KP. On the one hand, the KP is quite specific and there is very little uncertainty surrounding it. Countries may not be attracted to the terms, but the terms are clear. Some of the risk was also reduced with the flexibility provisions. Thus, there is no reason to rely on peers for information and opinion. On the other hand, the KP is more meaningful, and ignoring what peers do could jeopardize one's trust and competitive or status position within a cluster (i.e., among club members). Thus, the pressures to conform to peer influence are strong for the KP. While there are arguments on both sides, we think club member influence will prevail. Thus, Hypothesis 3 is:

H3: The likelihood of a country ratifying a "hard" international environmental treaty (for instance, the Kyoto Protocol) is greater if more countries with which they have ongoing positive inter-governmental relationships or which are their geographical, economic, or socio-cultural peers have ratified the treaty.

5 Model and variables

5.1 Model

Discrete-time event history analysis (EHA) is used to investigate the ratification behavior of countries. EHA, also known as survival analysis, was developed in biostatistics to identify variables that explain patients' mortality and now has been widely applied in social science to study a variety of non-recurring and repeated events (e.g., the ratification of a treaty). It uses longitudinal data collected on a set of observations (e.g., country-year), and usually, the dependent variable measures the duration of time that units spend in a state before experiencing some event. Event history data for discrete-time processes record the dependent variable as binary outcomes.

The variable to be explained in discrete-time event history analysis (EHA) is called the hazard rate which is defined as below.

$$h_{i,t} = \Pr(y_{i,t} = 1 | y_{i,t-1} = 0) \tag{1}$$

where t ($t = 1, \ldots, T$) indexes time and i ($i = 1, \ldots, I$) indexes country. The hazard rate, $h_{i,t}$, being a probability is an unobserved variable. The observed dependent variable $y_{i,t}$ is a binary variable that is scored 1 for ratified, 0 otherwise. The dichotomous nature of the variable and the fact that we have country level data on a yearly basis make a conditional logit the preferable estimation technique. Using the hazard rate, we can define the following odds ratio $y^*_{i,t}$.

$$y^*_{i,t} = \ln\left(h_{i,t}/\{1 - h_{i,t}\}\right) \quad (2)$$

To test for social influence effects, we applied the familiar spatial lag model (Anselin 1988) that Simmons and Elkins (2004), Cao (2010), and others have used for network data. We can think of this as a social influence model (Marsden and Friedkin 1993) and can be defined as:

$$\boldsymbol{Y}^*_t = \rho_r \boldsymbol{W}^r_t \boldsymbol{Y}_t + \alpha + \boldsymbol{X}_t\beta \quad (3)$$

where $\boldsymbol{Y}^*_t$ is an $I \times 1$ ($i = 1, \ldots, I$) vector whose element $y^*_{i,t}$ is given by the log odds ratio at t. $\boldsymbol{X}_t$ denotes the exogenous variable, α, β, and ρ_r denote parameters, and W^r_t is an $I \times I$ matrix whose i-jth element ($w^r_{ij,t}$) denotes the weight assigned to the level of influence from country j to i for relationship r at time t. $\boldsymbol{Y}_{i,\ t}$ is the $I \times 1$ vector whose element y_t shows whether country i had ratified the given treaty the same year (i.e., t year). We computed six social influence variables which are described below.

Maximum likelihood estimation (MLE) is applied for estimating the parameters. It was originally developed by R.A. Fisher in the 1920s and states that the desired probability distribution is the one that makes the observed data "most likely," which means that one must seek the value of the parameter vector that maximizes the likelihood function. The resulting parameter vector, which is sought by searching the multi-dimensional parameter space, is called the MLE estimate.

5.2 Data and variables

There were 166 countries in our analysis which covered the period from 1992 to 2008.[2] Since some countries did not exist in 1992, we had missing data for them for these years. Data on when the countries ratified the two treaties were taken from treaties' homepages. While we had the exact date of each ratification, we coded a country as ratifying a treaty in a given year if ratification took place as of December 31st of that year. All data sources are given in "Appendix Tables 4 and 5."

(1) Variables for testing rationalist theory

We included population size (1,000 s) logged, GDP per capita (in current dollars), an indicator of political freedoms, and the presence of lobby groups. For the industrial lobby within a country, we obtained data on industrial production as a percent of GDP. For the domestic environment lobby, we computed the number of international ENGOs per capita that were headquartered in each country (logged). Finally, because we were studying the UNFCCC and the Kyoto Protocol, we coded countries as being listed in Annex I or not similar to von Stein (2008).

(2) Variables for testing constructivist theory

To measure a country's exposure to science, we coded a country 1 if it was a member of the International Council for Science (ICSU) and 0 otherwise. To measure exposure to IGOs, we tallied the number of inter-governmental organizations that a country belonged to in 1990, 1995, 2000, and 2005. To code exposure to international environmental NGOs, we counted the number of major international ENGOs which had branches or offices in each country for each year. This included Greenpeace International, World Wildlife Federation, Friends of the Earth, Rainforest Action Network, Climate Action Network,

[2] The list of countries is available upon request.

International Union for the Conservation of Nature, and the 3rd World Network. Past ratification behavior was measured by computing the log of the proportion of the six major environmental agreements (International Convention for the Regulation of Whaling, Ramsar Convention, Convention on the Prevention of Marine Pollution by Dumping of Waste and other Matter, UN Convention on Law of the Sea, Vienna Convention, Basel Convention) that the country had ratified as of December 31st in the previous year. These agreements were used, because they are wide-known and addressed different international environmental problems.

(3) Variables for testing structural embeddedness theory

Co-participation in IGOs ($\boldsymbol{W}_t^{igo}$) was collected from the Correlates of War Project. The IGOs in the dataset are inter-governmental organizations that consist of at least three members (Pevehouse et al. 2004). We recorded each country's memberships in international governmental organizations for 1990, 1995, 2000, and 2005. To derive network ties between countries, we created a data matrix where the rows and columns are countries and the number in the cell is the number of IGOs that both countries belonged to. We then recorded diagonals to zero and standardized cell entries by dividing by the row total so that values were between 0 and 1 and row values summed to 1. The substantive interpretation of the product term ($\boldsymbol{W}_t^{igo}\boldsymbol{Y}_t$) is the proportion of nations (weighted by the strength of ties), that one is tied to via IGO memberships, which had ratified the treaty.

Diplomat ($\boldsymbol{W}_t^{\mathbf{dip}}$) data were also taken from the Correlates of War website and were for 1990, 1995, 2000, and 2005. We created a second matrix where the rows and columns were countries and the entries in the cells, 1 or 0, indicated if there was a chargé d'affaires between two countries. We again standardized entries by dividing by the row total and recoded diagonals to zero. The substantive interpretation of the product term ($\boldsymbol{W}_t^{\mathbf{dip}}\boldsymbol{Y}_t$) is the proportion of nations, that one had diplomatic ties to, which had ratified the treaty.

Geographic proximity ($\boldsymbol{W}_t^{\mathbf{proximity}}$) is the distance between two countries' capitals in kilometers, d_{ij}. The data were downloaded from Kristian S. Gleditsch's website (Gleditsch and Ward 2001). We standardized the 166 by 166 matrix of distances by taking the inverse of the distances between countries and multiplied by 100 ($\boldsymbol{w}_{ij}^{\text{proximity}} = (1/d_{ij}) \times 100$). Substantively, the new product vector, ($\boldsymbol{W}_t^{\mathbf{proximity}}\boldsymbol{Y}_t$), measures the extent to which countries nearby had ratified the treaty.

Countries' similar economic status ($\boldsymbol{W}_t^{\mathbf{gnipc}}$) is based on their GNI per capita. The World Bank Analytical Classifications divide countries into high, upper middle, low middle, and low income groups. We constructed a matrix, where a 1 was entered if both countries were in the same category and a 0 otherwise. This resulted in 5 adjacency matrices, one each for 1988, 1993, 1998, 2003, and 2008. We standardized entries by dividing by row sums and set diagonal elements to zero. The interpretation of the product term ($\boldsymbol{W}_t^{\mathbf{gnipc}}\boldsymbol{Y}_t$) is the proportion of countries in one's economic group that had ratified a treaty.

To measure countries' religious group ($\boldsymbol{W}_t^{\mathbf{religion}}$), we used the Central Intelligence Agency (CIA) estimates of the percentages of a country's population belonging to different religious traditions. Data were gathered in different years depending on availability. Since the breakdown across countries was inconsistent, we settled on very general religious categories: Christian, Moslem, Hindu, Buddhist, and Other. We created a single affiliation matrix where the 166 countries were the rows and the first four religious traditions were the columns. A value of 1 was assigned to a cell if 50 % or more of a country's population was listed as belonging to a given religious tradition and a 0 otherwise. We assigned the value of 0 if countries had unique religious traditions or no tradition attracted at least half the population. A single 166 by 166 adjacency matrix was

constructed where the value in the cell equaled 1 if two countries had at least half of their population belonging to the same religious tradition and a 0 otherwise. We standardized entries by dividing by the row sum and set diagonals to zero. The product vector ($\boldsymbol{W}_t^{\mathbf{religion}}\boldsymbol{Y}_t$) recorded the proportion of countries within the focal country's religious tradition that had ratified a treaty.

To measure countries' language group ($\boldsymbol{W}_t^{\mathbf{language}}$), we used the CIA's list of each country's official languages. We created a single affiliation matrix where the 166 countries were the rows and eight language groups were the columns: English, Russian, Spanish, German, French, Portuguese, Arabic, and Dutch. A cell was assigned a 1, if that was the official language of a country and a 0 otherwise. Countries which had their own unique language, for example, Japan, were assigned values of 0. We constructed a single 166 by 166 adjacency matrix where the value in the cell equaled the number of official languages countries had in common. We standardized entries by dividing by the row sums and set diagonals to zero. The product vectors ($\boldsymbol{W}_t^{\mathbf{language}}\boldsymbol{Y}_t$) described the proportion of countries with the same official languages that had ratified the treaty.

(4) Control variables

We included the percentage of land covered by forests on an annual basis as a measure of local environmental conditions and dummy variables for each year. The latter was important not only from a modeling point of view, but also because this era was marked by special historical events that were significant for a large number of countries in the world (e.g., the September 11th attacks and the wars that followed) and for specific treaties (e.g., the Marrakech Conference where details of the Kyoto Protocol were agreed upon). Other controls included a dummy indicating whether one of the four religious traditions was embraced by at least 50 % of the country's population and the number of official languages in a country among the eight we studied. These two variables controlled for the opportunities which countries had to be influenced by peers, since not all countries shared a religious tradition with others or spoke the same language, for example,s Japan had no peers on these two dimensions. This was also a reason to include the number of IGOs which a country belonged to. For a technical discussion explaining the importance of these controls, see Fujimoto et al. (2011).

6 Ratification of the agreements

We first examine the correlations among the proximity matrices ($\boldsymbol{W}_t^{\mathbf{igo}}$ through $\boldsymbol{W}_t^{\mathbf{language}}$). These are based on the Quadratic Assignment Procedure for Correlations (QAP-CORR) which estimates standard errors that take into account the non-independence of ordered pairs (Baker and Hubert 1981). The units of analysis are the $N(N-1) = 166 * 165 = 27{,}390$ pairs of countries (however, for diplomatic relations it is less because of missing data). The results are shown in Table 1. The correlation coefficients involving co-participation in IGOs, exchange of diplomats, and similar economic status are the average value of the coefficients during the period 1992–2008; similar religion, geographic proximity, and similar language were measured only once. Most correlations in Table 1 are significant, but the values are small. The strongest correlations showed that countries which belonged to the same inter-governmental organizations had a similar economic status ($r = 0.159$), were located near to each other ($r = 0.199$), or had a similar language ($r = 0.178$). This is not surprising, since many IGOs are regional in character.

Table 1 QAP correlations among the social proximity matrices

	IGO[a]	Diplomat[a]	GNIpc[a]	Religion	Proximity
Overlapping IGO memberships[a]					
Exchange of diplomats[a]	0.015*				
Similar economic status (GNIpc)[a]	0.159***	0.012			
Similar religion group	0.091**	0.031**	0.021		
Geographic proximity	0.199***	0.057**	0.095***	0.093***	
Similar language group	0.178***	0.022**	0.05***	0.092***	0.113***

[a] The correlations in these cells are averaged across the years for which we had data on these types of ties. The p values were the same across the years for these correlations

* $p < 0.05$; ** $p < 0.01$; *** < 0.001

6.1 Ratification of the UNFCCC

Initially we checked for multicollinearity including all variables and year dummies in our model. We found that many variance inflation factor scores (VIF) were above 10. This was because the social influence variables were highly correlated with each other. For example, the countries whose IGO relations had previously ratified the UNFCCC were also countries whose geographic neighbors had previously ratified the UNFCCC. No doubt this was due to the correlations among the proximity measures (see Table 1). The control, interest, and world society variables were not highly correlated. Subsequently we dropped several year dummy variables and, similar to Perrin and Bernauer (2010), included social influence variables one at a time in both our analyses.

The results for the UNFCCC are shown in Table 2.[3] Since the treaty was introduced for ratification in 1992, the first year of our analysis begins in 1992 and 1992 became the reference category for year dummy variables. The baseline model contains the interest, world society, and control variables. In the baseline model, industrial output as a percent of GDP (−), the log proportion of previous environmental treaties ratified (+), and the number of international environmental NGO branches/offices (+) were statistically significant at the 0.05-level. Models II through VII included the previous country level variables and added the social influence variables one at a time. Only social influence based on IGO memberships (+) and economic status (+) was statistically significant at the 0.05-level. Industrial output as a percent of GDP was negative and the proportion of previous environmental treaty ratifications (log) was positive in models II through VII. The presence of international environmental NGO branches/offices was positively significant at the 0.05-level in all but one model where it was significant at the 0.10-level.[4]

6.2 Ratification of the Kyoto Protocol

The analysis of the Kyoto Protocol parallels the analysis for the UNFCCC, and only countries that had ratified the UNFCCC as of a given year were included.[5] Since 1998 was the first year that countries ratified the KP, it became our reference category. We first

[3] The dummy variables years are not presented to save space.

[4] When comparing the goodness of fit statistics, be cautious because our N changes across analyses. This is because we had missing data for social influence based on diplomatic ties.

[5] The Kyoto Protocol could only be ratified by countries which had already ratified the UNFCCC.

Table 2 The results of ratification of the UNFCCC

Variables	Model I		Model II		Model III		Model IV		Model V		Model VI		Model VII	
	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
Annex I status	-0.322	0.438	−0.409	0.470	−0.141	0.405	−0.275	0.449	−0.464	0.488	−0.395	0.434	−0.277	0.432
Pop (1,000s) (log)	−0.091	0.102	−0.080	0.108	0.049	0.098	−0.092	0.102	−0.060	0.111	−0.091	0.103	−0.062	0.098
GDP per capita	−8.2E–06	1.8E–05	−1.0E–05	2.0E–05	9.7E–06	1.9E–05	−8.8E–06	1.8E–05	−2.7E–05	2.3E–05	−5.3E–06	1.8E–05	−4.0E–06	1.7E–05
Political freedoms	−0.126	0.183	−0.056	0.196	−0.147	0.197	−0.129	0.186	−0.043	0.200	−0.105	0.190	−0.111	0.183
#IENGO hdqtrs per capita (log)	0.112	0.300	0.152	0.339	0.103	0.336	0.119	0.291	0.175	0.344	0.107	0.321	0.179	0.275
Industry(%GDP)	−0.025*	0.011	−0.027*	0.012	−0.030*	0.012	−0.025*	0.011	−0.027*	0.012	−0.027*	0.011	−0.028*	0.011
Forest area (%)	−0.419	0.483	−0.482	0.521	−0.489	0.507	−0.438	0.477	−0.383	0.525	−0.452	0.493	−0.423	0.492
ICSU membership	−0.359	0.366	−0.373	0.379	−0.371	0.382	−0.363	0.366	−0.339	0.379	−0.315	0.369	−0.314	0.373
Proportion of treaties ratified (log)	1.181**	0.361	1.125*	0.352	1.093**	0.332	1.189**	0.365	1.100**	0.342	1.166**	0.356	1.149**	0.356
# IENGO offices, branches, affiliates	0.326*	0.145	0.299*	0.144	0.321*	0.162	0.327*	0.146	0.270#	0.148	0.323*	0.144	0.324*	0.144
IGO memberships	0.013	0.008	0.016#	0.008	0.011	0.008	0.013	0.008	0.016	0.009	0.014	0.008	0.010	0.008
Language sum	−0.457#	0.272	−0.431	0.289	−0.518	0.276	−0.460	0.272	−0.433	0.281	−0.430	0.283	−0.786	0.309
Religion binary	−0.252	0.460	−0.268	0.472	−0.060	0.464	−0.246	0.461	−0.273	0.475	−0.729	0.560	−0.270	0.452
$W^{igo}Y$			2.179*	1.004										
$W^{dip}Y$					0.135	1.103								
$W^{proximity}Y$							−0.035	0.139						
$W^{gnipc}Y$									2.679*	1.052				
$W^{religion}Y$											0.885	0.698		
$W^{language}Y$													0.975#	0.512
_cons	−4.904***	1.424	−5.285***	1.425	−4.666***	1.358	−4.898***	1.430	−5.263***	1.406	−4.588***	1.405	−4.670***	1.389

Table 2 continued

Variables	Model I		Model II		Model III		Model IV		Model V		Model VI		Model VII	
	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
Log likelihood	−238.577		−235.720		−212.844		−238.541		−233.816		−237.994		−237.140	
Pseudo R2	0.254		0.263		0.250		0.254		0.269		0.256		0.259	
AIC	521.153		517.439		469.688		523.082		513.632		521.988		520.280	
BIC	615.322		615.888		561.189		621.532		612.081		620.437		618.729	
N	534		534		473		534		534		534		534	
R2(Nagelkerke)	0.376		0.387		0.371		0.376		0.395		0.378		0.382	
CH2	102.77		112.280		89.060		103.780		119.910		106.430		124.020	

# $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

estimated the model with all the variables included, and there was multi-collinearity again. Two-year dummies were dropped (1999 and 2008), and again we entered each social influence variable one at a time.

The baseline model is shown in Table 3 Model I. Annex I status (−), GDP per capita (−), political freedoms (+), log IENGO headquarters per capita (+), and the log of the proportion of environmental treaties ratified (+) were statistically significant at the 0.05-level. Model II shows that states ratified the Kyoto Protocol if more countries which belonged to the same inter-governmental organizations as they had ratified the Protocol. In Model III, nations ratified the Kyoto Protocol if more countries that they had diplomatic ties to had ratified the Protocol. Social influence based on similar economic status and the distance between the countries was also positively significant. In Models VI and VII, the coefficients for social influence by religious peers and language peers were significant and positive.

Looking at the interest, world society, and control variables across Models II through VII, log IENGOs headquarters per capita (+) was significant at the 0.05-level in all the models; proportion of environmental treaties ratified (logged) (+) and GDP per capita (−) were significant at the 0.05-level in five models; Annex I status (−) was significant in four models; and political freedoms (+) was significant in three models.

6.3 Robustness tests

We reran the analysis for the Kyoto Protocol to see whether the social influence effects varied by time period. We divided our observations from 1998 to 2001 and from 2002 to 2008, because the Marrakech Conference in 2001 greatly clarified what was expected of countries and we thought social influence might taper off. Our results (available upon request) showed that from 1998 to 2001 social influence based on propinquity, economic status, and language was significant at the 0.05 level, and influence based on diplomatic ties and religion was significant at the 0.07-level; from 2002 onward, all social influence effects were significant at the 0.01-level. Thus, social influence was present throughout the ratification period, but appeared to intensify after the Marrakech Conference. The interest-based variables (Annex I status, GDP per capita, political freedoms, number of IENGO headquarters) and proportion of previous treaties ratified were significant predictors of ratification pre- and post-2001 with very little difference in the magnitudes of their effects.

7 Discussion and conclusion

The goal of this article was to test whether rationalist, constructivist, or structural embeddedness theories could better explain why countries ratified the UNFCCC and the Kyoto Protocol. We argued that the hardness and softness of a treaty mattered. We first hypothesized that variables measuring countries' interests and domestic politics would be significant explaining the ratification of a hard treaty such as the Kyoto Protocol but not a soft treaty like the UNFCCC. We found for the KP that poorer countries were more likely to ratify than wealthier countries perhaps because of the financial assistance that they were promised, freedoms had a positive effect, the log of environmental headquarters per capita had a positive effect perhaps reflecting the clout of the environmental lobby, and Annex I status had a negative effect on the likelihood of ratifying the Kyoto Protocol no doubt because of the obligations they were asked to assume. Only population and industrial output as a percent of GDP were not significant in the KP models. In contrast, only

Table 3 The results of ratification of the Kyoto Protocol

Variables	Model I		Model II		Model III		Model IV		Model V		Model VI		Model VII	
	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
Annex I status	−0.709*	0.292	−0.763*	0.334	−0.458	0.296	−1.069**	0.348	−0.851*	0.331	−0.832*	0.309	−0.509#	0.277
Pop (1,000s) (log)	−0.061	0.080	−0.059	0.090	0.010	0.089	0.010	0.094	−0.036	0.092	−0.059	0.083	−0.043	0.082
GDP per capita	−2.7E–06*	1.2E–05	−3.3E–05*	1.4E–05	2.8E–05*	1.3E–05	−1.7E–05	1.3E–05	−0.4E–04*	1.5E–05	−2.5E–04*	1.3E–05	−2.8E–05*	1.3E–05
Political freedoms	0.352*	0.174	0.392*	0.188	0.373*	0.184	0.367*	0.189	0.347#	0.192	0.292	0.180	0.240	0.185
#IENGO hdqtrs per capita (log)	0.568*	0.186	0.667*	0.210	0.598*	0.201	0.532*	0.214	0.701*	0.233	0.573**	0.201	0.633*	0.207
Industry(%GDP)	−0.002	0.008	1.9E–05	0.009	−0.006	0.009	−0.5E–04	0.009	−0.007	0.010	−7.7E–04	0.009	−0.006	0.009
Forest area (%)	−0.250	0.412	−0.308	0.453	−0.398	0.449	−0.022	0.431	−0.207	0.482	−0.491	0.416	−0.522	0.427
ICSU membership	−0.125	0.254	−0.167	0.277	−0.127	0.258	−0.215	0.273	−0.215	0.284	−0.143	0.263	−0.170	0.262
Proportion of treaties ratified (log)	1.006*	0.405	1.056*	0.450	0.989*	0.433	0.795#	0.389	0.933*	0.447	1.101*	0.437	1.116*	0.432
# IENGO offices, branches, affiliates	0.133	0.114	0.146	0.125	0.023	0.125	0.180	0.117	0.185	0.129	0.131	0.119	0.055	0.118
IGO memberships	0.008	0.006	0.010	0.006	0.008	0.006	0.007	0.006	0.010	0.006	0.009	0.006	0.009	0.006
Language sum	−0.418*	0.165	−0.482*	0.190	−0.471*	0.173	−0.298#	0.176	−0.493*	0.200	−0.427*	0.172	−0.978***	0.271
Religion binary	0.170	0.254	0.152	0.285	0.211	0.271	0.023	0.254	0.117	0.300	−0.144	0.381	0.205	0.290
$W^{igo}Y$			4.393***	0.690										
$W^{dip}Y$					2.304**	0.833								
$W^{proximity}Y$							0.431**	0.142						
$W^{gnipc}Y$									4.986***	0.671				

Table 3 continued

Variables	Model I		Model II		Model III		Model IV		Model V		Model VI		Model VII	
	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE	Coef.	Robust SE
$W^{religion}Y$											1.818*	0.743		
$W^{language}Y$													1.627**	0.531
_cons	−7.057***	1.669	−7.922***	1.938	−7.454***	1.879	−6.652***	1.649	−7.497***	1.905	−6.803***	1.766	−7.100***	1.749
Log likelihood	−340.246		−328.008		−322.980		−332.686		−318.680		−336.505		−335.041	
Pseudo R2	0.203		0.231		0.216		0.220		0.253		0.212		0.215	
AIC	724.493		702.016		691.960		711.372		683.361		719.011		716.082	
BIC	831.657		814.051		803.070		823.407		795.396		831.046		828.117	
N	964		964		926		926		964		964		964	
R2 (Nagelkerke)	0.280		0.315		0.296		0.302		0.342		0.291		0.295	
CH2	129.480		174.420		143.420		154.13		194.090		140.660		177.420	

# $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

industrial output as a percent of GDP was statistically significant in our models explaining the ratification of the UNFCCC. Thus, there was support for Hypothesis 1.

We next predicted that a country's integration into world society would be important for a soft treaty like the UNFCCC but not for a hard treaty like the Kyoto Protocol. The proportion of earlier environmental treaties ratified had a significant effect on the ratification of the UNFCCC in all our models, and the presence of international environmental NGO branches/affiliates had a significant effect on the UNFCCC in all but one model. The social influence effect through IGOs could also be interpreted as a global society effect. However, IGO memberships and ICSU memberships had little effect on either treaty. For the KP, the proportion of earlier environmental treaties ratified had a positive effect on the likelihood of ratifying this treaty, but none of the other global society variables did. These results provided support for Hypothesis 2 and are consistent with von Stein (2008) who found that memberships in IGOs and local Greenpeace memberships per capita affected the ratification of the UNFCCC, but not KP.

Finally, we expected that social influence variables would be important for the hard treaty, the Kyoto Protocol, but less important for the soft treaty, the UNFCCC. Social influence based on memberships in IGOs, diplomatic ties, geography, economic status, religion, and language was statistically significant for the KP. In contrast, only social influence based on IGO memberships and economic status was significant in the ratification of the UNFCCC. These results provided support for Hypothesis 3.

Our robustness tests suggested that social influence was not constant across time periods. Figure 1 sheds light on this. The UNFCCC came out in 1992 at the time of the Earth Summit in Rio de Janeiro and most of the countries ratified it quickly. In contrast, the ratification of the KP took longer. There was some hesitation between 1998 and 2001, and then, many countries ratified. These two patterns are consistent with the argument that social influence was present in the KP but not in the UNFCCC (Burt 1987). The latter is also consistent with the robustness analysis of KP which showed that social influence prior to 2001 was more limited, but after 2001, when ratifications intensified, it was happening on many different fronts. While conventional wisdom attributes the rash of ratifications after 2001 to the Marrakech Conference and the assistance offered to poorer countries, our empirical results suggest that social influence, for some reason, intensified during this

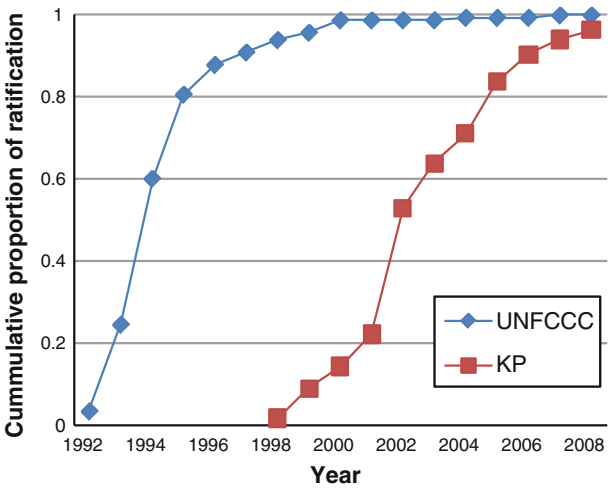

Fig. 1 The cumulative proportion of ratification

period. That much of the uncertainty surrounding the protocol was eliminated after Marrakech suggests that status competition or peer pressure may have been driving adoption after 2001 which resulted in almost every country ratifying the treaty.

Our results may help inform those designing strategies to curb climate change. The first lesson is that securing cooperation to solve global environmental problems is often a two-stage process. Soft conventions set the stage for the hard agreements that are hammered out in the protocol. Because the "softer" UNFCCC framed the problem of climate change using scientific discourse and global metaphors and established the purpose and objectives for the protocol, there was a framework for negotiation. Our concern is that world society and the global environmental community may be weakening and global conventions that use science-based arguments may be harder to sell to nations around the world. Unless countries recognize these arguments and their common fate, they will pursue their narrow self-interests.

The second lesson is that social influence can be an effective tool to elicit cooperation, but it is difficult to politically engineer these network effects. Diffusion through social influence takes time. Countries take a wait and see attitude, waiting for others to go first. In the case of KP, a variety of countries ratified the treaty in the first 2 years, none were developed nations, and self-interest was prominent.[6] That peripheral countries were innovators may explain why the treaty diffused slowly. However, this meant that the seed was cast broadly, and the idea found its way into "neighboring" countries through various routes. If social influence is an effective means to elicit international cooperation, as several researches suggest, treaty entrepreneurs need to recruit a range of countries from different regions, at different stages of development, and from different cultural backgrounds. They can build on the network formed among countries which cooperated in the KP regime, but they need to seed the idea outside of the treaty network to trigger diffusion more broadly. This strategy is a departure from the world society approach which diffuses ideas from the "core" or "center" to the "periphery" through international organizations. The latter may work for "soft" conventions, but something else is needed for "hard" protocols. Otherwise decisions are based on self–interest, and adoption will be limited to those who benefit directly.

Finally, it is important to recognize the study's limitations. UNFCCC and KP are not that dissimilar. They address the same environmental problem—climate change, with the same solutions—emission control. Also there are parts of the KP which are "soft" (e.g., enforcement and obligations of non-Annex I countries) and parts of the UNFCCC which are "hard" (e.g., clear goals and reporting obligations). Thus, these two may not be dissimilar enough to test our theory. Other factors such as exogenous world developments (e.g., 9/11, the rise of the BRICs), debates in the scientific community, and shifts in global ideologies (e.g., the spread of neo-liberal economic policies) in the intervening years could be more important. We do not have enough observations to assess this and need to analyze more treaties like Bernauer et al. (2011) before we can prove that hard and soft law matters. Finally, while quantitative analysis allows us to test theories of adoption in a rigorous manner, we need to integrate our quantitative research findings with case studies of environmental treaties. We found social influence effects among countries, but we need to illustrate these better with case material and the historical record.

[6] In1998 Maldives, Fiji, and El Salvador ratified KP. In 1999 Bahamas, Bolivia, Georgia, Guatemala, Jamaica, Mongolia, Nicaragua, Panama, Paraguay, Trinidad and Tobago, Turkmenistan, and Uzbekistan ratified KP.

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Appendix

See Tables 4 and 5

Table 4 Sources for variables

Variables	Data resources	Website
Annex I status	UNFCCC homepage	http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php
Population (1,000s)	International monetary fund database	http://www.imf.org/external/data.htm#data
GDP per capita	International monetary fund database	http://www.imf.org/external/data.htm#data
Political freedoms	Freedom house database	http://www.freedomhouse.org/
# IENGO headquarters	Union of international associations (1989–1990 to 2007–2008), Vol. 3	
# IENGO offices, branches, affiliates	Union of international associations (1989–1990 to 2007–2008), Vol. 1	
Forest area (%)	Food and agriculture organization of the UN database	http://faostat.fao.org/
Industrial (% GDP)	UN data database	http://data.un.org/Default.aspx
IGO memberships	COW Vr. 2.3: Pevehouse, Nordstrom, and Warnke (2004).	http://www.correlatesofwar.org/
ICSU membership	International Council for Science Homepage	http://www.icsu.org/about-icsu/our-members/?icsudocid=national-members
Diplomatic exchange	COW: Bayer (2006) Diplomatic exchange dataset v2006.1	http://www.correlatesofwar.org/
Geographic closeness	Gleditsch and Ward (2001)	http://privatewww.essex.ac.uk/~ksg/data-5.html
GNI per capita status	World bank	http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0contentMDK:20487070~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419~isCURL:Y,00.html
Language and religion	CIA: the world factbook 1998−2008	https://www.cia.gov/library/publications/the-world-factbook/fields/2122.html?countryName=&countryCode=&regionCode=%C2%A6; https://www.cia.gov/library/publications/the-world-factbook/fields/2098.html?countryName=&countryCode=&regionCode=o

Table 5 Sources of the ratification data

Abbreviation	Formal name	Data of adoption	Webpage
ICRW	International convention for the regulation of whaling	1948	http://www.iwcoffice.org/_documents/commission/convention_status.pdf
Ramsar	The ramsar convention on wetlands	1971	http://www.ramsar.org/key_cp_e.htm
LDC	Convention on the prevention of marine pollution by dumping of wastes and other matter	1972	http://www.imo.org/includes/blastDataOnly.asp/data_id%3D23854/2.pdf
LoS	UN convention on the law of the sea	1982	http://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&id=458&chapter=21
Vienna	Vienna convention for the protection of the ozone layer	1985	http://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-2&chapter=27&lang=en
BC	Basel convention on the control of trans-boundary movements of hazardous wastes and their disposal	1989	http://www.basel.int/ratif/convention.htm
UNFCCC	UN framework convention on climate change	1992	http://unfccc.int/files/essential_background/convention/status_of_ratification/application/pdf/unfccc_ratification_20091016.pdf
KP	Kyoto Protocol	1997	http://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-a&chapter=27&lang=en

References

Abbott, K. W., & Snidal, D. (2000). Hard and soft law in international governance. *International Organization, 54*(3), 421–456.

Anselin, L. (1988). *Spatial econometrics: Methods and models*. Dordrecht: Kluwer Academic.

Baker, F., & Hubert, L. (1981). The analysis of social interaction data. *Sociological Methods and Research, 9*(3), 339–361.

Bättig, M. B., & Bernauer, T. (2009). National institutions and global public goods: Are democracies more cooperative in climate change policy? *International Organization, 63*, 281–308.

Bernauer, T., Kalbhenn, A., Koubi, V., & Spilker, G. (2011). Is there a "depth versus participation" dilemma in international cooperation?. http://www.yale.edu/leitner/resources/IEPA-papers/Bernauer.pdf.

Burt, R. S. (1987). Social contagion and innovation: Cohesion vs. structural equivalence. *American Journal of Sociology, 92*, 1287–1335.

Cao, X. (2010). Networks as channels of policy diffusion: Explaining worldwide change in capital taxation, 1998–2006. *International Studies Quarterly, 54*, 823–854.

Congleton, R. D. (1992). Political regimes and pollution control. *Review of Economics and Statistics, 74*, 412–421.

Dinar, A., Blankespoor, B., Dinar, S., & Kurukulasuriya, P. (2010). Does precipitation and runoff variability affect treaty cooperation between states sharing international bilateral rivers? *Ecological Economics, 69*, 2568–2581.

Downs, G. W. (2000). Constructing effective environmental regimes. *Annual Review of Political Science, 3*, 25–42.

Downs, G. W., Rocke, D. M., & Barsoom, P. N. (1996). Is the good news about compliance good news for cooperation? *International Organization, 52*(3), 379–406.

Finus, M. (2008). The enforcement mechanisms of the Kyoto Protocol: Flawed or promising concepts? *Letters in Spatial Resource Science, 1*, 13–25.
Frank, D. J. (1999). The social bases of environmental treaty ratification, 1900–1990. *Sociological Inquiry, 69*, 523–550.
Fredriksson, P. G., & Gaston, N. (2000). Ratification of the 1992 climate change convention: What determines legislative delay? *Public Choice, 104*, 345–368.
Fredriksson, P. G., & Jim, R. W. (2007). Democratic institutions versus autocratic regimes: The case of environmental policy. *Public Choice, 130*, 381–393.
Fredriksson, P. G., Neumayer, E., & Ujhelyi, G. (2007). Kyoto Protocol cooperation: Does government corruption facilitate environmental lobbying? *Public Choice, 133*, 231–251.
Fujimoto, K., Chou, C., & Valente, T. W. (2011). The network autocorrelation model using two-mode data: Affiliation exposure and potential bias in the autocorrelation parameter. *Social Networks, 33*, 231–243.
Gleditsch, K. S., & Ward, M. D. (2001). Measuring space: A minimum distance database. *Journal of Peace Research, 38*(6), 749–768.
Hasenclever, A., Mayer, P., & Rittberger, V. (1997). *Theories of international regimes. Cambridge studies in international relations*. Cambridge: Cambridge University Press.
Hovi, J., Froyn, C. B., & Bang, G. (2007). Enforcing the Kyoto Protocol: Can punitive consequences restore compliance? *Review of International Studies, 33*, 435–449.
Jacobson, H. K. (2000). International institutions and system transformation. *Annual Review of Political Science, 3*, 149–166.
Karlsson-Vinkhuyzen, S. I., & Vihma, A. (2009). Comparing the legitimacy and effectiveness of global hard and soft law: An analytical framework. *Regulation and Governance, 3*, 400–420.
Marsden, P. V., & Friedkin, N. E. (1993). Network studies of social influence. *Sociological Methods and Research, 22*, 127–151.
Meyer, J. W., Frank, D. J., Hironaka, A., Schofer, E., & Tuma, N. B. (1997). The structuring of a world environmental regime, 1870–1990. *International Organization, 51*, 623–651.
Murdoch, J. C., & Sandler, T. (1997). The voluntary provision of a pure public good: The case of reduced CFC emissions and the Montreal Protocol. *Journal of Public Economics, 63*, 331–349.
Neumayer, E. (2002). Can natural factors explain any cross-country differences in carbon dioxide emissions? *Energy Policy, 30*, 7–12.
Perrin, S., & Bernauer, T. (2010). International regime formation revisited: Explaining ratification behavior with respect to long-range transboundary air pollution agreements in Europe. *European Union Politics, 11*(3), 405–426.
Pevehouse, J. C., Nordstrom, T., & Warnke, K. (2004). The COW-2 international organizations dataset Version 2.0. *Conflict Management and Peace Science, 21*, 101–119.
Simmons, B. A., & Elkins, Z. (2004). The globalization of liberalization: Policy diffusion in the international political economy. *American Political Science Review, 98*, 171–189.
Singer, J. D., & Small, M. (1966). The composition and status ordering of the international system: 1815–1940. *World Politics, 18*, 236–282.
Torfason, M. T., & Ingram, P. (2010). The global rise of democracy: A network account. *American Sociological Review, 75*, 355–377.
von Stein, J. (2008). The international law and politics of climate change: Ratification of the United Nations framework convention and the Kyoto Protocol. *Journal of Conflict Resolution, 52*, 243–268.
Ward, H. (2006). International linkages and environmental sustainability: The effectiveness of the regime network. *Journal of Peace Research, 43*, 149–166.
Weiss, E. G., & Jacobson, H. K. (Eds.). (1998). *Engaging countries: Strengthening compliance with international environmental accords*. Cambridge, MA: MIT Press.