KYOTO PROTOCOL COOPERATION: DOES GOVERNMENT CORRUPTION FACILITATE ENVIRONMENTAL LOBBYING?*

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Abstract

Does environmental lobbying affect the probability of environmental treaty ratification? Does the level of government corruption play a role for the success of such lobbying? In this paper, we propose that a more corruptible government may be more responsive to the demands of the environmental lobby. We use several stratified hazard models and panel data from 170 countries on the timing of Kyoto Protocol ratification to test this hypothesis. We find that increased environmental lobby group activity raises the probability of ratification, and the effect rises with the degree of corruption.

Keywords: Corruption; political economy; agreements; ratification; environmentalism.

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I. INTRODUCTION

The ratification stage of an international environmental agreement (IEA) is a crucial part of cooperation on global pollution problems. Relatively little is known about which factors contribute to IEA ratification (or the absence of it), although domestic politics and the degree of democracy are often viewed as important.[1] In this paper, we explore the roles of government corruption and *environmental* lobby groups for IEA ratification, with a particular focus on the Kyoto Protocol. Ratification was clearly a pivotal stage of the Kyoto process, with the Russian Federation ratifying only in late 2004, bringing the treaty into force, and the United States having withdrawn completely.[2]

Our inquiry is motivated by, for example, the observation that Mexico ratified the Kyoto Protocol almost two years earlier than South Africa, despite both countries having eleven environmental lobby groups and being at comparable levels of economic development.[3] Note that Mexico has a higher level of government corruption (lower government integrity) than South Africa.[4] More generally, Figure 1 points in the direction of an important interaction effect between environmental lobby group strength and governmental integrity. It shows the average ratification delay in days for four groups of countries: (*a*) countries with below median environmental lobby group strength and below median governmental integrity (using World Bank data, see Table II); (*b*) countries with above median environmental strength and below

[1] Murdoch *et al*. (2003, p. 360) argue that "The Kyoto Protocol also indicates that lobbying interests may also influence the ratification stage." On the role of democracy, see for example Congleton (1992), Murdoch and Sandler (1997), Fredriksson and Gaston (2000), Neumayer (2002a, 2002b), and Beron *et al*. (2003). In a study of the Helsinki Protocol on sulphur emissions, Murdoch *et al*. (2003) study both the participation decision and the degree of participation, and find a weaker effect of democracy than many other studies. See Congleton (2001) for a useful survey of the literature on the political economy of environmental treaties.
[2] To gain legal force, 55 countries representing 55% of Annex 1 country emissions had to ratify the Kyoto Protocol. As of September 28, 2006, 166 countries representing 61.6% of Annex 1 year 1990 emissions had ratified (or equivalently, acceded to) the Protocol (see http://unfccc.int/2860.php).
[3] Our data on environmental lobby groups comes from the International Conservation Union (www.iucn.org).
[4] According to the corruption measures of International Country Risk Guide, Transparency International, and the World Bank (see Table II for details), Mexico had average scores of 2.65, 2.66 and -.351, respectively, over the

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median integrity; (*c*) countries below median environmental strength and above median integrity; and (*d*) countries that are above the median both in terms of environmental lobby group strength and governmental integrity. Figure 1 suggests that the combination of high environmental lobby group strength and low government integrity speeds up ratification.

In this paper we posit that a government will be more likely to ratify an IEA the stronger the environmental lobby in the country. In turn, we expect this effect to be reinforced if the government is more corruptible because such a government will be more responsive to lobbies' demands. Our empirical work uses panel data on the timing of Kyoto Protocol ratification to test these hypotheses. Our basic models employ a stratified semi-parametric Cox proportional hazard model, which allows the baseline hazard of ratification to differ across groups (Cox and Oakes, 1984).[5] Stratification is important since Annex 1 and non-Annex 1 countries have widely different responsibilities under the protocol, which may affect the likelihood of ratification. In addition, we also use stratified fully parametric Weibull, Gompertz, lognormal, and logit models.

We find that environmental lobbying is empirically important for the timing of Kyoto Protocol ratification. Countries with a greater number of environmental lobby groups (corresponding to a greater number of environmentalists) ratify the Kyoto Protocol *earlier*, i.e. they have a higher probability of ratification in any time period. Moreover, the effect is conditional on the degree of government corruption. Greater corruption raises the influence of the environmental lobby groups. To our knowledge, this is the first evidence that environmental lobbying is facilitated by policymaker corruption. We find only limited evidence of an effect of

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period of our study (higher scores signal less governmental corruption). South Africa's respective scores are 3.025, 4.16 and 0.431.

[5] Since real world ratification processes take place over time, duration models (which capture *when* treaty ratification occurs) are likely to capture the most amount of information regarding ratification probabilities. Most earlier empirical studies of environmental treaty ratification probabilities focus on the event, rather than the timing of ratification, thus ignoring some valuable information. In our view, early ratifying countries signal their commitment to the IEA, raising the likelihood of its eventual success. The Cox proportional hazard model has

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industry lobbying on ratification, possibly due to the difficulty of measuring industry lobby group strength precisely, or the pro-Protocol agendas of some industry lobbies, which might benefit from the Kyoto Protocol.

The literature on international environmental treaties appears to have ignored the impact of corruption and environmental lobbying, despite recent theory and evidence that these forces are important for policy outcomes addressing local environmental problems. For example, López and Mitra (2000) develop a theory of the effect of corruption on the environmental Kuznets curve, and Fredriksson and Svensson (2003) study the interaction effect between corruption and political instability on agricultural sector environmental policies. To our knowledge, no previous paper studies the links between corruption and global environmental policymaking.

The impact of environmental groups on IEAs has not been extensively studied either. Hillman and Ursprung (1992), Aidt (1998, 2004), and Conconi (2002, 2003) study the theoretical effects of environmental lobby groups on environmental policy outcomes. On the empirical side, Durden *et al*. (1991) report that environmentalists have below average impact on coal strip-mining legislation (relative to other groups). Kalt and Zupan (1984) and Fowler and Shaiko (1987) report weak and inconsistent relationships between lobbying efforts of environmental interest groups and roll call votes in the US Congress. VanGrasstek (1992) finds an effect of environmental lobby groups' political action during the NAFTA negotiations in the US Senate, Cropper *et al*. (1992) finds that intervention by environmental advocacy groups raises the probability that the USEPA cancelled a pesticide registration, and Riddel (2003) shows that the Sierra Club and the League of Conservation Voters have been successful in influencing US Senate election outcomes using campaign contributions (via political action committees).

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previously been used in the literature (see, e.g., Fredriksson and Gaston, 2000; Neumayer, 2002a), and we therefore select this as our benchmark model.

Fredriksson *et al*. (2005) show that the number of environmental lobby groups positively influences the stringency of lead-content regulation for gasoline.[6]

The paper is organized as follows. Section II presents the hypothesis specification, Section III describes the empirical approach, and Section IV reports our results. Section V provides a brief conclusion.

II. HYPOTHESIS SPECIFICATION

Our aim in this section is to provide an intuitive hypothesis specification, based on the existing literature in the vein of the well-known Grossman and Helpman (1994) common agency approach. The existing literature on lobbying and corruption is vast (see, e.g., Jain (2001) and Aidt (2003) for surveys). While the previous literature argues that *industry* lobbying in the environmental policy area is affected by government corruption (see, e.g., Fredriksson *et al*., 2004), the role of corruption for the impact of *environmental* lobbying remains cloudy.

Consider a corruptible government facing an environmental treaty ratification decision who values both social welfare and bribes (contributions) offered by environmental (pro-reform) and industry (anti-reform) lobby groups. In the outcome of the political game, the concerns of the environmental lobby will affect the government's ratification decision through two channels. First, environmental concerns enter in social welfare, and are therefore *directly* valued by the government. Second, a policy more favorable to the environmental lobby will trigger a larger contribution from this group. Because the government values contributions, environmental concerns will also affect the policy decision *indirectly*. The magnitude of this indirect effect depends on the degree to which the government favors bribes relative to social welfare.

[6] Fredriksson and Ujhelyi (2005) study the impact of environmental and industry lobby group influence on IEA ratification probabilities under different institutional structures. Their focus is on differences in the number of veto players across countries, and do not consider the effect of corruption.

Following Schulze and Ursprung (2001) and Fredriksson and Svensson (2003), we interpret the government's weight on social welfare as the degree of government corruption. Thus, the environmental lobby group's influence on the probability of IEA ratification is *conditional* on the degree of corruption. In essence, increased corruption widens the channel through which environmental lobby group pressure may be exerted on policymakers.[7]

This discussion implies that the probability that a government ratifies the IEA, ρ, may be written as

$$\rho = f(e, e \cdot c, \mathbf{x}), \quad (1)$$

where e is the strength of the environmental lobby's preferences, c is the degree of government corruption, and $\mathbf{x}$ are control variables. Writing $\frac{d\rho}{de} = f_1 + f_2 c$, the hypothesis we test in this paper is that $f_1 > 0$ (the strength of the environmental lobby's preferences directly increases the likelihood of ratification) and $f_2 > 0$ (a more corrupt government is more responsive to these preferences).

III. EMPIRICAL APPROACH

The Empirical Model

Our objective is to test the hypothesis proposed in the previous section using panel data from up to 170 countries on the ratification of the Kyoto Protocol.[8] We start by observing that ratification is not a one-time event, but takes place over a longer period (more than 6 years for

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[7] While the type of influence that an environmental lobby can exert on politicians may not be restricted to monetary bribes, in our view a politician will be more receptive to any form of contribution which she might use for her private gain, when corruption in the country is high. This includes promises of political support or the threat of a negative campaign, provision of information, as well as money (bribes). See Riddel (2003) for recent empirical evidence of how several environmental lobby groups influenced political decisions made in the U.S. Senate with the help of political contributions (PACs).

[8] We view this IEA as particularly appropriate for our analysis since it is considerably more demanding in terms of associated abatement costs than any other existing IEA.

the Kyoto Protocol). Thus, ignoring the *duration* of ratification events may mask important factors influencing them.[9] Next, we note that casual inspection of the timing of ratifications suggests a sharp difference between Annex 1 and non-Annex 1 countries' ratification behavior. While many non-Annex 1 countries ratified within two years, Annex 1 ratifications did not begin until three years after the Protocol was opened for ratification.[10] The differing behavior across country groups appears natural since only Annex 1 countries currently have legal obligations under the Kyoto Protocol (note, however, that even non-Annex 1 countries may believe that they could face obligations during future negotiations, possibly making them apprehensive about early ratification). Thus, we need an estimation technique that allows stratification according to Annex 1 membership.

Based on these considerations, our benchmark model is the stratified Cox proportional hazard model. In this approach, the dependent variable in equation (1), ρ, is replaced by the conditional probability $\rho(t)$ that ratification occurs at time t given that the country has not ratified before t; this is the *hazard* of ratification. Next, the function f is specified to be exponential, so that (1) becomes

$$\rho_i(t) = \rho_{0i}(t)\exp(\alpha_1 e(t) + \alpha_2 e(t)\cdot c(t) + \boldsymbol{\beta}^T \mathbf{x}(t)), \qquad (2)$$

where i stands for the ith stratum (Annex 1 or non-Annex 1), $\rho_{0i}(t)$ is the "baseline hazard", differing between strata of countries (but uniform within a stratum), and (α_1, $\alpha_{2,}$ $\boldsymbol{\beta}^T$) are parameters to be estimated. Notice that the covariates (e, c, $\mathbf{x}$) may change over time (e.g., the government's corruptibility may change). Our use of panel data exploits this feature of the Cox model. Furthermore, the time-variant underlying baseline hazard of ratification may depend on

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[9] Duration analysis has been used also by Fredriksson and Gaston (2000) to investigate ratification behavior for the UN Framework Convention on Climate Change, and by Neumayer (2002a) to analyze ratification of the Montreal Protocol, the Biodiversity Convention and the Convention on International Trade in Endangered Species.

[10] The first Annex 1 country to ratify was Romania (March 19, 2001), followed by the Czech Republic (November 15, 2001) and Iceland (May 23, 2002).

unobserved variables, possibly in complex ways. An advantage of the Cox model is that the baseline hazard does not need to be estimated. In our Maximum Likelihood estimation the likelihood function is constructed using the observation that the probability that country *i* ratifies at time t_i equals

$$\hat{\rho}_i(t_i) = \frac{\rho_i(t_i)}{\sum_{j|t_j \geq t_i} \rho_j(t_i)} = \frac{\exp(\alpha_1 e(t_i) + \alpha_2 e(t_i) \cdot c(t_i) + \boldsymbol{\beta}^T \mathbf{x}_i(t_i))}{\sum_{j|t_j \geq t_i} \exp(\alpha_1 e(t_i) + \alpha_2 e(t_i) \cdot c(t_i) + \boldsymbol{\beta}^T \mathbf{x}_i(t_i))}. \qquad (3)$$

The likelihood function to be maximized with respect to the vector (α_1, α_2, $\boldsymbol{\beta}^T$) then equals $\prod_{t_i} \hat{\rho}_i(t_i)$.[11]

Main Variables and Data

The sample contains 170 countries, resulting in a total of 738 observations. Countries become "at risk" of ratification on March 16, 1998, when the Kyoto Protocol was opened for ratification. Time is measured in days. Countries either exit the sample by ratifying, or remain at risk until December 15, 2002 (day 1735), the last observation date for which we have data on all explanatory variables (the data is right-censored).[12] Table I shows the breakdown of the sample into ratifying/non-ratifying and Annex1/non-Annex1 countries. 88 countries (51.7 %) ratified before December 15, 2002, while the remaining countries exited the sample without ratifying. Among those that ratified, the mean duration was 1230 days, with a standard deviation of 459 days. Fiji ratified first, after 185 days. The last country to ratify in the sample was South Korea,

[11] See Cox and Oakes (1984) and Lancaster (1990) for further discussions of duration models.

[12] This cut-off date has the additional advantage that countries' ratification decisions until that point in time were less likely to have been affected by the possible changing (perceived) probabilities of the Protocol gaining legal force, as during the year 2003 the Russian Federation sent various conflicting signals regarding its ratification intentions. Ratification of the Protocol by the United States has always been highly unlikely, even long before the Bush administration's formal denouncement of the Protocol. Policy makers in other countries may therefore have anticipated that Russia would become the crucial veto player. In late 2004 Russia eventually ratified the Protocol.

after 1698 days. Data sources and descriptive statistics for our explanatory variables are provided in Table II.

The main variable of interest in this study is the strength of the environmental lobby, *e*. We measure this using the number of national environmental non-governmental organizations that are members of the World Conservation Union (ENGO). In the absence of either data on lobby group size or evidence suggesting sharply different group sizes across countries, ENGO is assumed to reflect the number of individuals with strong environmental preferences across countries.[13]

Industry lobby group (although not a variable of main interest in the present study) variables are also included. Data is not readily available on the size or number of industry sector lobby groups across countries. To capture the political pressure of the industry lobby (and to show that the use of a particular variable does not drive our results), we use three alternative proxies. These seek to reflect the amount at stake in the ratification policy outcome. First, the share of the labor force employed in the industrial sector (%INDUSTRY) provides a proxy for the economic importance of the mining and quarrying (including oil production), manufacturing, electricity, gas and water, and construction sectors. These industries are all likely to be heavily affected by climate change policies. %INDUSTRY covers broadly the economic sectors likely to suffer the most from the Kyoto Protocol, and is our main measure of industry influence. Second, we use a dummy variable for whether a country has a national committee or group of the International Chamber of Commerce (ICC). Many green organizations view the ICC as the main representative of industry interests on the Kyoto negotiations.[14] Third, the share of fuel exports

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[13] More precisely, the assumption is that ENGO reflects the number of organized consumers in a country, *controlling* for the variables described below (e.g., population).

[14] See, for instance, Corpwatch at http://www.corpwatch.org, and the Corporate Europe Observatory, at http://www.corporateeurope.org.

as a percentage of total merchandise exports (%FUEL) reflects the pressure arising from fuel producing firms directly affected by changes in fuel prices (see Neumayer, 2002a).

To capture government corruptibility, *c*, we employ three different measures. This is a main variable of interest, and using several measures enables us to judge whether our results are robust across different ways of measuring this difficult-to-quantify concept. The three measures yield somewhat different sample sizes (and thus an additional robustness check). All three are scaled so that higher levels correspond to a lower *c*, we therefore refer to them as government *integrity*. First, the International Country Risk Guide (ICRG) measure is provided by a private firm which sells country information to international investors based on their analysts' assessment of investment risk. This variable, INTEGRITY1, is measured on a 0 (lowest integrity) to 6 (highest integrity) scale. INTEGRITY2 is provided by Transparency International, a non-governmental organization devoted to the combating of corruption. INTEGRITY2 is a composite index, making use of multiple surveys of businesspeople and assessments by country analysts. It is measured on a 1 to 10 scale, with a higher score suggesting greater integrity. Since it does not provide an estimate for the degree of integrity for all countries in all years, we use the average integrity value over the period 1998 to 2002 (to avoid loss of observations). INTEGRITY3 comes from the World Bank's Governance Database (Kaufmann et al., 2003) and is also based on several different sources: partly polls of experts, and partly surveys of residents and businesspeople within a country. A linear unobserved components model is used to aggregate these various sources into one aggregate indicator.[15] Since INTEGRITY3 is available only for years 1997/8, 2000/1, and 2002/3, we use linear interpolation for the relevant two missing years.

A main hypothesis emerging from discussion of the stylized facts and the previous literature is the prediction that the effect of an increase in the number of environmental lobby groups is conditional on the degree of integrity. We therefore include the relevant interactions, ENGO* INTEGRITY*h*, *h*=1,2,3. For consistency, we also include the relevant INTEGRITY*h* interactions with the three proxies for industry lobbying (%INDUSTRY, ICC, %FUEL). Note that when an interaction term is significant, the coefficients on the individual components cannot be interpreted in the conventional way. Instead, in a model with a significant interaction term ENGO* INTEGRITY*h*, the coefficient on ENGO itself is the effect of ENGO when INTEGRITY*h* is equal to zero. For this reason, we re-scale the INTEGRITY2 and INTEGRITY3 variables such that the lowest observed value is equal to zero, similar to the INTEGRITY1 variable, which has this property already in its original form. This ensures that the coefficient of the ENGO variable always has the same substantive meaning, namely the effect of ENGO strength on ratification at the smallest value of INTEGRITY*h*.

Besides the main variables of interest, we include a number of controls. In order to capture abatement costs, we include per capita CO_2 emissions (CO2PC), population (POP), and area of a country (AREA). Higher levels of CO2PC may imply lower marginal abatement costs, assuming decreasing marginal returns to abatement. Alternatively, higher CO2PC may make a country more reluctant to ratify because the cost of inputs may increase relatively more (Fredriksson and Gaston, 2000). Thus, the expected effect of CO2PC is ambiguous. CO_2 emission data are not yet available for the years 2001 onwards. For this reason we used linear extrapolation to extend the data to 2002.[16] POP and AREA are commonly used proxies for the "resource base" (see Congleton, 1992). A higher resource base could reduce the cost of environmental regulation.

The second set of controls relates to environmental damages. The length of coastline (COAST) captures the fact that rising sea levels caused by global warming would more

[15] One of the sources used for INTEGRITY3 is ICRG, i.e. there is some overlap between the INTEGRITY1 and INTEGRITY3 variables. Due to the use of several sources, the latter variable has a greater sample size.

adversely affect states with long coastlines (Fredriksson and Gaston, 2000). ISLAND, created by the ratio COAST/AREA, reflects the likelihood that small island states are more likely to be severely affected than mainland countries. Moreover, assuming environmental quality is a normal good, citizens in countries with higher per capita real income (GDPPC) may be expected to demand an earlier ratification. Many earlier studies find a positive effect of per capita income on environmental quality (see, for example, Millimet *et al*., 2003).

We also include a dummy for the former socialist countries in Eastern Europe (SELLER), where firms have low marginal abatement costs. These countries are commonly believed to become sellers of tradable emission rights (hence obtain revenues) in the international emission trading system established by the Protocol. Thus, SELLER should have a positive effect on the ratification probability.

Finally, we include the combined democracy index, published by the Freedom House (DEMOCRACY). This takes values equal to 1 (not free), 2 (partially free), and 3 (free). Democratic values and institutions have frequently been reported to have a positive effect on IEA ratification probabilities (Congleton, 1992; Murdoch and Sandler, 1997) and other types of environmental policies (Deacon, 1999).[17]

IV. EMPIRICAL RESULTS

In our stratified proportional hazard model, we allow the baseline hazard to differ between Annex1 and non-Annex1 countries. Grambsch-Therneau tests of the proportional hazard assumption (not reported, available upon request) clearly show the need to stratify our

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[16] Our results are robust to alternative specifications, in particular if the 1998-2000 average is used over the entire period of study (results available from the authors upon request).

[17] Note that all time-dependent factors common to all countries (including new public information regarding the effects of climate change, or ratification by a major player) are controlled for by the baseline hazard (see equation (2)).

estimations according to whether countries belong to the Annex 1 or non-Annex 1 group (Grambsch and Therneau, 1994). Moreover, for all models reported below, the test did not reject the proportionality assumption within the individual strata.

In Models 1 and 2 in Table III, we include our control variables only. Of these, only DEMOCRACY and ISLAND have a significant positive effect on the ratification hazard. The finding for DEMOCRACY confirms much of the previous literature. The positive coefficient for ISLAND suggests that serious potential environmental damages due to a high coastline/area ratio induce countries to ratify earlier. POP, GDPPC, CO2PC, and SELLER are all insignificant. Abatement costs or windfall gains appear not to have significant effects on countries' ratification behavior towards the Kyoto Protocol.

In Models 3-5, we add our different measures of governmental integrity (INTEGRITY*h*), measures of environmental (ENGO) and industry lobbying (%INDUSTRY), as well as their interactions. We find that ENGO raises the ratification probability in all models and that the effect is conditional on the degree of government integrity. The interaction ENGO*INTEGRITY*h*, *h*=1,2,3, is negative and significant in all three models. Thus, whereas an increase in the number of environmental lobby groups has a positive effect on the probability of ratification, the effect declines as the degree of government integrity increases. Lower integrity facilitates influence-seeking for the environmental lobby groups. For example, Model 4 suggests that whereas the marginal effect of ENGO at the mean of INTEGRITY2 equals 0.026 (=∂PROBABILITY/∂ENGO =0.083-0.015*3.778), at one std. dev. below the mean the marginal effect equals 0.062 (=0.083-0.015*(3.778-2.368)).[18]

The interaction variables %INDUSTRY*INTEGRITY*h* have positive signs while %INDUSTRY itself is negative. However, these are not always statistically significant. Thus, we

[18] We evaluate the marginal effects using the average of the yearly means and std. devs. of INTEGRITY2.

find only limited evidence that industry lobbying lowers the likelihood of Kyoto Protocol ratification, or that the negative effect declines as governmental integrity improves.[19] Moreover, whereas DEMOCRACY remains significant, ISLAND loses its significance level in Models (3) and (4). The latter is due to the fact that many early ratifying small island countries drop out of the sample due to lack of data.

Table IV provides a number of models with our alternative measures of industry lobby group strength. This analysis also serves as a robustness check, since it may be the case that environmental lobby groups, being political opponents of the firm lobby, influence the success of their rivals. Thus, our ENGO results in Table III may have been due to particularly strong lobbying efforts by environmental groups stemming from heavy industry lobbying in some countries. However, the results reported in Table IV are highly consistent with our earlier findings. ENGO is positive and significant in all models and its interaction with INTEGRITY*h* is always negative and significant. Lack of integrity affects ratification by offering environmental lobby groups an easier channel through which political pressure may be exerted on governments. The main difference to the results reported in Table IV is that now industry lobbying has no discernible effect on the probability of Kyoto Protocol ratification. DEMOCRACY remains highly significant in all models, while POP and GDPPC never reach significance. ISLAND is positive and significant in only one model.

We perform a number of additional robustness tests. First, in a duration analysis such as ours, "tied failures" in the dataset (two or more countries ratifying on the same day) might be a concern if non-random. In our dataset, the only problematic tied failure is the 15 countries of the

[19] We acknowledge that due to poor data quality (and possible conflicting lobbying incentives, as discussed in the text above) we are unable to shed much light on the impact of industry lobbying on the Kyoto Protocol. This appears to be an interesting avenue for future research.

European Union (representing more than 50% of Annex 1 ratifications) ratifying jointly.[20] Therefore, all the models were run on a modified dataset in which the EU countries were taken out of the sample. The results were robust to this modification.

Second, while the Cox proportional hazard model is highly flexible, being a semi-parametric model it may be less efficient than fully parametric models (Collett, 1999; Hosmer and Lemeshow, 1999). The latter models require the choice of an underlying survival (or hazard) distribution. The Weibull and Gompertz distributions are particularly suited for data in which the hazard of ratification increases (or decreases) monotonically over time. The lognormal distribution is particularly suited for data in which the hazard first increases and then declines.[21] As a first step, visual inspection of our ratification data shows that over the period of study the hazard of ratification appears to increase monotonically. This suggests that the Weibull and Gompertz distributions may be suitable. Second, we used the Akaike Information Criterion (AIC). The model with the lowest AIC is usually selected, where $AIC = -2\ln L + 2(a+b)$, and where $\ln L$ is the log-likelihood of the estimation, a is the number of covariates in the model, and b is the number of distribution-specific parameters. With our data, the exact results depend on which measures of government integrity and industry lobby group strength are included in the estimations. However, across all estimations the Weibull and the Gompertz models perform close to identically. According to the AIC, both are slightly superior to the lognormal model. Table V reports the Weibull estimation results with robust standard errors using alternative measures of industry lobbying strength and INTEGRITY*h*. These regressions generally remain consistent with our earlier findings, as are the Gompertz distribution results (available from the authors upon request). Finally, Table VI reports logit estimation results (using year-specific time

[20] The other tied failures (in the large dataset) are Guinea, Kiribati and Mexico; Mali and Papua New Guinea; Bhutan, Chile, India and Tanzania; and Cameroon and Thailand.
[21] While the exponential distribution is also popular, it is merely a specific case of the Weibull distribution.

dummies to model the time-dependency of ratification), which are also largely consistent with our earlier findings (using probit instead of logit leads to substantially very similar results). Thus, our results appear highly robust to the choice of estimation technique.

V. CONCLUSION

In this paper, we explore how environmental lobbying aimed at influencing the ratification of international environmental agreements (IEA) is affected by the level of government corruption. The hypothesis tested is that an increase in the number of environmental lobby group members raises the ratification probability, and the effect is increasing in the level of government corruption. Greater corruption affords the environmental lobby group a greater opportunity to influence the government ratification decision, *ceteris paribus*.

We test this hypothesis using panel data on Kyoto Protocol ratification. We find that environmental lobbying raises the ratification probability, and the effect is stronger where the level of corruption is high. To our knowledge, this is a novel finding in the literature.

Our finding suggests that support offered by international organizations (such as the World Bank) to environmental lobby groups in developing countries may be particularly effective where governments' receptiveness to interest group influence – as measured by corruption – is high. Another implication is that corruption reform may actually reduce the influence of environmental interest groups. However, since such reform should also reduce the influence of industry lobby groups (although not detected in our data), its overall effect on cooperation on global environmental problems is unclear. Future research may address this issue. Our results should not be misconstrued as reason for delaying or avoiding policy reform aimed at reducing corruption. However, additional support to environmental lobby groups (from, e.g., the World Bank) may be required at the time of corruption reform in order for the political pressure on governments to undertake environmental policy reform not to decline as a result.

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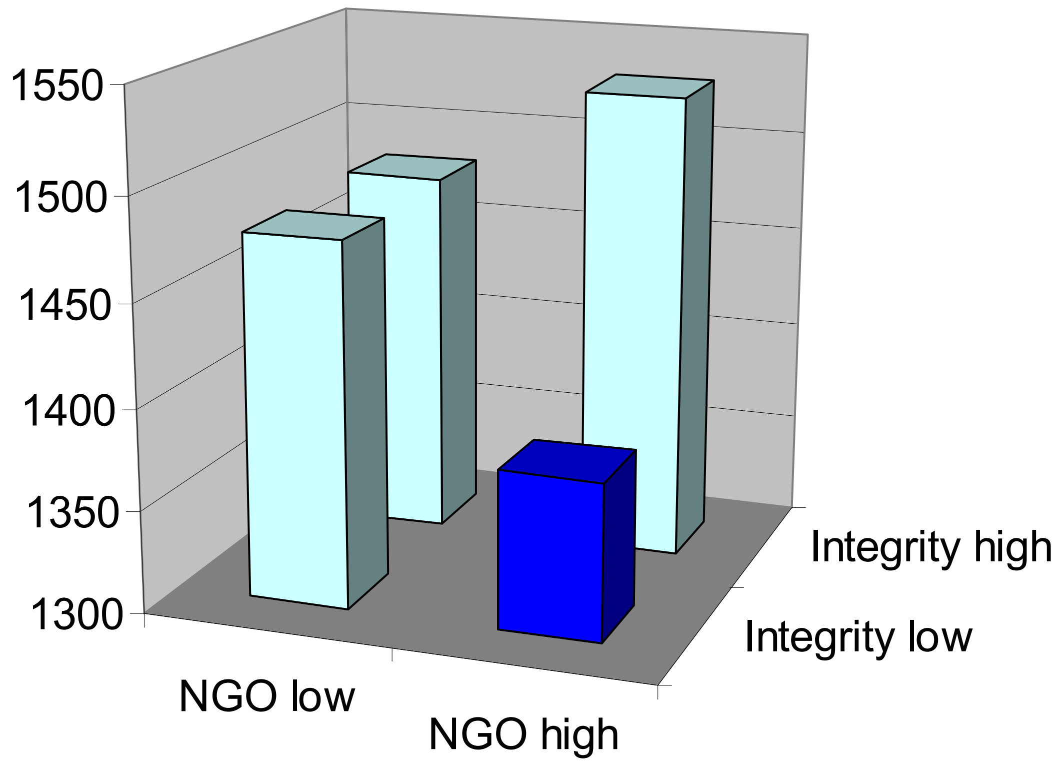
Figure 1.

Ratification delay in days for combinations of low and high environmental lobby group strength and governmental integrity



	NGO low	NGO high
Integrity low	1478	1377
Integrity high	1481	1530

Table I. Breakdown of the Sample by Ratification Behavior and Annex1 membership

Ratified before 12/15/2002?	Country		Total
	Annex1	non-Annex1	
Yes	26	62	88
No	10	72	82
Total	36	134	170

Table II. Variables and Data Sources

Variable		No. of Countries	Mean	Std. Deviation	Min	Max	Source
GDPPC (1000 $)	1998	170	6.32	10.12	0.11	50.62	WDI
	1999	162	6.46	10.54	0.11	53.01	
	2000	148	6.93	11.32	0.11	56.21	
	2001	137	7.14	11.70	0.12	56.38	
	2002	121	7.58	12.39	0.12	56.45	
POP (100 million)	1998	170	0.33	1.25	0	12.42	WDI
	1999	162	0.35	1.29	0	12.54	
	2000	148	0.39	1.36	0	12.62	
	2001	137	0.41	1.43	0	12.72	
	2002	121	0.45	1.53	0	12.81	
DEMOCRACY	1998	170	2.18	0.80	1	3	FH
	1999	162	2.25	0.80	1	3	
	2000	148	2.22	0.79	1	3	
	2001	137	2.22	0.79	1	3	
	2002	121	2.22	0.81	1	3	
CO2PC (metric tons)	1998	170	4.35	5.57	0.15	34.20	WDI
	1999	162	4.17	5.03	0.16	28.98	
	2000	148	4.03	5.02	0.16	29.10	
	2001	137	4.12	5.17	0.16	29.23	
	2002	121	3.81	4.38	0.16	20.85	
INTEGRITY1	1998	128	3.21	1.25	0	6	ICRG
	1999	123	3.13	1.24	0	6	
	2000	114	3.04	1.24	1	6	
	2001	107	2.93	1.27	0.17	6	
	2002	94	2.60	1.29	0	6	
INTEGRITY2	1998	106	3.63	2.31	0	9	TI
	1999	103	3.68	2.32	0	9	
	2000	95	3.77	2.38	0	9	
	2001	90	3.84	2.38	0	9	
	2002	81	3.97	2.45	0.66	9	
INTEGRITY3	1998	167	1.92	1.00	0.46	4.47	WBG
	1999	160	1.94	1.00	0.55	4.44	
	2000	147	1.96	1.03	0.13	4.43	
	2001	137	1.98	1.02	0.53	4.36	
	2002	121	1.97	1.06	0.19	4.28	
%INDUSTRY (percent)	1998	170	21.4	11.2	0.9	64.2	WDI
	1999	162	21.0	10.8	0.9	54.2	
	2000	148	21.1	11.2	0.9	54.2	
	2001	137	21.3	11.3	0.9	54.2	
	2002	121	20.9	11.1	0.9	48.7	
%FUEL (percent)	1998	129	13.58	24.65	0	96.98	WDI
	1999	125	13.96	24.47	0	96.48	
	2000	116	16.51	27.26	0	99.63	
	2001	108	16.68	27.30	0	99.63	
	2002	93	15.95	26.68	0	99.63	
ICC		169	0.49	0.50	0	1	ICC
ENGO		170	4.19	6.73	0.00	44.00	IUCN
AREA (100 000 km^2)		170	7.34	20.31	0.00	170.75	CIA
COAST (10 000 km)		170	0.43	1.98	0.00	24.38	CIA
ANNEX1		170	0.21	0.41	0	1	UNFCCC
SELLER		170	0.08	0.27	0	1	UNFCCC

(continued on next page)

Notes:
ICRG: Data from the International Country Risk Guide, available at http://www.icrgonline.com
WBG: Data from the World Bank's Governance Database, available at
http://www.worldbank.org/wbi/governance/pubs/govmatters3.html
TI: Data from Transparency International, available at http://www.transparency.org/
WDI: Data from the World Bank Development Indicators database, available at http://www.worldbank.org.
FH: Freedom House country ratings, available at: http://www.freedomhouse.org/ratings/index.htm
ICC: Data from the website of the International Chamber of Commerce, available at
http://www.iccwbo.org/index.asp
IUCN: Data from the official IUCN website, at: http://www.iucn.org
UNFCC: Data from the official UNFCCC website, at: http:// www.unfccc.org.
CIA: Data from The World Factbook, U.S. Central Intelligence Agency, 2002, available at:
http://www.cia.gov/cia/publications/factbook

Table III. Cox Proportional Hazard Estimation Results I

Model:	(1)	(2)	(3)	(4)	(5)
ISLAND	0.060	0.071	-0.011	-0.170	0.108
	(0.026)**	(0.028)**	(0.109)	(0.306)	(0.057)*
POP	0.043	0.048	-0.008	-0.034	0.001
	(0.070)	(0.069)	(0.092)	(0.098)	(0.072)
GDPPC	0.018	0.029	0.001	0.023	0.020
	(0.014)	(0.022)	(0.015)	(0.014)	(0.014)
DEMOCRACY	0.538	0.522	0.918	0.996	0.612
	(0.176)***	(0.178)***	(0.234)***	(0.273)***	(0.205)***
CO2PC		-0.045			
		(0.035)			
SELLER		0.063			
		(0.763)			
ENGO			0.141	0.083	0.124
			(0.056)**	(0.041)**	(0.044)***
%INDUSTRY			-0.060	-0.038	-0.070
			(0.043)	(0.030)	(0.031)**
INTEGRITY 1			-0.110		
			(0.446)		
ENGO*INTEGRITY1			-0.040		
			(0.016)**		
%INDUSTRY*INTEGRITY1			0.022		
			(0.018)		
INTEGRITY2				-0.398	
				(0.250)	
ENGO*INTEGRITY2				-0.015	
				(0.008)*	
%INDUSTRY*INTEGRITY2				0.015	
				(0.009)*	
INTEGRITY3					-0.885
					(0.508)*
ENGO*INTEGRITY3					-0.039
					(0.015)**
%INDUSTRY*INTEGRITY3					0.038
					(0.018)**
Observations	738	738	566	475	732
Countries	170	170	128	106	167
Log likelihood	-315.7	-314.9	-241.8	-215.0	-333.6

Notes: Robust std. errors within parenthesis. *(**)[***] represents significant at the 10(5)[1]% level.

Table IV. Cox Proportional Hazard Estimation Results II

Model:	(1)	(2)	(3)	(4)	(5)	(6)
ISLAND	-0.021	-0.263	-0.168	-0.006	-0.131	0.126
	(0.163)	(0.383)	(0.160)	(0.116)	(0.310)	(0.054)**
POP	-0.010	-0.062	-0.018	-0.004	-0.041	-0.003
	(0.082)	(0.087)	(0.081)	(0.084)	(0.093)	(0.067)
GDPPC	0.004	0.021	0.029	0.008	0.015	0.019
	(0.019)	(0.021)	(0.020)	(0.015)	(0.015)	(0.014)
DEMOCRACY	1.101	1.240	1.078	0.919	1.084	0.673
	(0.266)***	(0.299)***	(0.257)***	(0.237)***	(0.277)***	(0.208)***
ENGO	0.118	0.113	0.104	0.128	0.108	0.100
	(0.059)**	(0.050)**	(0.049)**	(0.056)**	(0.050)**	(0.049)**
%FUEL	-0.022	-0.009	-0.009			
	(0.019)	(0.013)	(0.013)			
ICC				0.548	-1.020	-0.652
				(0.817)	(0.776)	(0.697)
INTEGRITY1	0.287			0.502		
	(0.215)			(0.320)		
ENGO*INTEGRITY1	-0.036			-0.037		
	(0.016)**			(0.016)**		
%FUEL*INTEGRITY1	0.008					
	(0.006)					
ICC*INTEGRITY1				-0.176		
				(0.317)		
INTEGRITY2		-0.000			-0.354	
		(0.146)			(0.228)	
ENGO*INTEGRITY2		-0.021			-0.020	
		(0.009)**			(0.009)**	
%FUEL*INTEGRITY2		0.005				
		(0.003)				
ICC*INTEGRITY2					0.426	
					(0.250)*	
INTEGRITY3			-0.082			-0.510
			(0.300)			(0.385)
ENGO*INTEGRITY3			-0.039			-0.035
			(0.016)**			(0.016)**
%FUEL*INTEGRITY3			0.006			
			(0.007)			
ICC*INTEGRITY3						0.579
						(0.402)
Observations	508	436	568	563	472	729
Countries	115	97	129	127	105	166
Log likelihood	-188.1	-161.9	-216.5	-241.9	-214.1	-333.9

Notes: Robust std. errors within parenthesis. *(**)[***] represents significant at the 10(5)[1]% level.

Table V. Weibull Estimation Results

Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
ISLAND	-0.027	-0.112	0.104	-0.027	-0.177	-0.155	-0.021	-0.081	0.118
	(0.104)	(0.328)	(0.058)*	(0.095)	(0.374)	(0.147)	(0.106)	(0.344)	(0.058)**
POP	-0.016	-0.048	-0.000	-0.021	-0.076	-0.029	-0.017	-0.059	-0.007
	(0.088)	(0.104)	(0.074)	(0.086)	(0.103)	(0.085)	(0.083)	(0.097)	(0.070)
GDPPC	0.008	0.030	0.026	0.010	0.026	0.028	0.016	0.024	0.026
	(0.017)	(0.017)*	(0.016)	(0.019)	(0.020)	(0.020)	(0.018)	(0.018)	(0.017)
DEMOCRACY	0.914	1.037	0.642	1.069	1.224	1.055	0.940	1.135	0.689
	(0.239)***	(0.295)***	(0.209)***	(0.292)***	(0.302)***	(0.269)***	(0.246)***	(0.300)***	(0.213)***
ENGO	0.118	0.065	0.116	0.090	0.093	0.096	0.107	0.096	0.094
	(0.056)**	(0.040)	(0.043)***	(0.056)	(0.042)**	(0.045)**	(0.056)*	(0.050)*	(0.049)*
%INDUSTRY	-0.062	-0.041	-0.073						
	(0.042)	(0.029)	(0.030)**						
%FUEL				-0.017	-0.005	-0.005			
				(0.013)	(0.013)	(0.012)			
ICC							0.554	-1.022	-0.546
							(0.832)	(0.796)	(0.685)
INTEGRITY1	-0.312			0.125			0.373		
	(0.444)			(0.183)			(0.319)		
ENGO*	-0.035			-0.028			-0.033		
INTEGRITY1	(0.016)**			(0.016)*			(0.016)**		
%INDUSTRY*	0.024								
INTEGRITY1	(0.018)								
%FUEL*				0.005					
INTEGRITY1				(0.003)					
ICC*							-0.207		
INTEGRITY1							(0.327)		
INTEGRITY2		-0.520			-0.061			-0.390	
		(0.233)**			(0.110)			(0.234)*	
ENGO*		-0.012			-0.017			-0.018	
INTEGRITY2		(0.008)			(0.008)**			(0.009)**	
%INDUSTRY*		0.017							
INTEGRITY2		(0.009)**							
%FUEL*					0.002				
INTEGRITY2					(0.002)				
ICC*								0.374	
INTEGRITY2								(0.252)	
INTEGRITY3			-1.099			-0.126			-0.544
			(0.491)**			(0.222)			(0.378)
ENGO*			-0.037			-0.035			-0.033
INTEGRITY3			(0.015)**			(0.016)**			(0.016)**
%INDUSTRY*			0.042						
INTEGRITY3			(0.018)**						
%FUEL*						0.002			
INTEGRITY3						(0.005)			
ICC*									0.485
INTEGRITY3									(0.403)
ANNEX1	-80.112	-80.411	-81.177	-75.856	-74.416	-75.132	-76.005	-77.441	-76.750
	(17.340)***	(17.974)***	(17.718)***	(16.313)***	(16.615)***	(16.183)***	(16.688)***	(17.055)***	(16.340)***
Constant	-20.174	-19.597	-18.757	-20.566	-22.632	-20.258	-21.987	-20.192	-18.725
	(2.827)***	(2.969)***	(2.306)***	(2.537)***	(3.241)***	(2.597)***	(2.884)***	(2.896)***	(2.264)***
Observations	566	475	732	508	436	568	563	472	729
Countries	128	106	167	115	97	129	127	105	166
Log likelihood	-49.0	-38.5	-87.7	-42.9	-29.8	-55.0	-49.2	-38.3	-88.9

Notes: Robust std. errors within parenthesis. *(**)[***] represents significant at the 10(5)[1]% level.

Table VI. Logit Estimation Results

Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ISLAND	0.118	-0.155	0.154	0.059	-0.271	-0.141	0.043	-0.127	0.171
	(0.123)	(0.415)	(0.075)**	(0.116)	(0.472)	(0.233)	(0.140)	(0.439)	(0.073)**
POP	0.017	-0.042	0.007	-0.007	-0.073	-0.021	-0.005	-0.052	-0.009
	(0.127)	(0.165)	(0.092)	(0.141)	(0.200)	(0.133)	(0.124)	(0.164)	(0.089)
GDPPC	-0.008	0.026	0.020	-0.011	0.014	0.021	0.001	0.016	0.018
	(0.014)	(0.017)	(0.014)	(0.016)	(0.022)	(0.019)	(0.015)	(0.018)	(0.015)
DEMOCRACY	1.175	1.398	0.723	1.420	1.804	1.308	1.165	1.473	0.766
	(0.328)***	(0.396)***	(0.257)***	(0.410)***	(0.455)***	(0.361)***	(0.331)***	(0.397)***	(0.259)***
ENGO	0.141	0.095	0.141	0.124	0.133	0.131	0.134	0.115	0.116
	(0.067)**	(0.054)*	(0.058)**	(0.069)*	(0.061)**	(0.062)**	(0.062)**	(0.063)*	(0.066)*
%INDUSTRY	-0.007	-0.037	-0.062						
	(0.041)	(0.038)	(0.033)*						
%FUEL				-0.020	-0.003	-0.005			
				(0.014)	(0.018)	(0.015)			
ICC							1.235	-0.921	-0.296
							(0.923)	(1.107)	(0.889)
INTEGRITY1	0.390			0.287			0.699		
	(0.463)			(0.198)			(0.354)**		
ENGO*	-0.038			-0.033			-0.036		
INTEGRITY1	(0.017)**			(0.017)**			(0.016)**		
%INDUSTRY*	0.001								
INTEGRITY1	(0.017)								
%FUEL*				0.007					
INTEGRITY1				(0.004)*					
ICC*							-0.436		
INTEGRITY1							(0.341)		
INTEGRITY2		-0.541			-0.043			-0.471	
		(0.314)*			(0.136)			(0.360)	
ENGO*		-0.016			-0.023			-0.020	
INTEGRITY2		(0.009)*			(0.010)**			(0.010)*	
%INDUSTRY*		0.016							
INTEGRITY2		(0.011)							
%FUEL*					0.002				
INTEGRITY2					(0.003)				
ICC*								0.423	
INTEGRITY2								(0.377)	
INTEGRITY3			-0.994			-0.101			-0.540
			(0.610)			(0.253)			(0.506)
ENGO*			-0.042			-0.043			-0.037
INTEGRITY3			(0.018)**			(0.019)**			(0.019)*
%INDUSTRY*			0.036						
INTEGRITY3			(0.021)*						
%FUEL*						0.003			
INTEGRITY3						(0.006)			
ICC*									0.419
INTEGRITY3									(0.520)
ANNEX1	-0.928	-0.869	-0.216	-1.170	-1.051	-0.710	-1.034	-0.845	-0.303
	(0.467)**	(0.427)**	(0.410)	(0.440)***	(0.460)**	(0.405)*	(0.437)**	(0.437)*	(0.409)
Constant	-8.772	-7.016	-6.454	-8.929	-9.130	-8.131	-9.657	-7.349	-6.537
	(1.572)***	(1.417)***	(0.976)***	(1.425)***	(1.508)***	(1.287)***	(1.487)***	(1.405)***	(0.984)***
Observations	566	475	732	508	436	568	563	472	729
Countries	128	106	167	115	97	129	127	105	166
Log likelihood	-141.0	-124.5	-198.7	-128.7	-110.0	-147.4	-140.0	-124.1	-199.2

Notes: Robust std. errors within parenthesis. *(**)[***] represents significant at the 10(5)[1]% level.