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Analysis

Democracy and climate change policies: Is history important?☆

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ABSTRACT

This paper argues that it is countries' historical experience with democracy, the democratic capital stock, rather than current levels of democracy that determines current climate change policies. Empirical evidence using data starting as far back as year 1800 for 87 countries, which together are responsible for 93.7% of global carbon emissions, suggests that the democratic capital stock has an important and robust effect on climate change policies. A history of executive constraints is particularly important. The current level of democracy does not play a role once democratic capital has been accounted for.

1. Introduction

The recent Arab Spring, with its promise of a further spread of democracy, brings renewed attention to the issue of democracy and its effects on social and policy outcomes. While the Arab Spring has yet to deliver on its promise and the environment does not feature much in the struggle between the democracy activists and the authoritarian regimes, an improved understanding of the relationship between democracy and environmental policies appears highly relevant and important. In this paper, we seek to shed new light on the empirical effects of democracy on climate change policies. In contrast to the existing literature, we focus on the effects of countries' long run history of democratic experience. We aim to contribute to our understanding of how the democratization process occurring across the globe for the last two centuries determines recent policies addressing climate change. In particular, we investigate the effect of "democratic capital" on environmental policies addressing climate change, where "democratic capital" is defined, following Persson and Tabellini (2009), as a country's accumulated stock of civic and social assets built by historical experience with democracy.

The existing theoretical and empirical literatures on the effects of democracy on environmental policies and quality have reported ambiguous or weakly positive effects. We argue that this literature is incomplete and misses potentially important effects; it has not fully taken countries' histories of democracy and autocracy into account, in particular with regard to recently implemented climate change policies.

Our empirical work utilizes the Climate Laws, Institutions and Measures Index (*CLIMI*) from Steves et al. (2013), a composite index of multiple aspects of climate change policy. Using data classifying countries as democracies and autocracies going as far back as year 1800, we find that democratic capital has a robust positive effect on national and multi-lateral policies addressing climate change. Moreover, once we control for democratic capital, the current level of democracy has no significant impact. These results are robust toward including further control variables, instrumenting for democratic capital with the democratic capital of contiguous countries and excluding countries from certain regions one at a time in regional jackknife estimations. Our results also hold up to using an alternative dependent variable (Esty et al., 2005), measuring the degree of global environmental cooperation. In an extension, we differentiate between two different components of our democracy measure. We find that the stock of executive constraints, i.e., a larger cumulative historical experience with constraints facing the executive, drives our

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results. In contrast, the stock of political competition has no statistically significant effect.

It appears that we cannot expect climate change policies (and perhaps international environmental policies more generally) to improve rapidly in countries that recently experienced democratization. Only over time do democratic principles penetrate a society and its policymaking apparatus sufficiently to have a positive effect. If countries consolidate democracy, and in particular put sufficient constraints on the executive, we expect environmental policies to become more stringent over time.

The paper is organized as follows. Section 2 revisits the effect of democracy on the environment and develops our argument why democratic history matters. Section 3 reviews the existing literature and Section 4 discusses our empirical approach and data. Section 5 reports our main results, while Section 6 presents our robustness analysis. Section 7 concludes.

2. Revisiting the Effect of Democracy on the Environment: Why History Matters

A number of theoretical predictions exist regarding the effect of the current level of democracy on environmental policies. Congleton (1992) argues that autocrats' time horizons are shorter and they therefore set weaker environmental policies. An autocratic ruler is also likely to appropriate a larger share of the economy's income for himself, which has an ambiguous effect on the strictness of environmental regulations. The autocrat's marginal cost of environmental standards increases since she now bears a larger share of the associated fall in national income. Meanwhile, a higher income may also lead the autocrat to set stricter environmental standards if environmental quality is a normal good. However, environmental quality is a public good and the very rich can buy themselves out of the exposure to pollution. Thus, an argument building on environmental quality being a normal good does not apply (Hotte and Winer, 2012).

Bueno de Mesquita et al. (2003) and Acemoglu and Robinson (2006) argue that policymaking in democracies and autocracies differs because policymakers in democracies are forced to take a large share of the population into account, rather than just the elite as in autocracies. In democracies, the loyalties to leaders are weaker, forcing leaders to provide higher levels of public goods in order to survive in office. Olson (1993), McGuire and Olson (1996), and Deacon (2009) argue that the small elites which govern autocracies are focused on personal self-enrichment and are unwilling to forgo private benefits in order to provide public goods that benefit the masses. With a higher level of political participation, delivering social welfare and public goods becomes a greater concern in a democracy, as long as the median voter prefers greater environmental quality (Bättig and Bernauer, 2009). The pressure to take pollution damage (social welfare) into account also depends on the degree of political competition and accountability (Fredriksson et al., 2005; List and Sturm, 2006; Wilson and Damania, 2005). Farzin and Bond (2006) argue that interactions exist between the levels of democracy, income, income inequality, urbanization, education, and age distribution (see also Eriksson and Persson, 2003).[1] Improved democracy is predicted to raise pollution abatement. Barrett and Graddy (2000) and Torras and Boyce (1998) argue that democratization makes citizens better informed and better organized for protest. Bättig and Bernauer (2009) suggest that greater freedom to travel internationally, to pursue joint research, to communicate, and to exchange ideas with foreigners leads to greater awareness of environmental issues, their risks, and their mitigation. Moreover, while democratization stimulates industry lobbying, it also encourages environmental lobbying, including on international cooperation.[2]

Since climate change mitigation is a global public good, its geographic scope does not correspond to political jurisdictions. Democratic systems operate primarily at the national (and more local) level, rather than at the international level, and democracy may therefore have a smaller effect on the provision of global transboundary public goods than on local public goods. However, as argued by Bättig and Bernauer (2009) there is no reason why (due to this free-rider problem) further democratization would have differential effects in democracies and autocracies.

While the theories discussed above focus on the policy effects of the *current* level of democracy, they are still relevant for our empirical investigation which focuses on the *stock* of democratic capital. Today's environmental policies are the result of numerous historical institutional and policy choices, all influenced by the level of democracy at the time. Different historical experiences with democracy are likely to lead to different policy outcomes, as previous decisions form the base for subsequent choices. Our measure of democratic capital takes this historical process into account. Moreover, our measure helps capture transitions between democracy and autocracy which are by themselves likely to be detrimental to building the institutions needed to produce global public goods.

It may also take time for environmental policy to become a focus of the democratic process. In countries such as Serbia and Sierra Leone with high values of current democracy but with limited histories of democracy, the democratic and electoral process may not have had enough time to focus on a "secondary policy" (List and Sturm, 2006) such as environmental policy.[3] Only over time will voters and environmental interest groups (needing time to organize) pressure politicians to start formulating appropriate institutions and policies. One channel through which the democratic capital stock may affect environmental policy is by raising expectations that the country will be a stable democracy in the future (Persson and Tabellini, 2009). Persson and Tabellini report that the probability of a currently democratic country remaining democratic increases with a larger democratic capital stock, and that democratic capital raises economic growth (indirectly, by increasing stability).[4] Persson and Tabellini argue that a virtuous circle exists where the accumulation of democratic and physical capital reinforces each other. Thus, democratic capital may actually help drive the Environmental Kuznets Curve (EKC) relationship documented in the literature (Dinda, 2004; Fosten et al., 2012). Second, an expectation of continued stable democracy may also result in advocates for environmental policies having a greater incentive to fight for reform because their influence will continue in the future. Third, an expectation of continued democracy increases the time horizon of politicians and political parties. This matters for environmental policymaking where costs occur earlier than the benefits, especially for climate change policies. If democracy is more likely to prevail, democratic parties and their constituent groups are more likely to benefit from implemented environmental policies in the future.[5] Fourth, if polluting industries have higher expectations that the country will remain democratic it may be relatively less beneficial to wait with investment in pollution control technology and to lobby against regulations. Fifth, competitive leadership selection processes in democracies are likely to yield more competent leaders (Besley and Reynal-Querol, 2011).[6] Since environmental policies are generally built slowly over time, a history of competent leaders influences policy outcomes positively.

[1] Future research may want to evaluate such interactions using measures of democratic capital. In this paper, we abstract from these issues as we focus on the implications of democratic capital for this literature.

[2] Bättig and Bernauer (2009) cite efforts to protect the ozone layer as an example.

[3] List and Sturm provide a model where politicians use a "secondary policy" to cater to an interest group with strong preferences, but only as long as they are eligible for re-election. This model receives empirical support (see also Fredriksson et al., 2011).

[4] A current autocracy is also more likely to transition into a democracy the greater is its democratic capital.

[5] Fredriksson and Wollscheid (2013) provide evidence that countries with older (stronger) political parties have stricter national environmental policies, but only if political stability is high.

[6] Besley and Reynal-Querol report that democratically elected leaders are more likely to be highly educated.

Sixth, even in a current autocracy, the policy effects of previous democratic experiences may persist as policies may not be dismantled immediately (Coate and Morris, 1999). Also, political parties and individuals with democratic experience may be more likely to find ways to influence autocrats through collective action, particularly in the presence of "institutionalized" ruling parties with a long history at the time of taking power (Gehlback and Keefer, 2011, 2012). Conversely, a current autocracy with a significant history of democracy may reintroduce stringent environmental policies more quickly due to its institutional and cultural memory, compared to a country without democratic experience.

3. Existing Literature and Our Contribution

While several studies in the empirical literature establish a positive relationship between the current level of democracy and the stringency of environmental policies or quality, the opposite is also reported. We are among the first to argue and show that it is democratic capital rather than the current level of democracy that matters for climate change and, particularly, for climate change *policies*. Our findings thus complement and bring some clarity to the existing empirical literature.

Democratic countries have been found more likely to be associated with lower atmospheric and water emissions such as of chlorofluorocarbon, SO_2 and CO_2, smoke, heavy particles, total suspended particles, chemical and biological oxygen demand and fecal concentration in water (Barrett and Graddy, 2000; Bernauer and Koubi, 2009, 2013; Farzin and Bond, 2006; Li and Reuveny, 2006; Winslow, 2005). More democratic countries are more prone to reduce the lead content in gasoline, provide public sanitation, protect land, and to reduce deforestation (Buitzenzorgy and Mol, 2011; Deacon, 2009; Fredriksson et al., 2005). Democracies are also more likely to ratify the Montreal Protocol, the UNFCCC, the Kyoto Protocol, the Convention on Biological Diversity and the Convention on International Trade in Endangered Species, and to comply with multilateral environmental agreements (Congleton, 1992; Fredriksson and Gaston, 2000; Fredriksson et al., 2007; Neumayer, 2002a; von Stein, 2008).

However, Scruggs (1998) finds an insignificant relationship between democracy and three environmental indicators (dissolved oxygen demand, fecal coliform, particulates) once income inequality has been controlled for. Roberts and Parks (2007) find a negligible impact on CO_2, while Arvin and Lew (2011) find mixed results on CO_2 emissions, water pollution, and developing country deforestation. Midlarsky (1998) argues that improved democracy increases deforestation, CO_2 emissions, and water-related soil erosion. Bernauer and Kuhn (2010) report inconclusive evidence that democracy affects transboundary emissions in European rivers. Steves et al. (2013) find no effect of current democracy on *CLIMI* (which we also use), but do not include the democratic capital stock. Another major difference between our models and those presented by Steves et al. (2013) is that we control for GDP/capita, while they do not, and our sample is more globally representative, including 16 more countries.[7] In total, our sample's 87 countries are responsible for 93.7% of global carbon emissions.

Two previous papers use some forms of measures of democratic experience. Gallagher and Thacker (2008) study the EKC hypothesis using 1960–2000 data on CO_2 and SO_2 emissions from up to 156 countries and include a measure of "democracy stock". Their paper differs from ours because, first, their data cannot capture the effects that the Kyoto Protocol may have had beyond 2000. Second, their analysis focuses on carbon emissions only, whereas our focus is on a comprehensive measure of climate change policies.[8] Third, we account for the potential endogeneity of democratic capital stock by instrumental variable regression. Moreover, as measure of democracy stock, Gallagher and Thacker sum each country's *polity2* score from 1900 onwards (Polity IV data by Marshall and Jaggers, 2007), discounted by one percent per year. This is consequently a different measure than our democratic capital stock measure, and it does not go as far back as some of our measures. Gallagher and Thacker find a negative effect of democracy stock on both CO_2 and SO_2 emissions. Similar to us, they find no effect of the current level of democracy once democracy stock is included in their global sample. But current democracy does have such an effect once developed countries are excluded. Scruggs (2009) uses the 1972–2000 average Freedom House democracy score (not discounted) to study whether democracies tended to improve their environmental performance at a higher rate than autocracies during 1990–2000. Eight indicators were used in aggregated form, two of which are related to climate change (CO_2 and methane (CH_4) emissions). Scruggs finds no effect of his democracy measure on environmental performance.

It is noteworthy that many of the ambiguous effects of democracy reported in the literature relate either to climate change emissions or to climate change policies. It is therefore intentional that we focus on climate change in our analysis of the effect of democratic capital (the history of democratic experience) and its relative importance compared to the current level of democracy. It is also intentional that we focus on a comprehensive measure of climate change policies rather than on carbon emissions. Additional greenhouse gases are relevant and, importantly, it takes time for policies to translate into noticeable changes to emissions. We therefore contend that a policy measure rather than the level of emissions is the more informative dependent variable to study.

4. Empirical Approach and Data

The hypothesis to be tested is whether a higher democratic capital stock raises the stringency of climate change policies. Our measure of the stringency of climate change policies across countries is Steves et al.'s (2013) Climate Laws, Institutions and Measures Index (*CLIMI*), derived from the 2005–2010 annual national communications to the UNFCCC. *CLIMI* measures countries' adopted policies that address climate change through mitigation (not adaptation). The components of *CLIMI* are (relative weight and within-component sub-weights within parenthesis): international cooperation (0.1) (subgroups: Kyoto ratification (0.5), Joint Implementation or Clean Development Mechanism host (0.5)), domestic climate framework (0.4) (subgroups: cross-sectoral climate change legislation (0.33), carbon emissions target (0.33), dedicated climate change institution (0.33)), significant sectoral fiscal or regulatory measures or targets (0.4) (subgroups: energy supplies/renewables (0.3), industry (0.2), forestry (0.17), agriculture (0.13), transport (0.13), buildings (0.07)), and additional cross-sectoral fiscal or regulatory measures (0.1). *CLIMI* takes values between 0 and 1; higher values represent stricter policies. The UK has the highest *CLIMI* score at 0.801 while Tonga has the lowest at 0.011.

As a second dependent variable, we use a measure of global environmental cooperation from Esty et al. (2005), the *Global Environmental Cooperation Index*. This index is a combination of information pertaining to a country's number of memberships in environmental intergovernmental organizations, contribution to international and bilateral funding of environmental projects and development aid, and participation in international environmental agreements.

Our main dependent variable *CLIMI* is derived from information collected over the period 2005–2010. All values for our explanatory variables are averages over this time period. The independent variables of main interest are democratic capital and the current level of democracy, both building on the *polity2* variable from the Polity IV data set (Marshall and Jaggers, 2007). We create a number of measures of *Democratic Capital* using different time frames and cut-offs for the definitions of democracy versus autocracy. *Polity2* takes values between −10 (strict autocracy) and 10 (consolidated democracy). We use two

[7] From, e.g., the literature on the EKC, per capita income is well known to be an important determinant of environmental policies and pollution levels.

[8] Due to its focus on the EKC, it also has a completely different set of control variables.

alternative definitions of democracy. First, we define democracies as those having a positive *polity2* score, following Persson and Tabellini (2009). As an alternative, we define democracies as those having a *polity2* score above 5 since countries below this threshold (but above −5) are usually categorized as "anocracies"; combining characteristics from both democratic and autocratic regimes (Plümper and Neumayer, 2010). As seen below, which definition is chosen makes little difference. This is perhaps not surprising since most countries fall close to the polar ends of *polity2*. *Current Democracy* is simply the average *polity2* value for years 2005–2010.

We use three different time periods to calculate democratic capital, all ending in year 2010. The alternative time periods are 1800–2010, 1900–2010, and 1950–2010, respectively. Note that if a country attains independence after these start years, then the measure starts in the year of the country's independence. The period 1800–2010 is the longest period possible given that *polity2* starts in 1800, while the start year of 1900 follows Gallagher and Thacker (2008). We employ 1950 as an alternative start year since it could be that only more recent democratic capital build-up matters. Following Persson and Tabellini (2009), democratic capital accumulates in years in which a country is a democracy (an increase of one) but not when an autocracy. Democratic capital depreciates at a rate $(1-\delta)$ per year, i.e. only a share δ remains of the prior year's capital stock. Let $z_{i,t}$ be the stock of democratic capital of country i in year t; $a_{i,t}$ is an indicator variable which takes a value of unity in years when country i is a democracy; zero otherwise. Democratic capital then accumulates according to $z_{i,t} = a_{i,t} + \delta z_{i,t-1}$, where $z_{i,t_0} = 0$. We calculate and utilize the values for *Democratic Capital* for $t_0 = 1800$, 1900, and 1950, respectively, and assume $(1-\delta) = 0.06$, following Persson and Tabellini. The resulting values are rescaled to lie in the range 0 to (converging to) 1 (by multiplying all calculated values by $(1-\delta)$) following Persson and Tabellini. Most of the countries with strictly autocratic current regimes also have low to very low values of *Democratic Capital*. However, there is significant variation among current democracies in their democratic capital stock. Some Eastern European countries like Hungary and Poland, for example, have *polity2* values of 10, but their democratic capital is only slightly higher than the sample average at around 0.70. Mongolia, Serbia and Sierra Leone are further examples of high values of current democracy with fairly modest values of democratic capital. At the other extreme are the established Western countries with a democratic tradition such as the UK, the US, Switzerland, the Scandinavian countries, but also Costa Rica and India.

We measure lobbying and voters' incentives with two different variables. Per capita carbon emissions (*CO_2 per capita emissions*) from World Bank (2012) reflects consumers' incentive to keep fossil fuel prices low, as well as the fossil fuel producers' lobbying incentive to keep climate change policies weak. This variable thus reflects the amount at stake for CO_2 emitters, and thus their lobbying incentives. However, higher levels of per capita CO_2 likely also imply lower marginal abatement costs (Fredriksson et al., 2007). We are aware that *CLIMI* may already have affected *CO_2 per capita emissions*, but believe that the resulting reverse causality is sufficiently small not to create much endogeneity concern. We show below that our results are not affected by dropping this variable. *KP Commitment* measures the emission reduction commitment in percent emission reductions relative to 1990 (or an alternative base year) of Annex I countries under the Kyoto Protocol. Countries with such commitment, whether they honor it or not, can be expected to have better climate change policies, not least because it gives environmental lobby groups stronger traction to press the government into formulating better climate change policies (Aichele and Felbermayr, 2012). In the estimations reported below, *KP Commitment* is set to zero for all non-Annex 1 countries as they have never signed up to any emission reduction targets. The results are however fully robust toward setting this variable to −8 for all non-Annex 1 countries. −8 is the observed minimum among Annex 1 countries in the sample (Australia was allowed to increase its emissions by 8%, hence it scores −8).[9] To control for the effect that non-Annex 1 countries have on this variable, we include a dummy variable for non-Annex 1 countries. Per capita income in thousands of US$ in purchasing power parity, *GDPpc*, captures the increase in demand for environmental quality as income rises (World Bank, 2012). Many currently and historically democratic countries, but not all of them, are Western capitalist economies. In order to make sure that our main explanatory variables do not pick up the effect of economic liberalization, we use the *Economic Freedom* index from the Heritage Foundation (2013). Table 1 provides descriptive statistics, including for a number of further control variables which are included in robustness tests.

In sum, we estimate variants of the following model:

$$\begin{aligned} CLIMI_i = {} & \alpha + \beta_1 KP\ Commitment_i + \beta_2 Non{-}Annex\ 1\ dummy_i \\ & + \beta_3 CO_2 per\ capita\ emissions_i + \beta_4 GDPpc_i \\ & + \beta_5 Economic\ Freedom_i + \beta_6 Current\ Democracy_i \\ & + \beta_7 Democratic\ Capital_i + \varepsilon_i \end{aligned}$$

where i denotes country, α is a constant, β_i, $i = 1,..,7$ are variable coefficients, and ε_i is the error term. In our main estimations, we use ordinary least squares (OLS). Since our sample is necessarily cross-sectional, we cannot control for unobserved country heterogeneity with the help of country fixed effects. One may therefore be concerned whether unobserved country heterogeneity correlated with a country's democratic history (*Democratic Capital*) is truly the driver of any positive effect of democracy on climate change policies. This represents a more pressing endogeneity concern than the potential moderate reverse causality of *CLIMI* on *CO_2 per capita emissions*. In robustness tests, we account for the possibility that *Democratic Capital* is correlated with the error term by instrumenting for it in two-stage least squares instrumental variable (IV) regressions. In these IV regressions, we instrument for *Democratic Capital* by the values of *Democratic Capital* in geographically contiguous countries. These are defined as countries that either share a land border or are separated by sea distance of less than 150 miles. These are sufficiently strong instruments to avoid the weak instrument problem, but they should be uncorrelated with unobserved country heterogeneity under the identification assumption that countries' unobserved heterogeneities are not themselves spatially correlated with each other across contiguous borders.

5. Empirical Results

The benchmark OLS results are presented in Table 2. In addition to our basic control variables, Model 1 includes only *Current Democracy* and not *Democratic Capital*. *Current Democracy* has a positive, but statistically insignificant effect on *CLIMI*. Model 2 instead includes only *Democratic Capital* and not *Current Democracy*. *Democratic Capital* (1800–2010 data; *polity2* > 0 as democracy cut-off) is statistically significant with the expected positive coefficient. Model 3 includes both *Current Democracy* and *Democratic Capital*. Despite the high correlation between the two variables (above 0.8), the estimations do not suffer from any apparent multi-collinearity problems. Their variance inflation factors are 5.73 and 5.28, respectively, and thus well below the values of 10 (or even 30), typically regarded as indicating multi-collinearity problems (Chatterjee and Hadi, 2006). *Democratic Capital* continues to be statistically significant with a slightly larger coefficient size compared to Model 2, while *Current Democracy* continues to be statistically insignificant.

In Model 4, we drop *CO_2 per capita emissions* to check whether our results are affected potential reverse causality, even if it is likely to be very moderate in size. Results turn out to be fully robust. The effect of

[9] Results for this alternative operationalization of *KP Commitment* are available upon request.

Table 1
Summary statistics.

Variables	Obs	Mean	Std. Dev.	Min	Max
CLIMI	87	.36	.23	.02	.80
Global Environmental Cooperation	128	.07	.70	−1.52	1.74
KP Commitments	87	2.43	3.80	−8	8
Non-Annex 1 dummy	87	.61	.49	0	1
CO_2 per capita emissions	87	5.90	5.40	.02	26.31
GDP per capita	87	16.58	14.85	.31	57.79
Economic Freedom	87	61.99	10.12	42.10	83.37
Current Democracy	87	5.01	6.22	−10	10
Democratic Capital (*polity2* > 0; 1800-)	87	.60	.36	0	.99
Democratic Capital (*polity2* > 0; 1900-)	87	.60	.36	0	.99
Democratic Capital (*polity2* > 0; 1950-)	87	.59	.36	0	.97
Democratic Capital (*polity2* > 5; 1800-)	87	.56	.38	0	.99
Democratic Capital (*polity2* > 5; 1900-)	87	.56	.38	0	.99
Democratic Capital (*polity2* > 5; 1950-)	87	.55	.37	0	.97
Climate Vulnerability	87	13.19	18.71	−9.42	100
Trade Openness	86	89.77	5.64	25.07	415.19
Control of Corruption	87	.16	1.08	−1.44	2.45
Political Stability	84	.12	.10	0	.5
Small Island State	87	.03	.18	0	1
French Legal Origin	87	.40	.49	0	1
Socialist Legal Origin	87	.33	.47	0	1
German Legal Origin	87	.06	.23	0	1
Scandinavian Legal Origin	87	.05	.21	0	1

GDPpc decreases, but the effects of *Current Democracy* and *Democratic Capital* stay practically the same as in Model 3. In Model 5, we restrict the sample to developing countries only by dropping all high-income OECD countries from the sample. Contrary to Gallagher and Thacker (2008), *Current Democracy* does not matter in the developing country only sample. Having thus established that it is *Democratic Capital* rather than *Current Democracy* that matters for climate change policies, in the remaining models we omit *Current Democracy*. We also use five alternative definitions of *Democratic Capital*. *Democratic Capital* has a consistently positive and highly significant effect on *CLIMI* in all these models. This suggests that the more recent history of democracy (the last 60 years) is the most important determinant, and taking longer time periods into account (for which discounting also reduces the importance of democracy further) does not change the effect on *CLIMI*. Moreover, the estimated effects are non-negligible. Using Model 8 as an example, a 1 standard deviation change in *Democratic Capital* is estimated to result in a positive change equal to 23.2% of a standard deviation of *CLIMI* (*CLIMI* mean = 0.32; std. dev. = 0.23). Since much of the previous literature has ignored measures of the democratic capital stock, we believe our results shed new light on how democracy affects environmental policy.

Among the control variables, *KP Commitments* and *GDPpc* are consistently significant with the expected positive signs, and *CO_2 per capita emissions* is consistently negative and significant in all models. This suggests that the Kyoto Protocol may have a positive effect on climate policy stringency at the national level, while anti-climate change policy lobbying and voter-pressure are successful where CO_2 per capita emissions are large. Per capita income has the expected positive effect on climate change policies either because demand for such policies is a normal good or because richer countries are in a better position to formulate strong climate change policies. *Economic Freedom* has a positive effect that however is statistically insignificant, except in the sample of non-OECD countries.

6. Robustness Analysis

Tables 3 to 6 report results from robustness tests. The *Democratic Capital* measure used in Tables 3 and 5 starts in 1800 and classifies a democracy as having *polity2* > 0, but neither the starting point nor the cut-off point matters for the results (results available upon request). In Table 3, we add a number of control variables in order to avoid omitted variable bias. The additional controls include a measure of *Climate*

Table 2
Main regressions.

Variables	1	2	3	4	5	6	7	8	9	10
KP Commitments	0.0159***	0.0168***	0.0169***	0.0215***	0.0122	0.0168***	0.0167***	0.0164***	0.0164***	0.0163***
	(0.00451)	(0.00467)	(0.00470)	(0.00608)	(0.0147)	(0.00467)	(0.00465)	(0.00447)	(0.00447)	(0.00445)
Non-Annex 1 dummy	−0.0558	−0.0506	−0.0618	−0.0175	−0.0784	−0.0506	−0.0513	−0.0450	−0.0450	−0.0455
	(0.0617)	(0.0547)	(0.0592)	(0.0621)	(0.111)	(0.0547)	(0.0548)	(0.0510)	(0.0510)	(0.0509)
CO_2 per capita emissions	−0.0140***	−0.0132***	−0.0138***		−0.00949**	−0.0132***	−0.0133***	−0.0127***	−0.0127***	−0.0128***
	(0.00444)	(0.00415)	(0.00429)		(0.00429)	(0.00415)	(0.00414)	(0.00406)	(0.00405)	(0.00403)
GDP per capita	0.00874***	0.00784***	0.00752***	0.00388*	0.00428**	0.00784***	0.00789***	0.00761***	0.00761***	0.00766***
	(0.00174)	(0.00168)	(0.00179)	(0.00231)	(0.00210)	(0.00168)	(0.00168)	(0.00164)	(0.00164)	(0.00163)
Economic Freedom	0.00254	0.00268	0.00309	0.00249	0.00565**	0.00268	0.00273	0.00224	0.00224	0.00226
	(0.00199)	(0.00192)	(0.00204)	(0.00251)	(0.00250)	(0.00192)	(0.00193)	(0.00193)	(0.00193)	(0.00194)
Current Democracy	0.00543		−0.00366	0.000104	−0.00574					
	(0.00369)		(0.00570)	(0.00586)	(0.00629)					
Dem Cap (*polity2* > 0; 1800-)		0.127**	0.175**	0.180**	0.203**					
		(0.0515)	(0.0814)	(0.0840)	(0.0924)					
Dem Cap (*polity2* > 0; 1900-)						0.127**				
						(0.0515)				
Dem Cap (*polity2* > 0; 1950-)							0.127**			
							(0.0524)			
Dem Cap (*polity2* > 5; 1800-)								0.149***		
								(0.0484)		
Dem Cap (*polity2* > 5; 1900-)									0.149***	
									(0.0484)	
Dem Cap (*polity2* > 5; 1950-)										0.151***
										(0.0489)
Constant	0.111	0.0577	0.0374	−0.00620	−0.0956	0.0576	0.0564	0.0766	0.0765	0.0753
	(0.130)	(0.136)	(0.137)	(0.151)	(0.153)	(0.136)	(0.136)	(0.126)	(0.126)	(0.126)
Observations	87	87	87	87	60	87	87	87	87	87
R-squared	0.697	0.710	0.711	0.675	0.410	0.710	0.709	0.718	0.718	0.718

Robust standard errors in parentheses.
*** p < 0.01.
** p < 0.05.
* p < 0.1.

Table 3
Robustness analysis: Further control variables.

Variables	1	2	3	4	5	6	7
KP Commitments	0.0168***	0.0169***	0.0176***	0.0163***	0.0169***	0.0149***	0.0157***
	(0.00469)	(0.00500)	(0.00480)	(0.00465)	(0.00476)	(0.00497)	(0.00564)
Non-Annex 1 dummy	−0.0502	−0.0494	−0.0378	−0.0510	−0.0437	−0.00455	0.0451
	(0.0566)	(0.0572)	(0.0544)	(0.0555)	(0.0596)	(0.0576)	(0.0708)
CO_2 per capita emissions	−0.0132***	−0.0134***	−0.0110**	−0.0139***	−0.0131***	−0.0112***	−0.0101**
	(0.00417)	(0.00406)	(0.00423)	(0.00413)	(0.00423)	(0.00382)	(0.00442)
GDP per capita	0.00783***	0.00797***	0.00538**	0.00830***	0.00793***	0.00826***	0.00719**
	(0.00171)	(0.00174)	(0.00245)	(0.00174)	(0.00170)	(0.00194)	(0.00300)
Economic Freedom	0.00267	0.00247	0.000203	0.00213	0.00300	0.00343	-0.00111
	(0.00196)	(0.00225)	(0.00253)	(0.00199)	(0.00204)	(0.00209)	(0.00327)
Dem capital (polity2 > 0, 1800-)	0.127**	0.126**	0.117**	0.114**	0.122**	0.160***	0.130**
	(0.0513)	(0.0621)	(0.0508)	(0.0527)	(0.0515)	(0.0522)	(0.0584)
Climate Vulnerability	−5.38e − 05						0.000509
	(0.00148)						(0.00135)
Trade Openness		−3.36e − 05					−0.000456
		(0.000353)					(0.000448)
Control of Corruption			0.0538				0.0956**
			(0.0354)				(0.0430)
Political Stability				0.158			0.164
				(0.147)			(0.154)
Small Island State					−0.0477		0.0899
					(0.0466)		(0.0655)
French Legal Origin						0.0620	0.0998
						(0.0549)	(0.0636)
Socialist Legal Origin						0.122**	0.204**
						(0.0561)	(0.0771)
German Legal Origin						0.118*	0.113
						(0.0708)	(0.0837)
Scandinavian Legal Origin						0.135**	0.0913
						(0.0619)	(0.0789)
Constant	0.0593	0.0743	0.227	0.0799	0.0362	−0.129	0.109
	(0.137)	(0.141)	(0.184)	(0.138)	(0.146)	(0.152)	(0.240)
Observations	87	86	87	84	87	87	83
R-squared	0.710	0.708	0.717	0.709	0.711	0.737	0.755

Robust standard errors in parenthesis.
*** p < 0.01.
** p < 0.05.
* p < 0.10.

Vulnerability from Wheeler (2011); more vulnerable countries might out of self-interest have stronger climate policies. *Trade Openness* is taken from World Bank (2012), measured as imports plus exports over GDP. Neumayer (2002b) shows that more open countries cooperate more on global environmental problems. Corruption has been shown to affect environmental policy negatively (see, e.g., Barbier et al., 2005); we use a measure of the absence of corruption from Kauffman et al. (2009), *Control of Corruption*. Political stability affects the time horizon of politicians and thus their propensity to incur short-term cost in order to obtain long term benefits (Bohn and Deacon, 2000; Fredriksson and Svensson, 2003). It fosters investment in "state capacity" (Besley and Persson, 2011), which in turn increases the provision of public goods. *Political Stability* comes from Beck et al. (2001). A *Small Island State* dummy takes into account the urgency of policymakers in countries threatened by sea-level rise to take action; it comes from World Bank (2012). Legal origin has been shown to influence policymaking, institutions and economic growth in fundamental ways (La Porta et al., 1999); we utilize dummies for *French*, *Socialist*, *German*, and *Scandinavian Legal Origins* (*British Legal Origin* is the excluded category).

These robustness tests confirm the benchmark results. *Democratic Capital* is statistically significant in all models in Table 3. Among the added controls, *Socialist Legal Origin* exhibits significant positive coefficients in two models, and *Scandinavian Legal Origin* and *Control of Corruption* in one model each. Neither *Climate Vulnerability*, *Trade Openness*, *Political Stability*, nor *Small Island State* is significant. *Political Stability* may not reach statistical significance because *Democratic Capital* is already picking up a history of regime changes. Dropping *Democratic Capital* from the model, *Political Stability* has the expected positive and statistically significant effect.

Table 4 presents our two-stage least squares IV regression results.[10] These are highly consistent with our earlier estimates, as *Democratic Capital* is statistically significant in all models, and the same control variables remain significant with consistent signs. The *Democratic Capital* coefficient sizes are slightly larger but roughly equal to those reported in Tables 2 and 3.

In Table 5, we undertake regional jackknife estimations to determine whether our results are driven by the inclusion of countries from a particular region in the sample, following the classification of regions by World Bank (2012). The previous results are robust to the exclusion of regions. *Democratic Capital* remains significant in all models except in Model 8, where it is marginally insignificant. This model excludes Latin America and the Caribbean, which has the highest levels of *Democratic Capital* outside the developed world and fairly stringent climate change policies compared to other developing countries. This is the cause of the marginally insignificant coefficient in this model. Note, however, that if we define democracies as scoring above *polity2* values of 5, then *Democratic Capital* has a statistically significant effect even with the region of Latin America and the Caribbean excluded from the sample. Results for the control variables are similar to the ones reported in earlier tables.

In Table 6 we employ the *Global Environmental Cooperation Index* as our dependent variable. This variable is available for more countries,

[10] We lose two observations since neither Fiji, nor New Zealand, is contiguous to any country.

Table 4
Robustness analysis: Instrumental variable regression.

Variables	1	2	3	4	5	6
KP Commitments	0.0190***	0.0190***	0.0190***	0.0180***	0.0180***	0.0179***
	(0.00475)	(0.00475)	(0.00474)	(0.00433)	(0.00433)	(0.00430)
Non-Annex 1 dummy	−0.0183	−0.0182	−0.0173	−0.0246	−0.0245	−0.0242
	(0.0580)	(0.0580)	(0.0583)	(0.0538)	(0.0538)	(0.0536)
CO_2 per capita emissions	−0.0114**	−0.0114**	−0.0114**	−0.0118***	−0.0118***	−0.0118***
	(0.00467)	(0.00467)	(0.00467)	(0.00451)	(0.00451)	(0.00448)
GDP per capita	0.00752***	0.00752***	0.00756***	0.00748***	0.00748***	0.00752***
	(0.00184)	(0.00184)	(0.00183)	(0.00181)	(0.00181)	(0.00179)
Economic Freedom	0.00195	0.00195	0.00197	0.00173	0.00173	0.00173
	(0.00209)	(0.00209)	(0.00211)	(0.00205)	(0.00205)	(0.00206)
Democratic Capital (*polity2* > 0; 1800-)	0.180*					
	(0.0919)					
Democratic Capital (*polity2* > 0; 1900-)		0.180*				
		(0.0920)				
Democratic Capital (*polity2* > 0; 1950-)			0.184*			
			(0.0939)			
Democratic Capital (*polity2* > 5; 1800-)				0.173**		
				(0.0863)		
Democratic Capital (*polity2* > 5; 1900-)					0.174**	
					(0.0863)	
Democratic Capital (*polity2* > 5; 1950-)						0.177**
						(0.0868)
Constant	0.0410	0.0408	0.0372	0.0751	0.0750	0.0732
	(0.135)	(0.135)	(0.136)	(0.124)	(0.124)	(0.125)
Observations	85	85	85	85	85	85
R-squared	0.703	0.703	0.702	0.715	0.715	0.715
F-test of excluded instrument in first stage	44.12	44.06	42.93	45.57	45.59	46.67

Robust standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

such that our sample size increases to 128. Models 1 to 3 are based on OLS estimation, Model 4 employs instrumental variable two-stage least squares regression. Model 1 includes only *Current Democracy*, Model 2 adds *Democratic Capital* to the estimation model, while Models 3 and 4 exclude *Current Democracy*. Richer countries fare better on this index, while countries with higher *CO_2 per capita emissions* co-operate less. Not surprisingly, given that the new dependent variable is not directly focused on climate change policies, the *KP Commitments* variable is now statistically insignificant. *Current Democracy* has a positive and statistically significant effect. Yet, it no longer matters once *Democratic Capital* is included in the estimation model. This suggests that *Democratic Capital* matters more generally (rather than *Current Democracy*) for co-operative efforts at solving global environmental policies.

Lastly, in Table 7 we extend our analysis by dis-aggregating the concept of democracy as measured by the *polity2* variable into its two most important components, constraints on the executive (a sub-component called *xconst* in Polity IV) and political competition (*polcomp* in Polity IV). The *xconst* measure reflects the extent of institutionalized constraints on the decision-making powers of chief executives imposed by one or more "accountability groups" (e.g., legislature, independent

Table 5
Robustness analysis: Regional jackknife estimations.

Variables	1	2	3	4	5	6	7	8
Excluded region	East Asia & Pacific	Eastern Europe & Central Asia	South Asia	Middle East & North Africa	Sub-Saharan Africa	Western Europe	North America	Latin America & Caribbean
KP Commitments	0.0155	0.0159***	0.0168***	0.0190***	0.0147***	0.0163***	0.0187***	0.0172***
	(0.00968)	(0.00416)	(0.00466)	(0.00572)	(0.00417)	(0.00601)	(0.00512)	(0.00469)
Non-Annex 1 dummy	−0.0716	−0.00833	−0.0537	0.00384	−0.0627	−0.0437	−0.0362	−0.0834
	(0.0806)	(0.0743)	(0.0555)	(0.0724)	(0.0530)	(0.0566)	(0.0572)	(0.0667)
CO_2 per capita emissions	−0.0131***	−0.0178***	−0.0133***	−0.00769	−0.0194***	−0.0103**	−0.00922**	−0.0122***
	(0.00471)	(0.00506)	(0.00418)	(0.00692)	(0.00403)	(0.00404)	(0.00394)	(0.00426)
GDP per capita	0.00766***	0.00888***	0.00790***	0.00866***	0.00863***	0.00533**	0.00710***	0.00800***
	(0.00204)	(0.00244)	(0.00170)	(0.00187)	(0.00139)	(0.00225)	(0.00179)	(0.00173)
Economic Freedom	0.00302	0.00486**	0.00276	0.00175	0.000781	0.00383*	0.00335*	0.00155
	(0.00223)	(0.00240)	(0.00191)	(0.00215)	(0.00208)	(0.00215)	(0.00197)	(0.00192)
Dem Capital (*polity2* > 0; 1800-)	0.144**	0.156**	0.121**	0.120**	0.0989*	0.116**	0.151***	0.0929
	(0.0551)	(0.0703)	(0.0534)	(0.0556)	(0.0543)	(0.0531)	(0.0495)	(0.0672)
Constant	0.0317	−0.121	0.0576	0.0421	0.258*	4.62e − 05	−0.0149	0.149
	(0.138)	(0.194)	(0.136)	(0.151)	(0.145)	(0.148)	(0.132)	(0.144)
Observations	77	60	86	80	73	71	85	77
R-squared	0.763	0.725	0.711	0.712	0.731	0.481	0.749	0.732

Robust standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 6
Robustness analysis: Alternative dependent variable (*Global Environmental Cooperation Index*).

Variables	1	2	3	4
	OLS	OLS	OLS	IV
KP Commitments	0.00883	0.0138	0.0130	0.0122
	(0.0164)	(0.0158)	(0.0156)	(0.0146)
Non-Annex 1 dummy	0.273	0.200	0.238	0.293*
	(0.196)	(0.185)	(0.174)	(0.172)
CO_2 per capita emissions	−0.0628***	−0.0607***	−0.0598***	−0.0499***
	(0.0124)	(0.0123)	(0.0118)	(0.0117)
GDP per capita	0.0314***	0.0261***	0.0274***	0.0249***
	(0.00794)	(0.00738)	(0.00721)	(0.00619)
Economic Freedom	0.0209**	0.0209**	0.0196**	0.0117
	(0.00852)	(0.00852)	(0.00848)	(0.0112)
Current Democracy	0.0270**	−0.0122		
	(0.0123)	(0.0202)		
Democratic Capital		0.726**	0.568***	1.015***
(*polity2* > 0; 1800-)		(0.341)	(0.208)	(0.352)
Constant	−1.629***	−1.767***	−1.697***	−1.531***
	(0.466)	(0.452)	(0.448)	(0.472)
Observations	128	128	128	127
R-squared	0.405	0.429	0.428	0.398
F-test of excluded instrument in first stage				53.48

Robust standard errors in parentheses.
*** p < 0.01.
** p < 0.05.
* p < 0.1.

judiciary, council of nobles), thus capturing the extent of checks and balances between the various parts of the decision-making process. The *polcomp* measure reflects the existence of truly competitive, free, and fair elections. We define a country as having in place sufficient constraints on the executive if the *xconst* variable, which runs from 1 to 7, takes on values of 6 or 7, which means the country either has executive parity or subordination, or is in between this and substantial limits on executive authority. We similarly define a country as having in place sufficient political competition if the *polcomp* variable, which runs from 1 to 10, takes on values of 9 or 10, which means the country either has fully free, fair and competitive elections or is in the transition to this state with limited conflict among competing groups or coercion from the state. Similar to the aggregate democracy measure, we construct capital stock measures based on these definitions, but also include the current values of executive constraints and political competition. Table 7 shows that current values of neither executive constraints nor political competition matter for *CLIMI*. Instead, the stock of executive constraints, i.e., a larger cumulative historical experience with such constraints, has a positive and statistically significant impact on climate policies. By contrast, the stock of political competition has no statistically significant effect. This suggests that it is the cumulative historical experience of constraints on the executive that matters for climate change policies rather than cumulative historical experience with free and competitive elections.

7. Conclusion

This paper argues that democratic capital (long-term historical experience with democracy) is an important determinant of climate change policies. In fact, we find that the current level of democracy has no effect on environmental policy once democratic capital is introduced. Higher levels of democratic capital stock (in particular, the stock of historical experience of constraints on the executive) are associated with more stringent climate change policies. Thus, recent transitions to democracy are unlikely to have short-term positive effects on environmental policies addressing climate change. As democracy is consolidated over time, we expect such transitions to eventually have a positive environmental policy impact, however. The Arab Spring (and other democratization) can be considered an initial step in the right direction also for the environment. In the short run additional policy measures and international cooperation appear necessary to address climate change.

Table 7
Dis-aggregating democracy: Executive constraints versus political competition.

Variables	1	2	3
KP Commitments	0.0135**	0.0135**	0.0133**
	(0.00537)*	(0.00537)	(0.00536)
Non-Annex 1 dummy	−0.0689	−0.0689	−0.0696
	(0.0617)	(0.0617)	(0.0616)
CO_2 per capita emissions	−0.0139***	−0.0139***	−0.0139***
	(0.00386)	(0.00386)	(0.00384)
GDP per capita	0.00577***	0.00577***	0.00580***
	(0.00180)	(0.00180)	(0.00179)
Economic Freedom	0.00210	0.00210	0.00215
	(0.00169)	(0.00169)	(0.00170)
Executive Constraints	0.0181	0.0181	0.0183
	(0.0202)	(0.0202)	(0.0203)
Political Competition	−0.0254	−0.0254	−0.0260
	(0.0171)	(0.0171)	(0.0172)
Executive Constraints Capital (1800-)	0.0120**		
	(0.00537)		
Political Competition Capital (1800-)	0.00519		
	(0.00668)		
Executive Constraints Capital (1900-)		0.0120**	
		(0.00538)	
Political Competition Capital (1900-)		0.00520	
		(0.00668)	
Executive Constraints Capital (1950-)			0.0119**
			(0.00543)
Political Competition Capital (1950-)			0.00570
			(0.00675)
Constant	0.184	0.184	0.183
	(0.127)	(0.127)	(0.127)
Observations	86	86	86
R-squared	0.762	0.762	0.763

Robust standard errors in parentheses.
*** p < 0.01.
** p < 0.05.
* p < 0.1.

Appendix A. Countries in sample and their climate change policies as measured by *CLIMI*

Albania (.199), Algeria (.023), Argentina (.401), Armenia (.201), Australia (.265), Austria (.641), Azerbaijan (.108), Bahrain (.086), Belarus (.262), Belgium (.66), Bolivia (.296), Brazil (.464), Bulgaria (.457), Burundi (.037), Cameroon (.084), Canada (.316), China (.485), Colombia (.34), Congo, Dem. Rep. (.091), Congo, Rep. (.049), Costa Rica (.517), Cote d'Ivoire (.064), Croatia (.29), Czech Republic (.653), Denmark (.722), Dominican Republic (.319), Egypt (.267), Estonia (.383), Fiji (.233), Finland (.787), France (.783), Georgia (.238), Germany (.665), Greece (.608), Guinea-Bissau (.087), Hungary (.483), India (.358), Indonesia (.402), Ireland (.667), Italy (.641), Japan (.636), Jordan (.156), Kazakhstan (.226), Korea, Rep. (.629), Kyrgyz Republic (.214), Latvia (.433), Lithuania (.615), Macedonia, FYR (.293), Madagascar (.029), Mauritania (.071), Mexico (.486), Moldova (.247), Mongolia (.288), Morocco (.339), Mozambique (.023), Netherlands (.691), New Zealand (.602), Niger (.025), Norway (.749), Peru (.437), Poland (.496), Portugal (.468), Romania (.497), Russian Federation (.134), Rwanda (.182), Saudi Arabia (.023), Senegal (.088), Serbia (.139), Sierra Leone (.016), Singapore (.468), Slovak Republic (.422), Slovenia (.698), South Africa (.456), Spain (.758), Sweden (.701), Switzerland (.77), Tajikistan (.134), Turkey (.381), Turkmenistan (.115), Ukraine (.398), United Arab Emirates (.159), United Kingdom (.801), United States (.34), Uruguay (.369), Uzbekistan (.262), Venezuela (.09), Vietnam (.345).

References

Acemoglu, D., Robinson, J.A., 2006. The Economic Origins of Dictatorship and Democracy. Cambridge University Press, New York.

Aichele, R., Felbermayr, G., 2012. Kyoto and the carbon footprint of nations. Journal of Environmental Economics and Management 63, 336–354.

Arvin, B.M., Lew, B., 2011. Does democracy affect environmental quality in developing countries? Applied Economics 43, 1151–1160.

Barbier, E.B., Damania, R., Léonard, D., 2005. Corruption, trade and resource conversion. Journal of Environmental Economics and Management 50, 276–299.

Barrett, S., Graddy, K., 2000. Freedom, growth, and the environment. Environment and Development Economics 5, 433–456.

Bättig, M.B., Bernauer, T., 2009. National institutions and global public goods: are democracies more cooperative in climate change policy? International Organization 63, 282–308.

Beck, T., Clarke, G., Groff, A., Keefer, P., Walsh, P., 2001. New tools in comparative political economy: the database of political institutions. World Bank Economic Review 15, 165–176.

Bernauer, T., Koubi, V., 2009. Effects of political institutions on air quality. Ecological Economics 68, 1355–1365.

Bernauer, T., Koubi, V., 2013. Are bigger governments better providers of public goods? Evidence from air pollution. Public Choice 156, 593–609.

Bernauer, T., Kuhn, P.M., 2010. Is there an environmental version of the Kantian peace? Insights from water pollution in Europe. European Journal of International Relations 16, 77–102.

Besley, T., Persson, T., 2011. Pillars of Prosperity. Princeton University Press, Princeton.

Besley, T., Reynal-Querol, M., 2011. Do democracies select more educated leaders? The American Political Science Review 105, 552–566.

Bohn, H., Deacon, R.T., 2000. Ownership risk, investment, and the use of natural resources. American Economic Review 90, 526–549.

Bueno de Mesquita, B., Smith, A., Siverson, R.M., Morrow, J.D., 2003. The Logic of Political Survival. MIT Press, Cambridge.

Buitzenzorgy, M., Mol, A.P., 2011. Does democracy lead to a better environment? Deforestation and the democratic transition peak. Environmental and Resource Economics 48, 59–70.

Chatterjee, S., Hadi, A.S., 2006. Regression Analysis by Example, fourth ed. Wiley, New York.

Coate, S., Morris, S.E., 1999. Policy persistence. American Economic Review 89, 1327–1336.

Congleton, R.D., 1992. Political institutions and pollution control. The Review of Economics and Statistics 74, 412–421.

Deacon, R.T., 2009. Public good provision under dictatorship and democracy. Public Choice 139, 241–262.

Dinda, S., 2004. Environmental Kuznets curve hypothesis: a survey. Ecological Economics 49, 431–455.

Eriksson, C., Persson, J., 2003. Economic growth, democratization, and the environment. Environmental and Resource Economics 25, 1–16.

Esty, D.C., Levy, M., Srebotnjak, T., de Sherbinin, A., 2005. 2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship. Yale Center for Environmental Law and Policy, New Haven.

Farzin, H.Y., Bond, C.A., 2006. Democracy and environmental quality. Journal of Development Economics 81, 213–235.

Fosten, J., Morley, B., Taylor, T., 2012. Dynamic misspecification in the environmental Kuznets curve: evidence from CO_2 and SO_2 emissions in the United Kingdom. Ecological Economics 76, 25–33.

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., Svensson, J., 2003. Political instability, corruption and policy formation: the case of environmental policy. Journal of Public Economics 87, 1383–1405.

Fredriksson, P.G., Wollscheid, J.R., 2013. Political institutions, political careers and environmental policy. Mimeo, Resources for the Future.

Fredriksson, P.G., Neumayer, E., Damania, R., Gates, S., 2005. Environmentalism, democracy, and pollution control. Journal of Environmental Economics and Management 49, 343–365.

Fredriksson, P.G., Neumayer, E., Ujhelyi, G., 2007. Kyoto Protocol Cooperation: Does Government Corruption Facilitate Environmental Lobbying? Public Choice 133, 231–251.

Fredriksson, P.G., Wang, L., Mamun, K.A., 2011. Are politicians office or policy motivated? The case of U.S. governors' environmental policies. Journal of Environmental Economics and Management 62, 241–253.

Gallagher, K.P., Thacker, S.C., 2008. Democracy, Income, and Environmental Quality. PERI Working Paper 164, University of Massachussets Amherst.

Gehlback, S., Keefer, P., 2011. Investment without democracy: ruling-party institutionalization and credible commitment in autocracies. Journal of Comparative Economics 39, 123–139.

Gehlback, S., Keefer, P., 2012. Private investment and the institutionalization of collective action in autocracies: ruling parties and legislatures. Journal of Politics 74, 621–635.

Heritage Foundation, 2013. Index of Economic Freedom. http://www.heritage.org/index/ (last visited April 4, 2013).

Hotte, L., Winer, S., 2012. Environmental regulation and trade openness in the presence of private mitigation. Journal of Development Economics 97, 46–57.

Kauffman, D., Kray, A., Mastruzzi, M., 2009. Governance matters VIII: aggregate and individual governance indicators, 1996–2008. World Bank Policy Research Working Paper No. 4978.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1999. The quality of government. Journal of Law, Economics, and Organization 15, 222–279.

Li, Q., Reuveny, R., 2006. Democracy and environmental degradation. International Studies Quarterly 50, 935–956.

List, J.A., Sturm, D.M., 2006. How elections matter: theory and evidence from environmental policy. Quarterly Journal of Economics 121, 1249–1281.

Marshall, M.G., Jaggers, K., 2007. Polity IV Project: Dataset Users' Manual. George Mason University and Center for Systemic Peace (http://www.systemicpeace.org/inscr/p4manualv2006.pdf).

McGuire, M., Olson, M., 1996. The economics of autocracy and majority rule: the invisible hand and the use of force. Journal of Economic Literature 34, 72–96.

Midlarsky, M., 1998. Democracy and the environment: an empirical assessment. Journal of Peace Research 35, 341–361.

Neumayer, E., 2002a. Do democracies exhibit stronger international environmental commitment? A cross-country analysis. Journal of Peace Research 39, 139–164.

Neumayer, E., 2002b. Does trade openness promote multilateral environmental cooperation? World Economics 25, 815–832.

Olson, M., 1993. Dictatorship, democracy and development. The American Political Science Review 87, 567–576.

Persson, T., Tabellini, G., 2009. Democratic Capital: the nexus of political and economic change. American Economic Journal: Macroeconomics 1, 88–126.

Plümper, T., Neumayer, E., 2010. The level of democracy during interregnum and affected transition periods: recoding the polity2 score. Political Analysis 18, 206–226.

Roberts, J.T., Parks, B.C., 2007. A Climate of Injustice: Global Inequality, North-South Politics, and Climate Policy. MIT Press, Cambridge.

Scruggs, L.A., 1998. Political and economic inequality and the environment. Ecological Economics 26, 259–275.

Scruggs, L., 2009. Democracy and Environmental Protection: An Empirical Analysis. Paper presented at the annual meeting of the Midwest Political Science Association, Chicago, IL.

Steves, F., Treisman, D., Teytelboyn, A., 2013. Political Economy of Climate Change Mitigation Policy. Working Paper. European Bank of Reconstruction and Development and University of Oxford, London and Oxford.

Torras, M., Boyce, J.K., 1998. Income, inequality, and pollution: a reassessment of the environmental Kuznets curve. Ecological Economics 25, 147–160.

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.

Wheeler, D., 2011. Quantifying vulnerability to climate change: implications for adaptation assistance. Working Paper 240. Center for Global Development.

Wilson, J.K., Damania, R., 2005. Corruption, political competition and environmental policy. Journal of Environmental Economics and Management 49, 516–535.

Winslow, M., 2005. Is democracy good for the environment? Journal of Environmental Planning and Management 48, 771–783.

World Bank, 2012. World Development Indicators CD-Rom. World Bank, Washington DC.