DEMOCRACY, BUREAUCRATIC CAPACITY AND ENVIRONMENTAL PERFORMANCE

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ABSTRACT

This paper explores the link between democracy, bureaucratic capacity and environmental performance. While many previous empirical studies have focused either on democracy or bureaucratic capacity in isolation, this paper suggests that these two factors must be considered in interaction to account for the variation in the delivery of public policy outcomes. Democracy, shaping the functioning of the input side of political systems, determines how the decisions are made in a polity, while bureaucratic capacity, shaping the functioning of the output side, determines whether and how these decisions get implemented. The study empirically tests the interaction hypothesis on one of the major environmental problems—air pollution. The results show that the effect of democracy on carbon dioxide emissions is indeed contingent on the levels of bureaucratic capacity: Democracies emit less only if their bureaucratic capacity is high. If bureaucratic capacity is low, democracies do not do any better than authoritarian regimes.

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Introduction

In an era marked by the prevalence of democracy and the looming threat of the environmental crisis, research consistently aims to answer a question: Can democracy generate effective solutions to environmental problems? Indeed, the participation of civil society, the rise of environmental awareness through free media, and active collaboration in international environmental agreements—features common to democracies—have been said to play a crucial role in placing environmental issues on the political agenda and for adopting environmental policies. What is equally crucial, however, is whether these environmental policies essentially get implemented.

Recent research claims that democracy, with its free elections and wide representation of different interests in power structures, is necessary but might not be a sufficient condition for solving societal problems, since it does not account for the ability of governments to implement policies (Rothstein 2011). While keeping the previous focus on democracy, this paper also underscores the importance of bureaucratic capacity in reaching desirable policy outcomes. While democracy level can determine how different issues are brought up on the political agenda and how political decisions are made, bureaucratic capacity, often characterized by the absence of corruption and meritocratic employment, determines whether and how the decisions are implemented. The paper thus suggests that the two processes should be analyzed in conjunction whenever we talk about their effect on public policy outcomes.

The interaction between democracy level and bureaucratic capacity is especially important for those societal problems that require long-term thinking from decision-makers and that cannot be solved by short-term quid pro quo exchanges in electoral campaigns. Such problems include the environment. Clean environment generally refers to environmental conditions in which it is possible for people to sustain good health, including, e.g., clean air free from harmful chemicals and particles and clean drinkable water. Despite the fact that environmental quality directly affects human health and welfare, environmental protection is often not the first priority for citizens due to more pressing material needs (Inglehart 1990; Cotgrove and Duff 1981). Since the effect of environmental policies cannot be directly observed after the implementation process has been initiated, environmental issues are therefore not necessarily a priority on the political agenda. While political leaders in democracies are known to be short-sighted due to constant political challenge through electoral

cycles (Congleton 1992), high bureaucratic capacity in democracies acts as a buffer against policy revisions when governments change (ICRG 2014), and therefore is favorable to long-term policy commitments (Charron and Lapuente 2011).

This paper empirically tests whether the effect of democracy on the environment is contingent on the level of bureaucratic capacity. To do this, I perform between-effects regression using time-series cross-section data for one of the major types of environmental problems—air pollution, measured in the amount of carbon dioxide emissions per capita. The issue both requires the government to adopt rules and regulations aimed at restricting pollution levels and collective action from polluters to conform to the regulations. In addition, it requires a strong functioning government apparatus to implement the decision, enforce the rules and monitor the compliance of polluters.

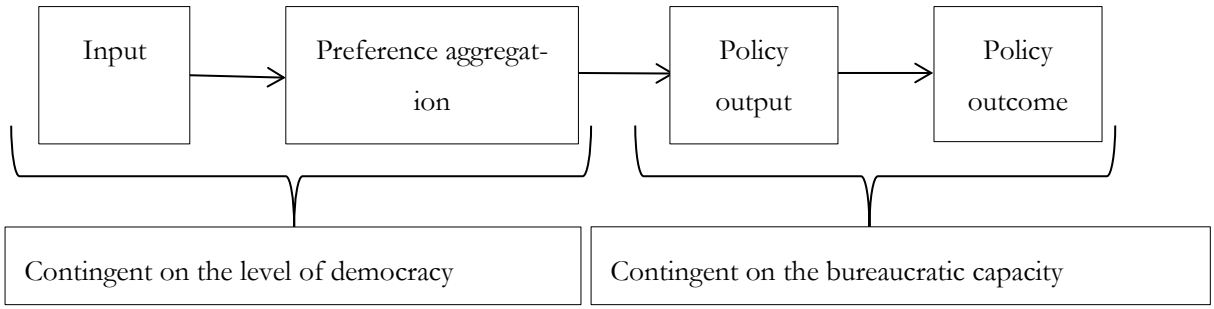
The next section provides a brief overview of the existing literature on the relationship between democracy, bureaucratic capacity and environmental performance and introduces the theoretical model of the study. Further I describe the data and present the empirical strategy. Next comes the presentation of the results and discussion of the main findings. The last section offers conclusions.

Theoretical framework

Environmental policy outcomes

Let us consider political processes as a constant cyclical connection between input and output of the political system (Easton 1965). The input side of the political system represents the aggregated preferences of the citizenry (in democracies) or the elite (in authoritarian regimes) that affect decision-making (Cornell and Grimes 2015). During the policy-making process, preferences are transformed into policy outputs in the form of laws and regulations, "statutes produced by legislatures" (Ringquist 1995). After the implementation process, which implies administrative actions taken by the bureaucracy, citizens can observe the actual impact of public policies or policy outcomes—"the consequences for society […] that stem from government action and inaction" (Anderson 2003).

FIGURE 1, POLICY-MAKING PROCESS WITHIN A POLITICAL SYSTEM



Environmental performance, which is the focus of this paper, implies the actions the actors take to achieve higher environmental quality—an environmental outcome of environmental protection legislation (Ringquist 1995). The analysis of this paper does not cover policies or policy outputs directly, but implicitly addresses them as intermediary factors in the chain of the policy-making process.

Democracy and the environment

Recent comprehensive reviews of the literature on the democracy-environment relationship are well presented by Li and Reuveny (2006), Bernauer and Koubi (2009),[1] and Sjöstedt and Jagers (2014). The main theoretical arguments explaining why democracies are expected to take better care of the environment than non-democracies can be summarized as follows.

Firstly, political rights and freedom of media increase public awareness of environmental problems and therefore promote adoption of environmental policies. This mechanism mostly functions through the work of environmental groups and public opinion (Schultz and Crockett 1990; Payne 1995). Secondly, a democratic regime is more responsive to the environmental concerns of the public than non-democracy through electoral accountability and the possibility for green parties to organize and participate in decision-making (Kotov and Nikitina 1995). Thirdly, democratic values are more environmentally friendly than values promoted in autocracies: Democracies comply with

[1] The reader should note a mistake in the article by Bernauer and Koubi (2009), in which the authors cite and interpret Congleton (1992), whose model predicts a positive relationship between democracy and pollution control, not negative, as authors claim.

international environmental treaties because they respect rule of law (Weiss and Jacobson 1999). Respect for human rights and human life in democracies leaves less space for harmful environmental degradation (Gleditsch and Sverdrup 2003). Fourthly, public masses in democracies have higher pro-environmental attitudes than the elites in autocracies because reduced production and consumption affect the elites economically (Congleton 1992). Finally, democracies are expected to have better environmental performance, since the median voter has longer time horizons and cares about long-term environmental improvement more than elites in autocratic regimes that aim for short-term outcomes and allocate resources away from environmental issues (Congleton 1992).

However, arguments have also been raised as to why democracies might perform comparatively worse than authoritarian states in managing their environments. Firstly, autocrats have the coercive power to reorient society for sustainability, while in democracies, free individuals will tend to overharvest common-pool resources and deviate from environmentally friendly behavior (Hardin 1968). Secondly, and closely related, autocracies can impose restrictions on population growth (Heilbroner 1974). Thirdly, since democracies are mainly market economies and corporate interests rank high in political decision-making, access of businesses to power makes it harder to keep environmental priorities higher than economic ones (Dryzek 1987). Fourthly, democracies might prioritize economic interests to satisfy the needs of specific groups of voters and win more votes (Midlarsky 1998). This reasoning led to the development of the idea of "environmental authoritarianism." The existing few papers on environmental authoritarianism define such a regime "as a public policy model that concentrates authority in a few executive agencies manned by capable and uncorrupt elites seeking to improve environmental outcomes" (Gilley 2012, 288).

Although there is strong criticism of environmental authoritarianism (Shahar 2015), the main idea is clear: For environmental outcomes to be achieved, elites in a state need to "seek" improvement in environmental outcomes and have the capacity to implement policies. This conclusion can in fact be projected to any type of regime.

Empirical support is as ambiguous as theoretical arguments. Numerous quantitative studies find a positive effect of democracy on some environmental outcomes and negative or no effect on others (e.g. Li and Reuveny 2006; Midlarsky 1998; Arvin and Lew 2009). The important limitation of the studies that examine the relationship between the level of democracy and the environmental out-

comes, however, is that only a few control for the implementation segment of the policy process, namely bureaucratic capacity.

> Environmental quality is not simply affected by the presence or absence of regulation. Pollution is also affected by different levels of regulation; stringency of regulation is more important when it comes to policy outcomes than the presence or absence of regulation. (Ringquist 1995, 311)

Autocratic and democratic political regimes, with respect to efforts to improve environmental quality, in principle differ on the input side of the political system—the way in which incentives to invest in improving environmental quality are formed (see Figure 1). The empirical evidence shows that in democracies, the issue is brought up through strong "green" civil society movements (Dryzek 2003), corporatist interests' influence (Scruggs 1999; Scruggs 2001) or international pressure (Neumayer 2002). In autocracies, the decision more exclusively depends on the will of the autocrat and the elite and can be affected by, for instance, international pressure or pressure from the public, to a much lesser extent.

However, as depicted in Figure 1, the decision to protect the environment and the actual outcome are separated by the chain of the policy-making process. After the issue appears on the political agenda, there comes the decision to prioritize the environment alongside other budget expenditures, adopt laws and regulations. Consequently, environmental regulations enter an implementation stage that includes introduction of the appropriate policy instruments, monitoring and enforcement (Howlett et al. 2009).

> A clear statute is not enough to ensure policy success [...] The statute must also provide the implementing agency with technical resources, policy tools, and sanctions for noncompliance that are adequate for the task in hand. (Ringquist 1993, 1026)

Therefore, regardless of the way "environmental input" reaches decision-making stage, all types of political regimes require a well-functioning state apparatus that implements the decisions. Such well-functioning apparatus, however, is not necessarily an attribute of democratic systems. As Huntington (1991, 2589) notes:

> Democracies may be: inefficient, corrupt, shortsighted, irresponsible, dominated by special interests and incapable of adopting policies demanded by the public good. These make such governments undesirable but they do not make them undemocratic. [Therefore,] democracy should be clearly distinguished from the other characteristics of political systems.

Bäck and Hadenius (2008) find support to this claim in the J-shaped relationship pattern between administrative quality and democracy level, indicating that some of the authoritarian regimes have higher capacity to implement tasks than some of the democracies.

Bureaucratic capacity and the environment

The importance of the state's bureaucratic capacity for the provision of public goods and services is broadly discussed in political economy literature, which emphasizes that without well-functioning institutions, the selfish goals of political leaders will prevent them from acting for the collective good (Acemoglu et al. 2001; Miller 2000; North 1981). In a weak state with low capacity, political actors can engage in quid pro quo exchanges, and voters will benefit from club or private goods instead (Charron and Lapuente 2010).

High administrative capacity is especially important in the implementation of such policies that are not the first priority on governments' agendas, such as—often—environmental policies. Without the efficient organization of the government apparatus, implementation will be delayed, and the ability of the state to monitor compliance of citizens and organizations and punish free-riders will be decreased (D'Arcy and Nistotskaya 2013).

Ringquist (1993) particularly underscores that the necessary element of bureaucratic capacity is a competent agency committed to program goals, which provides adequate inspections and well-targeted enforcement in environmental policy implementation. Weiss and Jacobson (1999) state that administrative capacity is crucial for compliance with international agreements.

One of the most disruptive forces influencing bureaucratic or administrative capacity is corruption, which interferes in the hiring process of government officials and thus affects competence level and the level of commitment to policy goals. It disrupts the rule of law: In corrupt societies, bureaucrats can be bribed, and rules are simply not followed. In a corrupt system, public revenues can be di-

verted from their target purpose and enrich government officials instead. Since corruption can account for many disruptive processes within this political system, this paper further uses corruption as a proxy for bureaucratic capacity.

The literature suggests that corruption can influence environmental outcomes through at least four driving forces. First, corruption can directly decrease stringency of the environmental regulations (Damania et al. 2003) and the effectiveness of environmental policy implementation (López and Mitra 2000) by affecting the level of compliance (Wilson and Damania 2005). In the regulations of emissions, for example, corruption creates "an opportunity for the inspector and firm to engage in corrupt behavior by colluding and underreporting true emission levels" (Damania 2002, 410). Polluting businesses can also avoid complying with environmental regulations by bribing government officials (Desai 1998, 300). O'Connor (1994, 94) similarly points out that "when violators of standards are detected […] polluters are exempted from fines […] because of the power they wield." In a corrupt system, inspectors can choose to remain blind to illegal actions through either inadequate enforcement, information sharing or being directly involved themselves, as Sundström (2015) finds in his in-depth study of corrupt practices in South African fisheries.

Secondly, theoretical work and empirical evidence shows that corruption can indirectly affect the environment by hindering economic growth and therefore either decreasing pollution at lower levels of economic development by obstructing growth of industries or increasing pressure on the environment in high-income countries by preventing green investments (Welsch 2004; Cole 2007).[2]

Thirdly, absence of corruption facilitates collective action by increasing trust among individuals and in governmental institutions. People in high trust societies are more inclined to comply with the rules and contribute to the common good (Rothstein and Eek 2009; Richey 2010). Therefore, corruption, through low trust, weakens stringency of environmental tax policy by decreasing incentives for citizens to pay taxes (Fredriksson and Mani 2002; Welsch 2004).

Fourthly, corruption hampers policy setting, since polluting businesses can directly bribe policy-makers to push through their interests into decision-making (Wilson and Damania 2005). It also

[2] Also, see Cole (2007) for a recent comprehensive review of the corruption-pollution relationship.

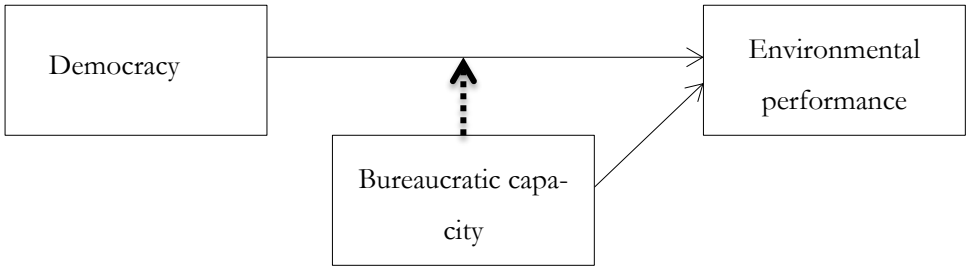
decreases time horizons of political leaders (Charron and Lapuente 2011), who have less incentives to adopt policies, outcomes from which can only be seen after a long time lag, since they know that corruption will hamper implementation.

Hypothesizing the relationship between democracy level, bureaucratic capacity and the environment

In this paper, I marry the two literatures and propose a hypothesis claiming that there is an interaction between the level of democracy and bureaucratic capacity in their effect on environmental performance. If we consider the effect of political factors on the environment, the level of democracy on its own is insufficient for determining environmental performance, since it does not fully account for how decisions are implemented. The level of democracy mainly influences how the input side of the political system functions and how political decisions to protect the environment are formed, while bureaucratic capacity defines how these decisions are implemented and whether they are implemented at all. Bureaucratic capacity, however, does not solely determine the outcomes either, since priorities on environmental commitments have to be first set on the input side of the system. Therefore, it is worth considering how different regimes deliver policy outcomes *depending on* the bureaucratic capacity, that is, the interaction between the input side (influenced by the level of democracy[3]) and the implementation side (influenced by bureaucratic capacity). The processes together in large part determine how the political system functions and plays out for environmental quality (see Figures 1 and 2).

[3] Low levels of democracy correspond to authoritarian regimes.

FIGURE 2. RELATIONSHIP BETWEEN DEMOCRACY, BUREAUCRATIC CAPACITY AND ENVIRONMENTAL PERFORMANCE [4]



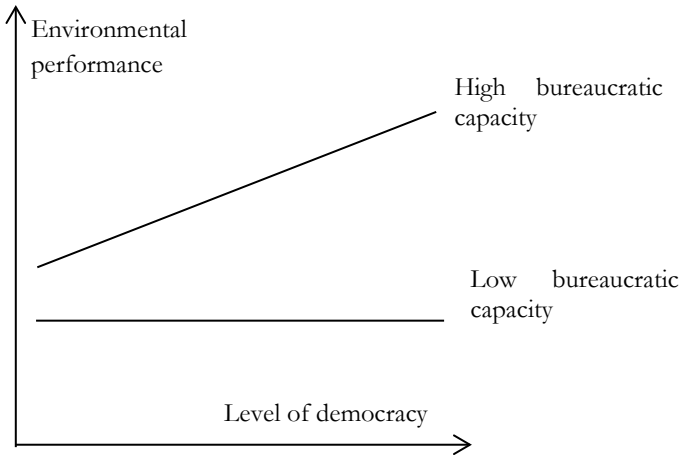
A few studies have looked at both sides of the story, but to my knowledge, there have so far been no attempts to theorize or test the interactive relationship. Sjöstedt and Jagers (2014) directly include democracy and corruption in the same model and test which of the two factors is more important when predicting the quality of the marine environment in Sub-Saharan Africa. The results show that lower corruption and higher democracy are independently associated with healthier marine ecosystems. Once both the predictors are included in the model, however, corruption becomes no longer significant. The authors conclude that corruption does not have a stronger effect on the environment than does democracy. In contrast, Pellegrini and Gerlagh (2006) in their analysis of the relationship between corruption and environmental policy stringency find that when corruption is included in the model, the effect of democracy disappears. The authors conclude that the positive relationship between democracy and environmental protection found in the previous studies was due to correlation between high democracy and low corruption. These conflicting findings can be attributed to different country samples, different methodologies (pooled OLS vs. cross-country OLS) leading to different conclusions, and different dependent variables (observed outcome vs. policy stringency).

In this paper, I will advance the previous attempts and directly test the independent and interdependent effect of democracy and bureaucratic capacity (here operationalized with corruption) on environmental performance. The expected relationship is illustrated in Figure 3. Environmental outcomes are expected to benefit from high bureaucratic capacity in both democratic and non-

[4] The reader should keep in mind that bureaucratic capacity and democracy are also related, which could be depicted with an arrow between the respective boxes on Figure 2, implying mediation. However, since the relationship between the two is not the main focus of the study and I do not explore the mediation effect, I do not illustrate it here and instead focus on the relationship between the characteristics of the political system on the one hand and environmental performance on the other hand.

democratic regimes, since it implies the capacity of the state to carry out its tasks, including implementation of environmental policies. Political leaders are also more likely to commit themselves to environmental protection in regimes with high bureaucratic capacity irrespective of the level of democracy. However, the effect of bureaucratic capacity on the environment is expected to be higher in democracies.

FIGURE 3, EXPECTED RELATIONSHIP BETWEEN DEMOCRACY LEVEL, BUREAUCRATIC CAPACITY AND ENVIRONMENTAL PERFORMANCE



In democracies (the right end of the X axis in Figure 3), high capacity of the bureaucracy to implement tasks is crucial to counterbalance the short-sightedness of the political leaders, who fight for power in short electoral cycles. It can prevent vote-buying and provision of "club" goods that are restricted to certain groups of people, instead of public goods, which are available to all. As a buffer, it can secure policies that require long-term commitments, such as environmental policies, against policy changes when the government changes (ICRG 2014). In a democracy with low bureaucratic capacity, long-term commitments such as environmental policies are less probable, since political leaders will be reluctant to make decisions that are unlikely to be implemented. In a country drenched in corruption and clientelism, polluting industries can also bribe policy-makers to support non-environmentally friendly decisions.

A similar picture is anticipated in autocracies with low bureaucratic capacity (the left end of the X axis in Figure 3), in which the interests of the narrow elite influence governmental decisions. The mechanism of how low bureaucratic capacity can influence environmental outcomes was described

in the previous section. Although the nuances differ from case to case, generally, I expect bureaucratic capacity to be positively related to environmental performance, regardless of the regime. In autocracies, however, bureaucratic capacity is expected to matter less for the implementation of environmental policies than in democracies, since decision-making and implementation in autocracies are less dependent on the non-elite actors.

Therefore, among autocracies, the difference in environmental performance between countries with high and low bureaucratic capacity is expected to be low, while in democracies, the difference in environmental performance of countries with high and low bureaucratic capacity is expected to be high. Similarly, democracies with high bureaucratic capacity are expected to have better environmental performance than autocracies with good institutions, while autocracies with low bureaucratic capacity are expected to have lower environmental performance than democracies with low capacity. In an authoritarian regime with high bureaucratic capacity, environmental quality is expected to be higher, however, than in a democracy with low bureaucratic capacity, since such a state is expected to have a strong coercive power and therefore to act as an "enforcer" (Bäck and Hadenius (2008). In democracies, though, institutions, as a set of independent rules, are crucial, since they play the role of enforcer that imposes checks and balances on governmental leaders and prevents free-riding (D'Arcy and Nistotskaya 2013). Without it, the democratic system becomes an empty shell, simply opening up opportunities for corruption, patronage and clientelism (Sjöstedt and Jagers 2014, 144).

From this discussion follows the hypothesis:

H_1 The effect of democracy on environmental performance is contingent on the level of bureaucratic capacity.

The contingency of the effect can imply numerous different patterns. Following the suggestion by Berry et al. (2012) on formulation of interaction hypotheses, I specify the relationship pattern as follows:

$H_{1.1}$ A higher level of democracy is associated with higher environmental performance only when bureaucratic capacity is high.

$H_{1.2}$ When bureaucratic capacity is low, there is no significant difference in environmental performance at high and low levels of democracy.

$H_{1.3}$ Political systems with high bureaucratic capacity and low levels of democracy have higher environmental performance than political systems with low bureaucratic capacity and high levels of democracy.

The relationship pattern suggested in the hypotheses is illustrated in Figure 3 and can be summarized in Table 1.

TABLE 1, THE EXPECTED RELATIONSHIP BETWEEN DEMOCRACY LEVEL, BUREAUCRATIC CAPACITY AND ENVIRONMENTAL PERFORMANCE (EP)

		Democracy	
		Low	High
Bureaucratic capacity	Low	Low EP	Low EP
	High	Higher EP	High EP

Data

In this paper, I test whether the proposed interactive relationship between democracy and bureaucratic capacity holds for one of the major environmental problems—air pollution. One of the most widely used measures of air pollution is carbon dioxide ($CO_{2)}$ emissions per capita, which also account for the largest share of greenhouse gases associated with climate change. CO_2 emissions are largely a by-product of energy use. They result from combustion of fossil fuels to generate electricity and heating, burning of gasoline and diesel in transportation, and chemical reactions in the production of metals, cement and chemicals, and other industry activities.

Data on emissions levels have certain advantages over the data on chemical concentration of the pollutant in the atmosphere. Concentration data are only relevant for the city level and are difficult to reliably estimate, since pollutants travel. Emissions, on the other hand, directly reflect actions that emitters take, since the measure directly shows how much carbon dioxide polluting enterprises

release.[5] The indicator is taken from Emissions Database for Global Atmospheric Research and is measured in tons of CO_2 emissions per capita per country and per year (Oliver et al. 2014). The CO_2 data are available for 188 countries over the years 1970-2013. The indicator is log-transformed due to positive skewness.

Independent variables

The first main independent variable of the study—the level of democracy—is a revised combined polity score taken from the Polity IV project (Marshall and Jaggers 2013).[6] The index originally ranges from -10 to 10, where -10 stands for totalitarian regimes, while10 corresponds to the most democratic polities. I rescale the index to take only positive values for a more convenient interpretation of the interaction term. In the new coding, counties having the scores between 1 and 5 are autocracies, states scoring between 5 and 16 are anocracies,[7] and nations scoring between 17 and 21 are democracies. The indicator is available from 1946 to 2012.

The second main independent variable is control of corruption, taken from the World Bank Governance Indicators (Kaufmann et al. 2014).[8] The indicator measures perceptions of corruption in a country at a particular point of time, where higher values represent lower corruption. I transform the indicator to take only positive values by adding 2.5 to each value. This makes it easier to compare the indicator with democracy scores in interaction. The indicator is available for the years 1996 to 2012.

Control variables

Control variables include real GDP per capita in constant 2005 prices, taken from the Penn World Table (Heston et al. 2012), population size, taken from the Maddison-project (Bolt and Zanden 2013), population density (WB 2014), latitude to control for eventual effect of weather conditions

[5] Carbon dioxide emissions from forest fires are excluded from the aggregated value to measure only anthropogenic emissions.
[6] The data are taken from Quality of Government Dataset (Teorell et al. 2014).
[7] For the definition of anocracy, see Marshall and Jaggers (2013).
[8] The choice of data required certain compromises. The World Bank corruption indicator is correlated with GDP per capita at a higher extent than the corruption measure from ICRG (2014) (see Table 4 in Appendix A). However, the World Bank allows for larger cross-country coverage (see Table 3 in Appendix A). Since in this study broader cross-country variation is more important than time coverage, to account for the maximum available variation in the sample, I use World Bank data.

(La Porta et al. 1999), urbanization rate (WB 2014) and trade openness taken from Penn World Trade (Heston et al. 2012).

Previous studies have shown that GDP per capita has an inverse U-shaped curved relationship with CO_2 emissions (Grossman and Krueger 1994). However, the theory of Environmental Kuznets Curve (EKC) assumes that the turn of the curve occurs, among other reasons, because countries start adopting and implementing environmental policies. Since the corruption indicator measures the capacity of the state to implement policies, I will use it as a means to model the curved pattern of the GDP-CO_2 emissions relationship and additionally to compare explanatory powers of models, which include a corruption variable with the EKC model. Urbanization rate is expected to have a positive effect on CO_2 emissions, due to concentration of cars and heating facilities in cities and towns. Trade in turn affects environmental behavior due to the pressure to uphold international environmental standards (Cole and Elliott 2003).

Variables that are not normally distributed are log-transformed with the aim to improve the distribution of residuals. These variables include GDP per capita, openness to trade, population size and population density. To minimize the number of missing values, I collected missing data on some of the independent variables.[9] As a result, the models in this paper have higher cross-country coverage than did the previous studies using the same data. Table 3 in Appendix A presents summary statistics for all variables, while Table 4 shows relevant correlations.

Method

In exploring the relationship between the slow-moving political variables and air pollution, we are more interested in long-run elasticity, or long-term total responses, rather than short-run elasticity, which measures immediate response of the dependent variable to the change. Following the advice by Stern (2010), who emphasizes the advantages of between estimator over other estimation techniques in analyzing the long-run relationship between CO_2 emissions and income, I also use the between-effects regression. In this study, I thus use time series data by calculating average values of

[9] The data on latitude are collected from CIA (2013) for Central African Republic, Comoros, St. Vincent and Grenadines and Tuvalu. Latitude measure is divided by 90 to restrict the variance to 0-1 interval. Data on trade openness are taken from UNCTAD for Myanmar, North Korea and Tuvalu. Data on urban population for Tuvalu, population size for Comoros and population density for Taiwan are taken from CIA (2013) statistics. Missing values in GDP per capita for Myanmar, North Korea, Tuvalu, Lichtenstein, Monaco, Andorra and San Marino are filled with data from Gleditsch (2011).

the variables for each country over the time period available, but I focus on the difference between countries, which is a major source of the variation in the data.[10] Between-effects regression therefore has an advantage over simple cross-country comparisons, since it adjusts the values for each country according to the historical data on the variables over the period available. It focuses on the long-run relationship between the variables by analyzing the data in view of cumulative historical changes that led to the current situation. The between-effects equation to be estimated is:

$$\overline{lnY_i} = \alpha + \beta_j \overline{X_{Ji}} + \mu_i \ , \qquad (1)$$

where $\overline{lnY_i}$ is a mean value of the natural logarithm of the dependent variable for the years available for each country. $\overline{X_{Ji}}$ is a vector of the mean values of independent variables for each country over the period available, while μ_i is a country-level error term. Mean values of the independent variables are taken over the same period of time for which the dependent variable is available.

I estimate the equation five times, making changes in the composition of X_{ji}. The first two models test the effects of democracy and corruption control separately on the amount of carbon emissions, with controls. The third model is a simple additive relationship between democracy, corruption control and control variables, including a natural logarithm of GDP per capita:

$$X_i = \beta_1 corr_i + \beta_2 dem_i + \beta_3 lnGDP_i + \beta_j Z_{ji} \qquad (2)$$

where *i* denotes country, *j* is the number of control variables, *corr* is control of corruption measure, *dem* is democracy measure, *lnGDP* is a natural logarithm of GDP per capita, and *Z* is a vector of the rest of control variables.

In the fourth model, I introduce the interaction term between corruption control and democracy (*dem*corr*):

$$X_i = \beta_1 corr_i + \beta_2 dem_i + \beta_3 dem_i * corr_i + \beta_4 lnGDP_i + \beta_j Z_{ji} \qquad (3)$$

[10] As shown by rho-coefficient, which indicates that 99,22% of the variance is due to differences across panels.

In the fifth model, I include a squared term of GDP per capita instead of the interaction term to compare the explanatory powers of the interaction model and Environmental Kuznets Curve model between GDP per capita and emissions:

$$X_i = \beta_1 corr_i + \beta_2 dem_i + \beta_3 lnGDP_i + \beta_4 lnGDP_i^2 + \beta_j Z_{ji} \quad (4)$$

The models have successfully passed standard regression diagnostics.

Results

Table 2 presents the results for equations 1-4. Model 1 shows the estimates of the relationship between democracy and CO_2 emissions per capita, controlling for economic, demographic and geographical factors. The result is negative and significant, indicating that more democracy is associated with fewer emissions per capita. Model 2 estimates the independent effect of corruption control on the emissions level. The results are also negative and significant, implying that higher control of corruption is associated with lower levels of emissions. Model 3 shows the estimates of the relationship between democracy and CO_2 emissions per capita while controlling for corruption. Democracy becomes insignificant, while control of corruption retains a negative effect on emissions, implying that countries with lower corruption emit less. Model 5 shows that the effect of corruption persists even when squared GDP per capita is included to control for the inverted U-shaped relationship between GDP and emissions levels,[11] while democracy remains insignificant. Model 4 explicitly tests whether the effect of democracy on carbon emissions depends on corruption. While the interaction term is statistically significant, neither of its composite parts is. When disentangling the effects in interaction, however, it is more useful to look at margin plots than solely relying on the numbers.

[11] When corruption is excluded from the model, GDP per capita squared is significant and negative. Because GDP per capita is correlated with corruption measure, the fact that GDP squared is no longer significant after corruption is included indicates that the corruption measure to some extent captures the turn of the relationship curve between GDP per capita and carbon emissions.

TABLE 2, RELATIONSHIP BETWEEN DEMOCRACY AND CORRUPTION IN THEIR INTERDEPENDENT EFFECT ON AIR POLLUTION

	CO_2 emissions per capita (log)				
VARIABLES	1	2	3	4	5
Democracy	-0.021**		-0.006	0.039	-0.008
	(0.009)		(0.009)	(0.025)	(0.011)
Control of Corruption		-0.368***	-0.353***	-0.066	-0.316***
		(0.065)	(0.070)	(0.160)	(0.085)
Democracy*Corruption				-0.018**	
				(0.008)	
GDP/capita sq (log)					-0.033
					(0.050)
GDP/capita (log)	0.906***	1.049***	1.056***	1.050***	1.599*
	(0.134)	(0.130)	(0.132)	(0.131)	(0.903)
Openness to trade (log)	0.487***	0.447***	0.439***	0.420***	0.416***
	(0.100)	(0.086)	(0.087)	(0.089)	(0.089)
Urban Population, %	0.015**	0.016***	0.015***	0.014***	0.015***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
Latitude	1.529***	1.709***	1.732***	1.916***	1.734***
	(0.370)	(0.314)	(0.325)	(0.322)	(0.323)
Population density (log)	-0.048	-0.030	-0.028	-0.044	-0.025
	(0.037)	(0.036)	(0.036)	(0.036)	(0.036)
Population (log)	0.125***	0.096**	0.096**	0.103**	0.092**
	(0.040)	(0.041)	(0.041)	(0.042)	(0.041)
Constant	-10.984***	-11.261***	-11.260***	-11.782***	-13.375***
	(0.987)	(0.896)	(0.902)	(1.004)	(3.879)
Observations	155	155	155	155	155
R-squared[12]	0.875	0.889	0.890	0.892	0.890

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are similar to standard errors, which means that the model is specified correctly (King and Roberts 2015). Inclusion of regional dummies instead of latitude worsens the distribution of residuals; therefore, the model presented here includes latitude. Country dummies for island nations and oil producers turned out to be insignificant. The equations were additionally estimated using Freedom House/Polity IV score from Hadenius and Teorell (2005), dichotomous democracy measure from Cheibub et al. (2010) and ICRG indicator of corruption (ICRG 2014). The results remained robust.

[12] Before inclusion of GDP per capita, R-squared is .78. The small difference in the R-squared between the models shows that interaction terms between control of corruption and democracy do not contribute much to explaining the variation in the dependent variable. However, examining interaction effects in detail through margins plots clarifies many of the nuances of the relationship between the level of democracy, control of corruption and air pollution.

The interactive relationship between corruption and democracy in their effects on CO_2 emissions is presented in Figure 4. The vertical axis on the left shows the magnitude of the marginal effect, while the vertical axis on the right is for the histogram and indicates the distribution of cases in the sample for the variable on the horizontal axis. Figure 4a shows that among countries with high and medium high control of corruption (scoring from 3 to 5 on a 0 to 5 scale), more democratic countries emit less. The histogram on the graph shows that this relationship holds for around 35% of the countries in the sample. Among countries that have low control of corruption (below 3 on a 0 to 5 scale), there is no significant difference in the effect of democracy on air emissions. In other words, both democratic and non-democratic regimes seem to perform similarly if the corruption level is low.

Figure 4b indicates that among countries scoring more than 8 on 1-21 scale, and therefore among both democratic and semi-democratic regimes,[13] countries with higher corruption control produce less CO_2 emissions per capita. The histogram overlaying the graph specifies that this is true for most cases in the sample. In countries that have a score below 7 on a 1-21 scale and are classified by Polity IV as autocracies, the effect of corruption control is insignificant. This means that there is no statistically significant difference in the emitting behavior between autocracies with high and low control of corruption.

[13] Also known as hybrid regimes (Diamond 2002), states under competitive authoritarianism (Levitsky and Way 2002), anocracies (Marshall and Jaggers 2013), or partly free countries (FreedomHouse 2013).

FIGURES 4, MARGINAL EFFECT PLOTS ILLUSTRATING CONDITIONAL EFFECTS OF DEMOCRACY (A) AND CORRUPTION (B) ON CO_2 EMISSIONS PER CAPITA

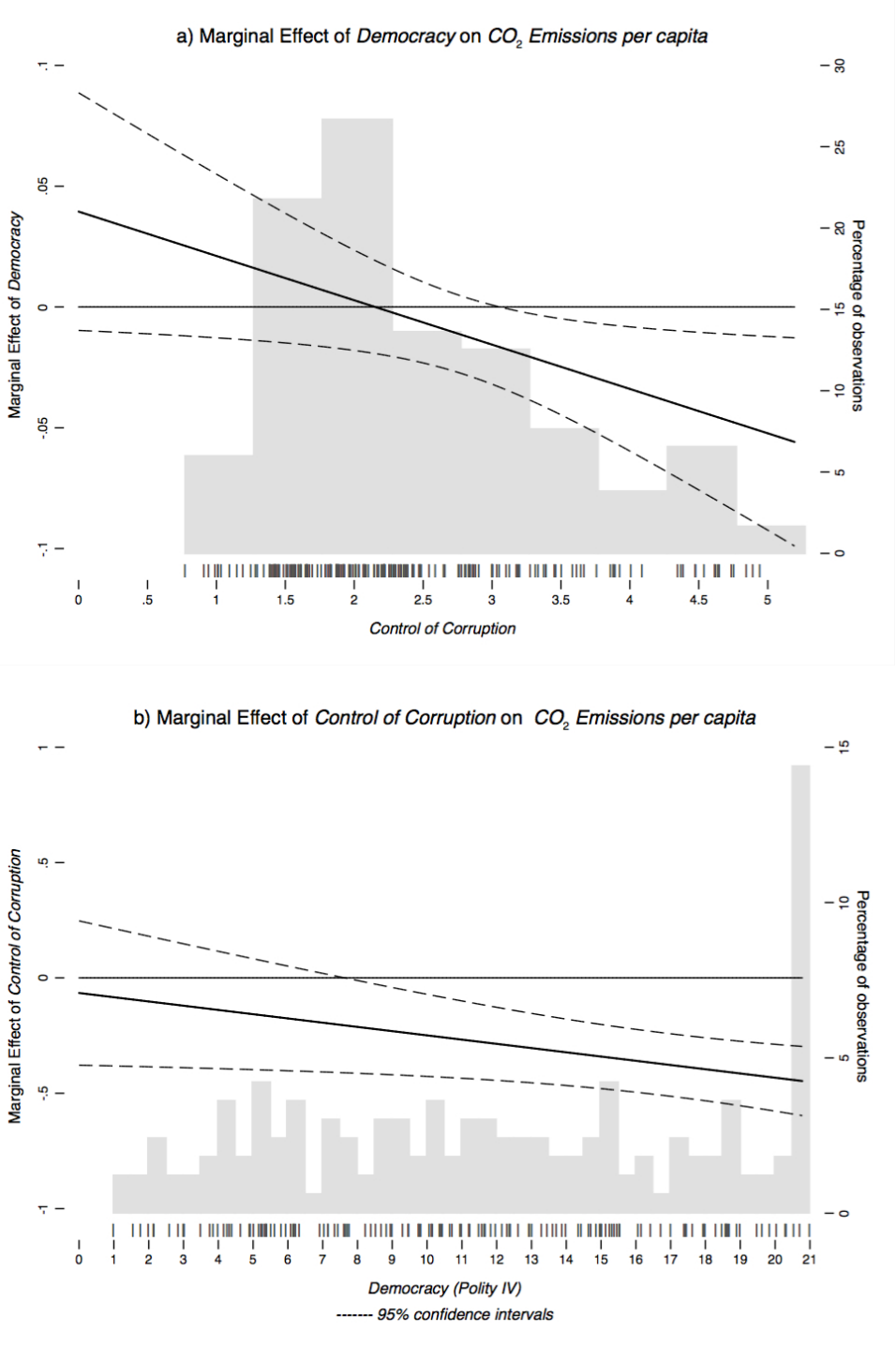
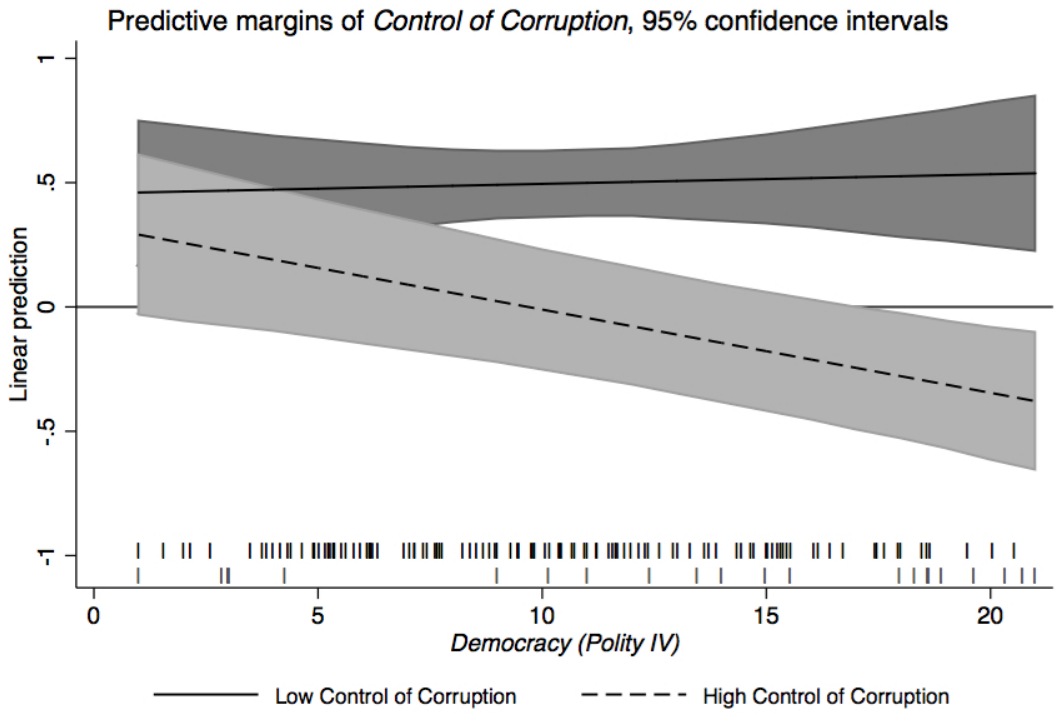


Figure 4 provides a clear illustration of the relationship between democracy and carbon emissions at different levels of corruption control, as well as between corruption control and carbon emissions at different levels of democracy, and therefore makes it possible to detect and analyze patterns described in hypotheses 1.1 and 1.2. However, it is difficult to grasp the difference between cases located at different ends of the democracy and corruption control scales and therefore to analyze the pattern proposed in hypothesis 1.3. To do this, I construct a dichotomous measure of corruption control in which countries scoring above 3 on a 0-5 scale (or 0.5 on the original World Bank scale) are coded as 1 and countries with values below 2.5 (or 0 on the original World Bank scale) are coded as 0.[14]

Figure 5 displays the marginal effect of corruption control on CO_2 emissions per capita conditional on democracy, using the dichotomized measure of corruption control. The vertical axis is a linear prediction of the marginal effect. Rug plots at the bottom of the graph depict the distribution of cases by each group of control of corruption. The rug plot on top shows the distribution of cases in the group with low levels of corruption control, while the rug plot situated below depicts the distribution of cases in the high control of corruption group.

[14] The choice of boundaries between groups is guided by the results obtained from marginsplots depicted in Figure 4a. Countries in which the effect of democracy is significant and negative are coded into one group, while countries in which the effect of democracy tends to be positive (although insignificant) are coded into another group. Countries in between, which take values between 2.5 and 3, are omitted to increase the variation between the groups and obtain distinguishable results. As a result, the group with high control of corruption has 37 cases and the group with low control of corruption has 104 cases. Countries that take values between 2.5 and 3 and are omitted include Bahrain, Brazil, Croatia, Cuba, Czech Republic, Kiribati, Greece, Italy, Jordan, South Korea, Lesotho, Lithuania, Malaysia, Oman, Namibia, Vanuatu, Poland, Seychelles, Slovakia, South Africa, Suriname, Trinidad and Tobago, Tunisia and Samoa.

FIGURE 5, CONDITIONAL MARGINAL EFFECT OF DICHOTOMIZED MEASURE OF CONTROL OF CORRUPTION ON CO_2 EMISSIONS PER CAPITA



The pattern in the graph clearly resembles the relationship pictured in Figure 3. Since the dependent variable is "flipped," mirroring environmental degradation (higher is bad) rather than environmental performance (higher is good) as in Figure 3, the pattern is reversed. The graph shows that being a corrupt country has a consistent positive effect on emissions, regardless of democracy level, as depicted by the solid line on Figure 5. In accordance with the patterns observed in the previous figures, however, the significant difference between corrupt and non-corrupt countries can only observed in countries scoring about 8 on the 1-21 scale, that is, democracies and anocracies. Being a non-corrupt country only results in lower emissions levels in democracies, while higher corruption control in authoritarian regimes does not seem to make any difference for the level of emissions.

Unlike the previous two figures, Figure 5 makes it possible to analyze the pattern suggested in Hypothesis 1.3. Comparing the left quadrant on the dashed line to the right quadrant on the solid line,

we can observe that autocracies with high corruption control (left quadrant on the dashed line) do not perform significantly better than democracies with low control of corruption (right quadrant on the solid line). Although the line for non-corrupt countries (dashed) is situated somewhat lower, as predicted in Figure 3, the confidence intervals between non-democratic countries with high corruption control and democracies with low corruption control would overlap if they were overlaid.

Discussion

The results show that the effect of democracy on environmental performance is contingent on the levels of bureaucratic capacity. Although the initial models tested the independent effects of democracy and bureaucratic capacity on environmental performance and showed that control of corruption is a stronger predictor of air emissions than democracy, detailed analysis of the interaction between the two revealed a more pronounced relationship.

The investigation showed that more democratic countries do tend to emit less, but only when bureaucratic capacity is high—the finding that supports Hypothesis 1.1. Similarly, the results showed that higher bureaucratic capacity in democratic and semi-democratic regimes is associated with fewer carbon dioxide emissions per capita. For example, being democratic and non-corrupt Austria is more beneficial for reducing air emissions than being democratic and corrupt Slovakia.

When bureaucratic capacity is low, however, democracy level does not seem to make a difference for the level of emissions. The results showed that low control of corruption seems to be associated with high carbon dioxide emissions across the whole democracy scale, which lends support to Hypothesis 1.2. In practice, it means that it makes no difference to the level of carbon dioxide emissions if a country is a democratic and corrupt Jamaica or an authoritarian and corrupt Azerbaijan.

Contrary to expectations, the findings do not provide any support to Hypothesis 1.3. Authoritarian regimes with high bureaucratic capacity do not seem to perform significantly better than democracies with low bureaucratic capacity. In practice it means that authoritarian Bhutan and Singapore, which have high levels of bureaucratic capacity, do not emit significantly less than democratic and corrupt India or Columbia. This finding speaks in favor of the democracy side of the story, implying that being a democracy is still important for reducing air emissions and that high bureaucratic capacity on its own is not a sufficient condition.

Implications for Environmental Kuznets Curve. It is acknowledged by the previous research that the inverted U-shaped relationship between GDP per capita and environmental performance is not a product of economic forces, but is rather a proxy for other processes occurring in the society, such as technological advancement and change to cleaner technology as well as improvements in environmental regulations. Results from this study support the argument that the turn of the curve at higher levels of GDP per capita can be partly accounted for by the fact that rich countries tend to have lower levels of corruption and thus better capacity to implement existing environmental policies.

Conclusions

Previous empirical studies on political determinants of environmental quality have traditionally focused either on the role of democracy or the role of bureaucratic capacity in improving environmental performance, rarely studying both factors together. This paper suggests that these two factors have to be considered in interaction, since they in large part shape the functioning of the input and output of the political system and therefore the delivery of public policy outcomes. While democracy level determines the process by which the decisions are made in a country, bureaucratic capacity defines how these decisions are implemented and whether they are implemented at all. Focusing on only one side of the story limited the previous research, resulting in ambiguous theoretical claims and findings. This paper instead suggests a new way of analyzing the effect of democracy and bureaucratic capacity on public policy outcomes and proposes looking at the patterns of interaction between them.

This study compares polluting behavior of countries across the globe, investigating how democracy and bureaucratic capacity interact in their effect on carbon dioxide emissions. The evidence supports the theoretical expectations that the effect of democracy on the level of carbon dioxide emissions depends on bureaucratic capacity. In accordance with most previous results, the findings of this paper show that more democratic countries tend to emit less. However, they contribute with one important specification: This is only true for those democracies in which bureaucratic capacity is high. When bureaucratic capacity is low, democracy level does not seem to have any effect on CO_2 emissions. It does not matter to the levels of air pollution whether a country has free elections, freedom of the press and an engaged civil society if the administrative apparatus of the state

does not function well and is drenched in corruption and clientelism. In such a case, democracies will not do any better than authoritarian regimes, in which decision-making power is in the hands of a narrow elite.

However, the results also show that bureaucratic capacity is not a universal cure. The assumption put forward by this study that authoritarian countries with high bureaucratic quality emit less than democratic countries with low bureaucratic capacity did not find any empirical support. Autocracies with high bureaucratic capacity do not seem to perform significantly better than democracies with low bureaucratic capacity. Taken together, these findings speak in favor of democracy, but only democracy that is free from corruption and has strong bureaucratic capacity. Neither democracy nor bureaucratic capacity alone seems to be sufficient conditions for reducing carbon emissions and fighting climate change.[15]

The main contribution of the study is two-fold. Firstly, it connects two literatures on different political determinants of environmental quality and tests the interaction between the input and output sides of the political system on environmental outcomes. Secondly, it sheds light on the driving forces behind the Environmental Kuznets Curve. Future research can focus on exploring how the relationship between democracy and bureaucratic capacity plays out for environmental outcomes in specific countries, further test the proposed interactive relationship for other indicators of environmental quality and, importantly, for different types of public goods.

[15] These results should be taken with caution, however, because they are based on between-estimation, which takes into account the countries' accumulated polluting behavior. If some countries have only recently started to intensively implement environmental policies aimed at reducing pollution (e.g., China), the results of the paper might not have captured this yet due to the time lag with which data become broadly available. Investigation of such efforts and their effects requires in-depth case studies, which are beyond the scope of this paper.

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Appendix A

TABLE 3, SUMMARY STATISTICS OF THE VARIABLES, COUNTRY MEANS

Variable	Obs	Mean	Std. Dev.	Min	Max
CO2 per capita	186	0.3912131	1.756642	-3.783232	3.882139
Democracy (rescaled)	166	12.07671	6.091159	1	21
Corruption, WB (rescaled)	182	2.432111	0.98532	0.7752227	4.945254
Corruption, ICRG	140	2.94041	1.12676	0.6364943	5.988506
GDP per capita	181	8.384114	1.267137	5.978339	11.00602
Openness to trade	181	4.115109	0.5911117	1.138329	5.486682
Urban population	184	48.88113	22.94092	6.526023	100
Population Density	184	3.898645	1.406525	0.2739286	8.465354
Population size	184	8.557628	1.982887	2.266713	13.91044
Latitude	177	0.2840239	0.1885861	0	0.7222222

TABLE 4, CORRELATION BETWEEN THE INDEPENDENT VARIABLES

	Democr.	Corr, WB	Corr, ICRG	GDP per capita (log)	Openness to trade (log)	Urban pop.	Latitude	Pop. Density (log)	Pop. (log)
Democracy	1								
Corruption, WB	0.5862	1							
Corruption, ICRG	0.5894	0.8976	1						
GDP per capita (log)	0.4618	0.7556	0.6209	1					
Openness to trade (log)	-0.0441	0.1281	0.0368	0.2425	1				
Urban population	0.2918	0.6195	0.496	0.8306	0.1777	1			
Latitude	0.4475	0.5623	0.5208	0.5936	0.1048	0.5305	1		
Population Density (log)	0.1733	0.1785	0.1216	0.1429	0.0593	0.076	0.1427	1	
Population (log)	0.0302	-0.1187	-0.019	-0.1743	-0.5573	-0.1381	0.0528	0.2008	1