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# Autocratic Angels? Democratic Demons?

## The Impact of Regime Type, State Capacity and Economic Development on Reaching Environmental Targets

*Katharina M. K. Stepping*
*Lilli Banholzer*

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**Dr Katharina M. K. Stepping** was formerly a Senior Researcher in the "Environmental Policy and Natural Resources Management" department at the German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE) in Bonn. In August 2016, she joined the Federal Ministry for Economic Cooperation and Development (BMZ) as a Senior Policy Officer for Climate Finance.

**Professor Dr Lilli Banholzer** was formerly a Senior Researcher in the "Governance, Statehood, Security" department at the German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE) in Bonn. She has been Professor for Political Science/Conflict Studies at the University of Mannheim since August 2014.

© Deutsches Institut für Entwicklungspolitik gGmbH
Tulpenfeld 6, 53113 Bonn
☎ +49 (0)228 94927-0
🖷 +49 (0)228 94927-130
Email: die@die-gdi.de
http://www.die-gdi.de

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October 2017 Katharina M. K. Stepping and Lilli Banholzer

## Abstract

This paper analyses whether variances in effective environmental policies that lead to achieving environmental targets can be attributed to the different types of political regimes, the level of a state's economic development, or its state capacity. Our analysis is based on a cross-sectional time-series dataset including around 132 countries and covering the period from 2000 to 2010. Our dependent variable is the Ecosystem Vitality index of the 2012 Environmental Performance Index (EPI). Against our assumption, we do not find consistent evidence that democratic regimes outperform autocratic ones when it comes to reaching environmental targets. The level of state capacity as such plays a rather unclear role where higher state capacity does not automatically translate into better environmental protection. However, democratic states with increasing capacity are less harmful to the environment than autocratic states with increasing capacity. The level of economic development on the other hand turns out as the best predictor for environmental performance: Environmental targets are less likely to be reached while economies are developing but, once a threshold has been passed, economic development starts to become positively correlated with environmental friendliness. The effect of economic development is more pronounced for democracies than for autocracies: people's preferences in a democracy seem to be more influenced by economic development than the preferences of autocratic leaders.

*Keywords: democracy, environment, public goods, Environmental Kuznets Curve*

*JEL codes: Q56, N40, O44, H41*

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# 1 Introduction

Climate change, biodiversity loss, and the degradation of ecosystems challenge all countries worldwide. The excessive human consumption of natural resources and energy not only causes the continued degradation of nature but has severe consequences for all species. Much of the international debate about how to deal with these challenges revolves around the role and function of the state.

According to common perception, autocratic regimes are tyrannical, misanthropic, and disrespectful of human rights, while democratic regimes are benevolent, grant education and health care, and respect human rights. This view of diametrically opposed "good" democracies and "bad" autocracies is supported by several studies (Deacon, 2009; Lake & Baum, 2001) – but does it hold for environmental politics?

Let us have a look at a couple of examples: In 2014, in reaction to the growing pollution caused by the excessive use and waste of plastic, California enacted a law abolishing single-use plastic bags (Steinmetz, 2014). A wave of protest had initially demanded that they be abolished. In Europe, campaigns to ban plastic bags have been opposed by the plastic manufacturing industry which argues, "Plastic bags are a sustainable, low-energy way to carry purchases" (Galbraith, 2012), even though plastic bags severely pollute oceans. While there is little hope that they will be entirely prohibited in the European Union (EU) anytime soon, the EU recently agreed on binding reduction targets for (light) plastic bags. In contrast, Rwanda's authoritarian government has effectively prohibited the use of plastic bags since 2008, while China attempts to push people to use their own reusable bags by banning the distribution of plastic bags (Galbraith, 2012). In 2011, authoritarian Myanmar even outlawed the production, storage and sale of plastic bags in its capital. These contrasting examples would seem to indicate that authoritarian states are more effective at implementing policies that benefit the environment but cost the public.

Empirically, we are interested in the factors that motivate countries to reach environmental targets. The first factor that we examine is the type of political regime. Theory suggests that, since democratic governments need broad support to survive politically, they disproportionately invest state resources in public goods that benefit large segments of society (Olson, 1993). Autocrats, on the other hand, generally depend on satisfying the needs of a relatively small segment of society, which allows them to exclude most citizens from political participation and ignore their needs (Bueno de Mesquita, Smith, Siverson, & Morrow, 2003). From a theoretical point of view, it thus seems easier for autocratic regimes to implement unpopular yet environment-friendly policies because they are less dependent on majority preferences and support from interest groups than are governments in democracies. For the environment, authoritarian rule might therefore be more beneficial than democratic rule.

Two other factors may also strongly influence the pursuit of environment-friendly targets: state capacity and economic development. A state's bureaucratic and administrative capacity determines if and how much it can formulate and implement policies. Every state needs a certain capacity to implement its preferred policies; low state capacity may eliminate the possibility of implementing environmental policies even if the state favours them. A state's economic development determines its political priorities and the amount of room to manoeuvre. Low levels of economic development may cause the pursuit of economic interests

such as growth to have higher priority than protecting the environment, while high economic-development levels may enlarge the scope for political action due to the state's greater financial resources.

In this paper, we add to the existing literature in several ways: First, unlike previous studies, our work examines three factors – regime type as political will; state capacity as political capacity; and economic development as economic capacity – side-by-side and systematically compares their (relative) importance. While recent studies have become more fine-grained in their analysis, we remain interested in the "large picture" and adopt a macro-level, quantitative perspective. We contribute to recent literature by making use of a new dataset which allows us to look at a larger sample than previous studies to test the hypotheses. Our dataset covers cross-sectional time-series data for 132 countries between 2000 and 2010. Thirdly, we use a novel dependent variable, the Ecosystem Vitality index of the 2012 Environmental Performance Index (EPI), which comprehensively captures performance on a variety of environmental targets, based on sound conceptual and statistical methodology.

Our results do not support our initial assumption that democratic regimes are per se more environmentally friendly than autocratic regimes. Similarly, growing state capacity in itself does not guarantee more environmental protection, although democracies with increasing state capacity are less harmful to the environment than autocracies with increasing state capacity. We find, however, a clear correlation between environmental performance and the level of economic development. While environment friendliness decreases with growing development it starts increasing again once a threshold has been passed. This effect is more pronounced in democracies in which people can voice their preferences. In autocracies, preferences and politics seem to remain more steady and less influenced by economic development.

Our paper proceeds as following: In Section 2, we will present the theoretical framework for the relationship of regime type, state capacity, and economic development to environmental policies before reviewing the literature and explaining the novelty of our analysis in comparison with similar empirical studies. In Section 3, we then describe the way our research project has been designed. Section 4 presents our results and details the robustness checks while, in Section 5, we discuss the results and offer conclusions.

## 2 What determines "environmental friendliness"?

### 2.1 The political regime

Many scholars have argued that in theory, democracy should impact positively on the provision of public goods (Deacon, 2009; Lake & Baum, 2001), specifically the provision of environmental quality (for instance, Congleton, 1992). Thanks to democratic political institutions, democracies have better information and signalling mechanisms with which to monitor environmental conditions (Chadwick, 1995). The free flow of information resulting from the freedom of the press is thought to inform citizens about environmental problems, and enable them to exchange ideas and knowledge about possible solutions and coping mechanisms (Barrett & Graddy, 2000; Midlarsky, 1998). Freedom of speech enables people to express their opinions and voice their concerns; freedom of assembly and the right to

found or join associations allows individuals to bundle their concerns, thus adding more weight and substance to their demands, and allowing them to demand action more effectively. Finally, the right to vote allows ordinary citizens to sanction their governments if they feel misrepresented or that their interests are not well met.

The main problem with non-democratic regimes, on the other hand, is that society is divided into the people who are allowed to provide input into the state's decision-making processes and those who are not (Chadwick, 1995). Non-democratic states "tend systematically to underestimate the costs of environmental degradation relative to the benefits gained from degrading activities" (Chadwick, 1995, p. 560). In contrast to autocracies, whose leaders tend to rely on a small elite, democratically elected leaders must satisfy the median voter. Some scholars (for example, Congleton, 1992) argue that authoritarian leaders can ignore environmental concerns that interfere with their politics and private preferences, particularly problems that mainly affect the populace rather than the autocrat's support groups (Neumayer, Gates, & Gleditsch, 2002).

The empirical literature on political determinants of environmental quality is rich yet, still developing and shows mixed results. Deacon (2009) finds that democracies fare better than autocratic governments at providing environmental public goods, such as water, public sanitation and pollution control. Li and Reuveny (2006) report that, while democracies do reduce the extent of human activities that directly damage the environment, the actual effect varies across environmental degradation types. They find a positive effect of democracies on $CO_2$ emissions and deforestation.

Bernauer and Koubi (2009) also observe a positive relationship between the degree of democracy and environmental outcomes – on just one dimension, air quality. Examining the implications of democracy for the provision of the global public good "climate stability", Bättig and Bernauer (2009) ascertain a positive effect of democracy on policy outputs (levels of political commitment to climate change mitigation) and an ambiguous effect on policy outcomes (emission levels and trends). Arvin and Lew (2011) find mixed results for the relationship between democracy and environmental quality, measured in $CO_2$ emissions, water pollution emissions, and deforestation damage.

Midlarsky (1998) and Barrett and Graddy (2000) find no uniform relationship between democracy and the environment: The former observed a positive effect of democracy on protected land area, but no correlation for the other measures – soil erosion by chemicals and fresh water availability – while democracy even seemed to have a negative effect on $CO_2$ emissions, deforestation and soil erosion by water. The latter study tested a rather large number of pollution variables and found that increasing civil liberties and political freedoms only positively and significantly affected the quality of some proxies for air and water quality. Neumayer (2002) determined that democracy correlated positively with environmental commitment, as signalled by signing and ratification of various multilateral environmental agreements. Cao and Ward (2015) discovered that core democracies, with large winning coalitions, considerable state capacity and highly stable regimes, performed better than autocracies when it came to air pollution control.

Opposing the view that democratic governments are more engaged in protecting the environment, other literature suggests that autocracies might be more suited to tackle environmental problems because "government action and steering are of central importance

for solving fundamental problems" (Wurster, 2013, p. 78). Beeson (2010) argues that, although authoritarian regimes may be unattractive, they might be better at handling pressing environmental issues. To do this, an autocrat must first be interested in pursuing environmental targets. Klick (2002) points out that an autocratic government could use high environmental standards to appease its population. Similar to the example of a well-developed communication system, high environmental standards could demonstrate the leader's goodwill towards the population, reducing the risk of a rebellion in general but without providing the population with the means to start a rebellion such as improved communication.

Taken together, despite mixed results and theoretical considerations, the current evidence seems to provide somewhat more support to the first line of argument. We therefore expect that, controlling for other factors, democratic countries are more successful at reaching environmental objectives than autocratic countries.

## 2.2 State capacity

Independently of the type of political regime, states can only deliver services effectively if they possess the capability or capacity to do so. For this reason, one would expect that the degree of state capacity would be a determining factor for the provision of public goods not least environmental quality. A state is assumed to need a bureaucratic apparatus to design and implement policies to foster development (Savoia & Sen, 2015, p. 2). Bureaucratic and administrative capacity relates not only to tax collection but also the ability to spend tax proceeds efficiently on public goods (Acemoglu, Ticchi, & Vindigni, 2011). State capacity is thus a "fundamental ingredient for effective governance" (Savoia & Sen, 2015, p. 1). In fact, countries with high state capacity are generally viewed as better equipped to provide public goods (Soifer & vom Hau, 2008).

The underlying theoretical concept and exact dimensions of state capacity are the subject of much academic debate (Fukuyama, 2004; Fukuyama, 2013; Hanson & Sigman, 2013; Hendrix, 2010; Savoia & Sen, 2015; Soifer & vom Hau, 2008), which can broadly be defined as "the ability of state institutions to effectively implement official goals" (Sikkink, 1991, cited in Hanson & Sigman, 2013, p. 2).[1] Going one step further, Hanson and Sigman (2013) distinguish between three dimensions of capacity: 1) extractive, the capability of the state to raise revenue; 2) coercive, the state's monopoly on the legitimate use of force within its territory in a Weberian sense; and 3) administrative, a well-functioning administration with skilled officials. Theoretically, the connection between environmental outcomes and state capacity should be neutral as state capacity only determines whether a state is capable of pursuing its favoured policies but not which preference a state has. However, assuming that a state is willing to implement environmental-friendly policies, a lack of state capacity can result in failing to reach the desired goals. Few studies empirically test the possible connection between state capacity and environmental factors. Ward, Cao and Mukherjee (2013) analyse the relationship between state capacity and environmental protection, supporting the assumption that state capacity matters (Ward et al., 2013, p. 19). However, they only refer to non-democratic regimes and three types of pollutants. We expect that capabilities to administer and implement policies, as well as to generate revenues, contribute to reaching

1 For a more detailed overview of various approaches to measure and conceptualise (the different dimensions of) state capacity, see Cingolani (2013) and Cingolani, Thomsson and Crombrugghe (2015).

environmental objectives.[2] We thus hypothesise that greater state capacity improves the state's performance in reaching environmental targets.

## 2.3 Economic development

The Environmental Kuznets Curve (EKC) hypothesises an inverted U-shape between economic development and environmental degradation (Panayotou, 1993). The underlying logic is that rising national income increases the economic activity, which – all else being equal – leads to an increased use of natural resources and rising emissions of pollutants (scale effect), while, after a certain threshold of national income has been passed, pollution levels are supposed to decline due to the changing composition from manufacturing to service industries (composition effect) and due to technological progress (technology effect) (Dinda, 2004; Spilker, 2013). In addition, environmental quality tends to be a luxury good at low income levels but turns into a regular public good once a certain standard of living has been attained (Spilker, 2013).

Several theories aim to explain the inverted U-shaped relationship between economic development and environmental pollution – as a result of behavioural changes and preferences, institutional changes, technological and organisational changes, structural changes, and international reallocation (de Bruyn & Heintz, 1999). Grossman and Krueger (1995) argue that scale, composition, and technology effects explain how growth affects the environment. More developed countries, for example, are able to develop clean technologies that pollute less, or not at all. Development is also believed to bring about a change in people's attitudes and their concern for the environment. Beckerman (1992) argues that, in economically more advanced countries, economic and social conditions lead to an increase in a population's concern about environmental problems (and the means to deal with them). Along with economic development and higher standards of living, popular preferences change while the public demands more environment-friendly policies from the government (Grossman & Krueger, 1995).[3] Selden and Song (1994) expect industrialisation and agricultural modernisation to increase pollution while other factors, such as positive income elasticities for environmental quality, changes in production and consumption, increasing environmental awareness, and more open political systems help to reduce pollution. Torras and Boyce (1998) argue that the more equitable distribution of power increases environmental quality by strengthening the policy-making influence of those who bear the costs of pollution relative to those who benefit from polluting activities. They find that literacy, political rights, and civil liberties positively affect environmental quality in low-income countries.

Both the empirical status of the EKC hypothesis and its theoretical basis are often discussed. First, the empirical evidence for this "intuitively appealing" logic (Dinda, 2004, p. 432) is mixed: Selden and Song (1994) find supporting evidence for the EKC hypothesis with respect to four pollutants, while Grossman and Krueger (1995) observe that economic growth initially

2 We do not include coercive capacity as the "state's ability to preserve its borders, protect against external threats, maintain internal order, and enforce policy" (Hanson & Sigman, 2013, p. 4), which would be measured, for instance, by military expenditures because of the only indirect link to environmental outcomes.

3 The underlying assumption is that people are can only voice their preferences when they enjoy political freedom (Barrett & Graddy, 2000) and can learn about the state of the environment (beyond changes that immediately impact on their welfare).

causes most indicators to deteriorate and then to improve. Their results suggest that, once income rises above a certain threshold, air and water quality benefit from economic growth. Shafik (1994), however, finds that some environmental indicators improve with rising income; others worsen first and improve later; and others still worsen steadily. The turning points also vary substantially across environmental indicators. Matthew A. Cole (1999) identifies manifold relationships between development and the environment, depending on the pollutant. In a similar vein, Gassebner, Lamla, and Sturm (2011) find supporting evidence for the EKC hypothesis with regards to water pollution. However, their evidence for air pollution suggests that, if a turning point does exist, it is found at income levels that are not observed in the real world. Arvin and Lew (2011) observe a positive relationship between gross domestic product (GDP) and $CO_2$ emissions – not in the inverse U-shape suggested by EKC theory, but in a linear relationship. They find only weak evidence for a U-shaped relationship for water pollution – and not in Africa.

Besides empirical considerations, these very heterogeneous results can also result from methodological issues, as noted by Dinda (2004) as well as Müller-Fürstenberger and Wagner (2007) who highlight econometric and theoretical problems in modelling the EKC hypothesis. Most of the evidence available on the EKC hypothesis has been criticised as "econometrically weak" (Stern, 2004, p. 1420) because little consideration has been paid to the statistical properties of the data and to model adequacy. Stern (2004) cautions against assuming a simple relationship between pollution and per capita income.

Despite the difference in observed effects, these studies reveal that there is a connection between economic development and environmental outcomes, providing a strong argument for us to include this factor in our analysis. Although this paper focuses on reaching environmental targets, not on environmental pollution, as in the EKC hypothesis, we assume a similar dynamic between economic development and reaching environmental targets. Low-income countries are presumed to not prioritise environmental targets, while middle-income countries with their greater financial and technological capacities put them higher on the agenda but not as high as they are in high-income countries. We expect that the wealthier a country is, the better it achieves environmental objectives.

## 2.4 Interaction effects

Beyond the independent effect of the political regime, state capacity and economic development, interaction effects between the three variables are theoretically possible.

First, the contribution of the political regime and state capacity to the provision of public goods, such as reaching environmental targets, is unclear: one could substitute for the other or complement it (Hanson, 2015). In other words, while a democratic state is arguably more willing to protect the environment, it might not be capable of reaching its targets if it lacks sufficient state capacity. There is some evidence for this possible relationship. Analysing the interaction effect between regime type and state capacity with regard to the level of air pollution, Povitkina (2015) discovered that democracies tended to emit less carbon dioxide, but only if they had a high state capacity. If the state capacity was low, democratic regimes did not perform any better than their autocratic counterparts. In other words, besides their political will – that Povitkina (2015) calls the "input side" – governments also need to be able to produce their favoured "output". We therefore assume that democratic and capable

states are better at reaching environmental targets, while autocratic and less capable countries do worse.

Second, at lower development levels, people likely prefer rapid economic development and are not too concerned with environmental problems, despite their often immediate suffering from direct exposure. Following Spilker (2013), democratic structures may only translate into better environmental outcomes after a certain threshold of economic development has been reached and when people start to agree to allocate their (scarce) resources for environmental protection and the like. Only then should their ability to put pressure on the government lead to better environmental outcomes. Consequently, we assume that democratic and economically developed countries should be better at reaching environmental targets, while autocratic and poorer country should perform worse.

Finally, economic development and state capacity are expected to reinforce each other in either a virtuous or a vicious cycle. Economic development tends to shape people's preferences in favour of environmental protection and to provide the necessary financial resources. State capacity, on the other hand, enables countries to effectively pursue policies and to reach agreed objectives. We therefore assume that rich and more capable states perform better in reaching environmental objectives than poor und less capable states.

# 3 Research design

## 3.1 Data

### 3.1.1 Dependent variable: environmental quality

When studying the impact of the political regime type on environmental targets, one of the greatest challenges is selecting the proxies to capture environmental quality, for two main reasons. Firstly, environmental quality cannot be measured in a simple way as it is a multidimensional concept: in its complexity, it cannot be represented by a single environmental indicator but needs indicators for all of the following: air and soil quality, water quantity and quality, and also biodiversity as a cross-cutting issue (Stepping, 2013). Secondly, in practice, the lack of comparable data on theoretically relevant indicators limits the possibilities (Böhringer & Jochem, 2007; Niemeijer, 2002). Appropriate sources with data on adequate indicators and recent years are generally hard to find, and even more so for developing countries with low monitoring capacities.

In order to consider different aspects of environmental quality in their analyses, previous studies used several environmental indicators (see, for instance, Arvin & Lew, 2011; Barrett & Graddy, 2000; Li & Reuveny, 2006; Midlarsky, 1998). Yet, results are difficult to compare across studies because the dependent variable varies greatly – sometimes several are used – with indicators that are rarely comprehensively discussed and hence often seem to have been selected somewhat arbitrarily and unable to cover the environmental spheres and cross-cutting issues systematically. Most studies test only one or two of the whole range of environmental variables, for example: water quality/pollution (Congleton, 1992; Murdoch, Sandler, & Sargent, 1997); air quality/pollution (Bernauer & Koubi, 2009; Cole & Neumayer, 2004; Fredriksson, Neumayer, Damania, & Gates, 2005), or environmental regulatory regimes (Esty & Porter, 2005). Other studies such as that of Scruggs (2003) analyse several pollution

variables but limit this to democracies. Moreover, because many studies use similar names for diverse proxy indicators, it is difficult – if not impossible – to compare results, even for what is supposed to be the same indicator. Air pollution/quality, for instance, is measured as nitrogen oxide ($NO_x$) emissions (Li & Reuveny, 2006), as sulphur dioxide ($SO_2$) concentrations (Bernauer & Koubi, 2009), or as $SO_2$, smoke and heavy particles (Barrett & Graddy, 2000).

We, for our part, prefer to use the Ecosystem Vitality dimension[4] of the 2012 Environmental Performance Index (EPI) as the main dependent variable because it measures the achievement of environmental quality comprehensively, comparably and transparently for three content-related and three technical reasons.[5] First, "the main advantage and added value of the EPI is that an aggregated index, with a set of environmental indicators […], is more reliable than looking at each indicator separately" (Saisana & Saltelli, 2012, p. 93). Second, by definition, the 2012 EPI explicitly accounts for the varying natural resource endowments, physical characteristics, and geography across countries. For this reason, some indicators were only included in the calculation if the respective indicator threshold was met; otherwise other indicators in the respective category received more weight (see Emerson, et al., 2012).[6] Third, the EPI focuses on environmental issues for which governments can be held accountable (Saisana & Saltelli, 2012), an essential criterion for our type of analysis. Fourth, the statistical and conceptual foundation for the composite indicator has been judged as generally convincing, with excellent data coverage, by external and independent evaluators (Saisana & Saltelli, 2012). Fifth, the index follows well-established recommendations for constructing a composite indicator (OECD [Organisation for Economic Co-operation and Development], & JRC [Joint Research Centre]/European Commission, 2008). These include that strict criteria for data selection (relevance, performance orientation, established scientific methodology, data quality, time-series availability, completeness) are used to assess whether a dataset is adequate to measure performance on pressing environmental concerns, and this is done for each indicator. Lastly, the EPI covers 132 countries for the consecutive years 2000 to 2010, which, unlike other studies, allows the application of cross-sectional time-series techniques and the use of a comprehensive dataset.

The EPI in general and the Ecosystem Vitality dimension in particular benchmark each country's performance with respect to environmental targets (see Table 1), tracking 22 outcome-oriented indicators in 10 policy categories related to environmental health and ecosystem vitality (Emerson et al., 2012). The same targets are established for all countries using inputs from treaties or other internationally agreed goals, standards set by international organisations, leading national regulatory requirements, expert judgment, and ranges of values observed in the data. A "proximity-to-target" score is calculated for each country and indicator, quantifying the gap between a country's current results and the

4 For more information on the Environmental Health dimension of the EPI, please refer to Emerson et al. (2012) or Stepping (2013).

5 The content-related and technical reasons are also valid for the Environmental Health dimension of the EPI.

6 The indicators "marine protected areas", "coastal shelf fishing pressure", and "fish stocks overexploited and collapsed" do not apply to landlocked countries, while a country that has no site designated as "critical" cannot use the "critical habitat protection" indicator. For desert countries with fewer than 100 square kilometers of forested land, the indicators "forest loss", "forest growing stock", and "change in forest cover" are not applicable. An energy-poor country with less than 130 kWh of annual electricity generation is not considered in the "renewable electricity generation" indicator.

targets. A score of 100 is equivalent to achieving or exceeding the target on a 0-to-100 scale. Variables and indicators reflect the promotion of ecosystem vitality and sound natural resource management. The ranking indicates "which countries are doing best in terms of reaching common environmental targets" (Moldan, Janoušková, & Hák, 2012, p. 10) for 132 countries, 89 of which are "developing" as defined by income. Table 1 provides an overview of the various different targets and respective sources of the Ecosystem Vitality dimension.

| **Table 1: Overview of targets and sources of targets for the dimension ecosystem vitality (2012 EPI)** | | | | | |
|---|---|---|---|---|---|
| **Policy category (EPI)** | **Indicator** | **Variable** | **Target** | **Unit of measurement** | **Source of target** |
| **Ecosystem vitality** | | | | | |
| Air | $SO_2$ per capita | Sulphur dioxide emissions | 0 | Kg $SO_2$ per person | Expert opinion. The target represents the ideal state of non-$SO_2$ pollution. |
| | $SO_2$ per US dollar gross domestic product (GDP) | Sulphur dioxide emissions | 0 | Grammes $SO_2$ per US dollar purchasing power parity (PPP) (in 2005 constant US dollars) | Expert opinion. The target represents the ideal state of non-$SO_2$ pollution. |
| Water resources | Change in water quantity | Water use | 0 | % | Expert opinion. |
| Biodiversity and habitat | Critical habitat protection | Alliance for Zero Extinction (AZE) sites | 100 | % | Expert opinion. The low performance benchmark is the minimum of the 2000-2010 dataset. |
| | Biome protection | World Database of Protected Areas | 17 | % | Convention on Biological Diversity. |
| | Marine protected areas | Per cent of exclusive economic zones (EEZ) area protected | 10 | % | Convention on Biological Diversity. |
| Agriculture | Agricultural subsidies | Nominal Rate of Assistance (NRA) | 0 | NRA | Expert opinion. The low performance benchmark is based on the 95th percentile of the 2000-2010 data. |
| | Pesticide regulation | Persistent organic pollutants regulation | 22 | 22 point scale | Stockholm Convention. |
| Forests | Forest growing stock | Growing stock in forest | 0.99047619 | Ratio of period 2 to period 1 | Expert opinion. The targets represent non-decline in forest growth. The target was chosen slightly below 1 for mathematical purposes on the distribution of 2000-2010 data and expert judgment. |
| | Change in forest cover | Trends in extent of forest 1990-2010 | 0.998781808 | Percent change from period 1 to period 2 | Expert opinion. The target was chosen slightly below 1 for mathematical purposes based on the distribution of 2000-2010 data and expert judgment. |
| | Forest loss | Forest cover loss | 0.015 | % | Expert opinion. The target was chosen based on the distribution of the indicator values, as a value between two spikes in data (one spike at .01 and another at .02) |
| Fisheries | Coastal shelf fishing pressure | Catch from trawling and dredging gears (mostly bottom trawls) | 0.000016 | Tonnes per square km | Expert opinion. The target is based on 5th percentile of 2000-2010 data, rounded off to 6 digits. |
| | Fish stocks overexploited | Fraction of EEZ with overexploited and collapsed stocks | 0 | Fraction | Expert opinion. The target represents the minimum value of the 2000-2010 dataset. |
| Climate change and energy | $CO_2$ per capita | Carbon dioxide emissions | 1.262 | Kg $CO_2$ per person | The Intergovernmental Panel on Climate Change (IPCC) indicates that emissions would need to be cut by one-half of Year 2000-levels by 2050; target per capita emissions are based on half of 2000 emissions divided by the projected 2050 population. |
| | $CO_2$ per US dollar GDP | Carbon dioxide emissions | 0.07842 | Kg $CO_2$ per US dollar GDP PPP (in year 2000 constant US dollars) | The IPCC indicates that emissions would need to be cut by one-half of Year 2000-levels by 2050; target per capita emissions are based on half of 2000 emissions divided by the projected 2050 GDP. |
| | $CO_2$ per kWh | Carbon dioxide emissions from electricity and heat | 0 | Grammes of $CO_2$ per kWh | Expert opinion. The target represents the ideal state of non-$C0_2$ emissions from electricity and heat. |
| | Renewable electricity | Renewable electricity production as a percentage of total electricity production | 100 | % | Expert opinion. The target represents the maximum value of 2000-2010 dataset. |
| Source: Authors, based on Emerson et al., 2012 | | | | | |

### 3.1.2 Explanatory variables

*i) Political regime*

The Democracy-Dictatorship (DD) dataset (Cheibub, Gandhi, & Vreeland, 2010) is used to classify the type of political regime in country *i* in year *t.* The dummy variable is coded as 1 if the regime qualifies as democratic and 0 otherwise. The dataset covers 199 countries, from 1946 to 2008.

The DD dataset permits empirical analysis of political regimes based on well-reasoned theoretical grounding and straightforward operationalisation, with clear-cut rules used to classify democratic and non-democratic regimes. Four rules operationalise whether a governmental office is filled through election, and whether or not the election is contested. Only when all four requirements are met is a regime classified as a democracy. To check the robustness of our results, we tested our models using the Polity IV measures for political regimes.

*ii) State capacity*

While there is no unique definition and conceptualisation of state capacity (see also subsection 2.2), we are mainly interested in bureaucratic and administrative capacity, as well as in extractive capacity, because we want to approximate the capacity to implement environmental policies. The former refers to the capability of the bureaucracy and administration to design and implement policy, as well as to produce and deliver public goods and services. The latter reflects the state's ability to raise revenue by taxing constituents (North, 1981).[7] A particular set of capacities is needed to raise revenue: "[S]tates must have the wherewithal to reach their populations, collect and manage information, possess trustworthy agents to manage the revenue, and ensure popular compliance with tax policy" (Hanson & Sigman, 2013, p. 4).

From a theoretical and methodological perspective, bureaucratic quality and the tax ratio are the best variables for measuring two dimensions of the multidimensional concept of state capacity (Hendrix, 2010, p. 283). The International Country Risk Guide's (ICRG) "Bureaucracy Quality" indicator reflects the bureaucratic and administrative capacity, measured on a scale from 0 to 4. High points are given to countries with strong and experienced bureaucracies that can govern without interruption or drastic policy changes when the government changes. Countries with weak bureaucratic apparatuses tend to experience dramatic changes in policy formulation and day-to-day administrative functions when the government changes. The taxing capacity is approximated by the tax ratio, hence the tax revenue is a percentage of GDP (World Bank, 2014a).

*iii) Economic development*

Macroeconomic analyses use per capita income as the classical proxy variable of economic development. We use logged GDP per capita in purchasing power parity and constant international US dollars from the World Development Indicators of the World Bank (World

7 "A state is an organization with a comparative advantage in violence, extending over a geographic area whose boundaries are determined by its power to tax constituents" (North, 1981, p. 21).

Bank, 2014a). We take the natural logarithm to render their distribution less skewed and mitigate potential problems of heteroscedasticity. We also include logged GDP per capita squared. We allow for a non-linear relationship because we assume that per capita income has a decreasing marginal effect on reaching environmental targets.

*iv) Political stability*

Insecurity and instability may inhibit a government from focusing on environmental protection and the corresponding policies. We thus control for a country's general political stability and use the indicator political stability. The Political Stability and Absence of Violence/Terrorism indicator of the Worldwide Governance Indicators (WGI) measures perceptions of the likelihood that a government will be destabilised or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism (World Bank, 2014b). It is measured on a scale ranging from approximately -2.5 to +2.5, with higher values indicating greater political stability.

*v) Economic pressure*

The general macroeconomic situation plays an important role in many political decisions. An economic downturn, for instance, tends to exert pressure on governments to boost economic growth. We therefore control for the GDP's annual percentage growth rate at market prices, based on constant local currency (World Bank, 2014a).

*vi) Pressure from the agricultural or industrial sectors*

The composition of the national economy and the relative importance of the different sectors vary between countries. For some, agriculture is central to economic activity, for others industry is more important. If an economy's agricultural share is large, the sector can push for lax environmental requirements, such as high boundaries for pesticides. Everything else being equal, more formal manufacturing or industrial production generates greater tax volume. While this greater tax volume would be reflected in a higher tax ratio and thus a higher level of taxing capacity, it could be negative for the environment because of pollution and other adverse effects. We thus include the economy's agricultural and industrial shares as percentages of GDP as control variables.

*vii) Political corruption*

The International Country Risk Guide (ICRG) "corruption" indicator measures corruption within a political system. The variable was re-coded to range from 1 (low corruption) to 6 (high corruption) (PRS Group, 2012). Political corruption can result in illegal rent-seeking activities that divert resources from the public good to private gain, and thus serves as a proxy for the country's low institutional quality. Pellegrini and Gerlagh (2006) find that corruption is a substantial and significant negative determinant of environmental policy. Corruption has also been linked to biodiversity loss (Smith, Muir, Walpole, Balmford, & Leader-Williams, 2003) and environmental degradation, for example in the Niger Delta (Ehwarieme & Cocodia, 2011).

## 3.2 Estimation technique and model

$$EV_t = \alpha_i + \gamma_t + \beta X_{i,t-1} + u_i$$

$$i = 1,\ldots, 132;\ t = 1,\ldots, 10$$

where *i* refers to the country and *t* refers to time. The dependent variable represents the ecosystem vitality score of country *i* in year *t;* $\alpha_i$ are country-fixed effects, $\gamma_t$ are time-fixed effects, $X_{i,t-1}$ is the vector of explanatory variables and $u_i$ is the error term. Explanatory variables are lagged in order to factor in that regime type, economic development, and state capacity may have a lagged effect. The time-specific intercepts account for time-varying omitted variables and stochastic shocks that are common to all countries. The Hausman test cannot be performed when using cluster-robust standard errors, so we used the overidentification test developed by Schaffer and Stillman (2010): rejecting the null hypothesis that random effects are consistent, we used fixed effects.

All our variables are in cross-national time-series data format. One major advantage of panel data is that it allows one to control for unobservables: variables that cannot be measured. This is true for differences across units (that is, country-specific differences such as religion and culture) as well as for differences across time (international agreements, changes in norms, natural disasters that might impact all national policies, and so on). This permits us to account for individual heterogeneity. One major limitation of panel data is the poor data availability of some variables since data is needed per year per country, meaning that our statistical models are shaped and driven by theoretical considerations, as well as by practical constraints and opportunities. We had to exclude certain variables (such as the Gini Index as a measure of inequality) because we lacked data for our model's time period. In some models, a high number of countries were dropped due to a lack of data. Data coverage for the dependent variable is fairly limited, with data only from 2000 to 2010. However, this timeframe makes our dataset strongly balanced.

Table 2 shows the ten countries ranked highest and lowest in terms of reaching environmental targets (ecosystem vitality), with information on their political regime, economic development, and state capacity. At the upper end, Switzerland ranked first or received high marks in several categories (Emerson et al., 2012), which is not necessarily surprising. Yet, countries with lower incomes, less state capacity or autocratic regimes also achieved impressive environmental outcomes. It is noticeable that the ten lowest-ranked countries are all coded as dictatorships. Although this could be a hint that regime type is a determining factor, further analysis is certainly needed.

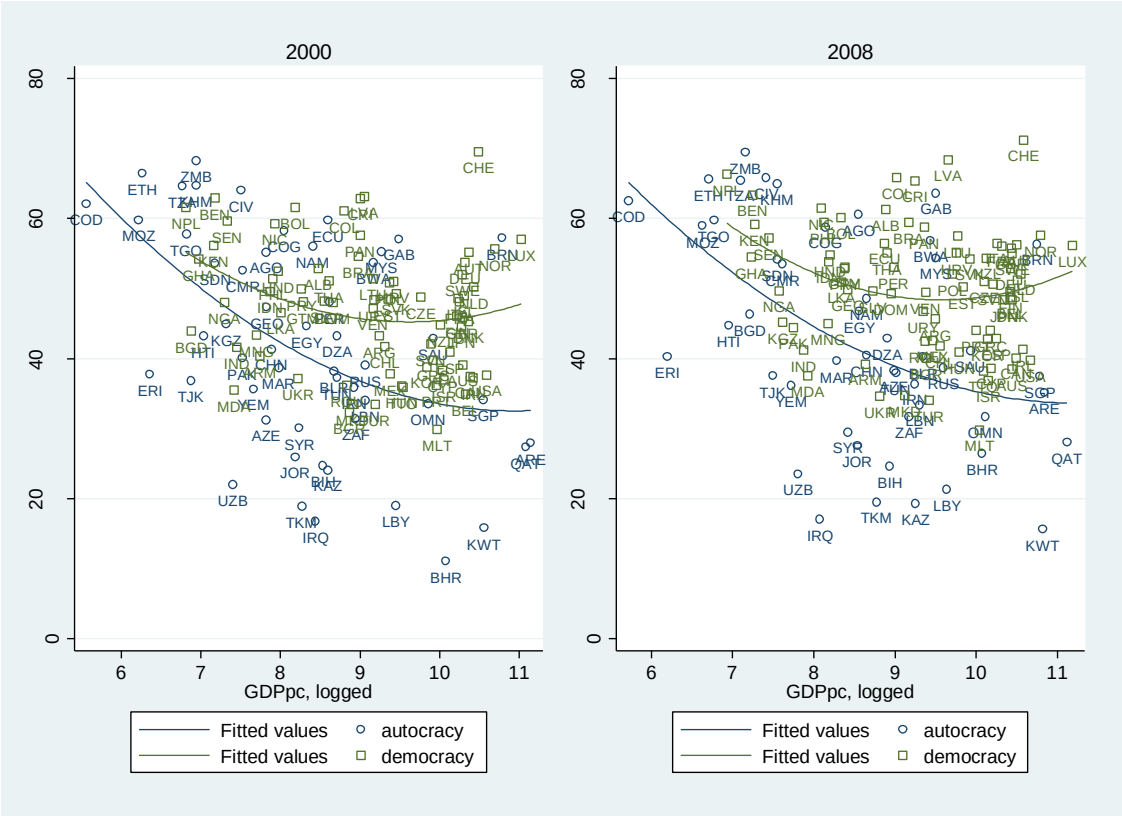
**Table 2: Countries with the highest and lowest scores for ecosystem vitality**

| | | | | State capacity | |
|---|---|---|---|---|---|
| Country | Ecosystem vitality | Political regime | Economic development | Bureaucratic quality | Tax revenues |
| *Ten highest ranked countries in terms of ecosystem vitality* | | | | | |
| Switzerland | 69.6 | Democracy | 39,066 | 4.0 | |
| Zambia | 69.5 | Dictatorship | 1,401 | 1.0 | 16.6 |
| Latvia | 68.9 | Democracy | 12,948 | 2.5 | 12.8 |
| Gabon | 66.8 | Dictatorship | 13,611 | 1.5 | |
| Nepal | 66.6 | Democracy | 1,083 | | 13.4 |
| Costa Rica | 66.0 | Democracy | 10,453 | 2.0 | 13.5 |
| Tanzania | 65.7 | Dictatorship | 1,293 | 1.0 | |
| Cambodia | 65.6 | Dictatorship | 1,968 | | 10.1 |
| Ethiopia | 65.6 | Dictatorship | 932 | 1.5 | 9.8 |
| Côte d'Ivoire | 65.6 | Dictatorship | 1,693 | 0.0 | 17.0 |
| *Ten lowest ranked countries in terms of EV* | | | | | |
| Qatar | 28.0 | Dictatorship | 69,798 | 2.0 | 14.4 |
| Jordan | 27.5 | Dictatorship | 5,249 | 2.0 | 15.9 |
| Bahrain | 26.5 | Dictatorship | 21,345 | 2.0 | |
| Uzbekistan | 23.4 | Dictatorship | 2,754 | | |
| Bosnia and Herzegovina | 22.7 | Dictatorship | 7,464 | | 20.3 |
| Libya | 20.6 | Dictatorship | | 1.0 | |
| Kazakhstan | 19.8 | Dictatorship | 10,916 | 2.0 | 8.9 |
| Turkmenistan | 19.7 | Dictatorship | 7,344 | | |
| Iraq | 17.1 | Dictatorship | 3,195 | 1.5 | |
| Kuwait | 14.8 | Dictatorship | 45,623 | 2.0 | 0.9 |

Source: Authors, based on Cheibub et al., 2010; Emerson et al., 2012; PRS Group Inc., 2012; World Bank, 2014a

Figure 1 provides a snapshot of how ecosystem vitality scores changed from 2000 to 2008 for both autocratic and democratic regimes, differentiating their developmental levels, which are shown in log values. The logarithmic transformation smoothens out the distribution, making the figure more legible. This presentation is consistent with our estimations. The two scatter plots show again how widespread ecosystem vitality scores are for both regime types and a broad range of per capita incomes. The regression curves of fitted values illustrate that, on average, ecosystem vitality scores were higher in 2008 than in 2000, indicating a general upward trend. We also see that, in both years, democratic regimes scored higher on average than autocratic regimes. The quadratic fit suggests a stronger upward trend at higher levels of per capita income for democratic regimes than for autocratic regimes. Finally, the figures for 2000 and for 2008 also show that, in both years, some autocratic countries scored as high as democratic countries and some democratic countries scored as low as certain autocratic countries, often at very different levels of income per capita. Hence, a more nuanced look is necessary.

**Figure 1: Ecosystem vitality and economic development per regime type (2000 versus 2008)**




Source: Authors

## 4 Results

The baseline model includes our three main explanatory variables: regime type; economic development; and state capacity (Table 3, Columns 1 and 2). These two columns differ only with respect to the proxy used to capture state capacity in each model; as mentioned in the note, Column 1 includes the proxy "bureaucratic capacity" (Model 1), while Column 2 includes the proxy "tax capacity" (Model 2).

Against our hypothesis, the coefficient for regime type turns out to be insignificant. We find no evidence that democratic countries perform better at reaching environmental targets than autocratic countries. This even remains true when we use an alternative measure for political regime (see Appendix, Table A.5). Economic development on the other hand is significantly correlated with reaching environmental targets. This correlation follows a U-shape and shows that economic development has a non-linear effect on achieving environmental targets, similar to the EKC.[8] When GDP per capita increases, environmental targets are less

8 The EKC, which shows environmental degradation on the y-axis, follows an inverted U-shape, while our curve has a normal U-shape because the study displays "reaching environmental targets" on the y-axis. In our case, a high y-value indicates a high level of environmental quality while for the ECK a high y-value indicates high levels of environmental degradation hence low levels of environmental quality. Therefore,

likely to be met – until a specific turning point is reached and economic development begins to have a positive effect on reaching environmental targets. Differentiating our estimated equation with respect to GDP per capita and setting this equal to zero yields the turning points: The estimated turning point is at around US dollars (USD) 4,800 per capita income for Model 1 and at around USD 18,000 per capita income for Model 2. Even though we clearly see the U-shaped nature of the correlation, the great difference between the two models does not allow us to define the exact turning point.

The results for state capacity vary per proxy. Looking at the estimation results, we do not see any significant relationship to environmental performance when we measure state capacity as "bureaucratic capacity" (Column 1). However, when we measure state capacity as "tax capacity", we see a significant negative relationship. At first glance, the ability of the state to raise and collect taxes per se does not lead to a more environmental politics but actually to the opposite. These results lend weight to our argument that state capacity only stands for what a state is *capable* of doing, not the kind of preferences it has. It seems that states with increasing capacity might prefer to foster economic growth at the expense of the environment.

But: Do capable democracies show a preference for environmental protection more often than capable autocracies? To get a better understanding of the possible interaction between state capacity and regime type, we included these interaction effects in our model (Table 3, Columns 5 and 6).[9,10] The tabular estimation results show that the interaction term between bureaucratic quality and regime type is insignificant, while the interaction term between tax capacity and regime type is however positive and significant. Given the nature of the interaction effect, a more detailed examination is needed, though.

our finding is in line with the EKC theory – although compared with the EKC curve, our curve seems to be "upside down".

9 Following Brambor, Clark, and Golder (2006), we included all constitutive terms of the interaction effects (e.g., X, Z, XZ).

10 The pairwise correlation analysis shows that political regime and bureaucratic capacity are moderately correlated (r=0.4509) and political regime and tax capacity are weakly correlated (r=0.2066). This correlation suggests that political regime and state capacity are connected but that in both cases, neither variable entirely absorbs the explanatory power of the other variable, so it is valid to examine whether or not the interaction of the political regime and state capacity affects the dependent variable.

**Table 3: Regression results**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dependent variable: Ecosystem vitality (three-year moving averages) | | | | | | | | | |
| Political regime $_{t-1}$ | -0.35 | 0.01 | -0.61 | -0.10 | 0.83 | -2.72 | -0.62 | -0.01 | 93.01 | 71.37 |
| | (-0.56) | (0.03) | (-0.80) | (-0.13) | (0.37) | (-1.76)* | (-0.82) | (-0.01) | (2.29)** | (1.53) |
| ln economic development$_{t-1}$ | -17.49 | -20.10 | -21.98 | -27.74 | -23.00 | -27.98 | -31.88 | -6.53 | -4.02 | -10.33 |
| | (-2.81)*** | (-2.87)*** | (-3.10)*** | (-3.08)*** | (-3.13)*** | (-3.15)*** | (-2.58)** | (-0.46) | (-0.50) | (-1.06) |
| ln economic development squared$_{t-1}$ | 1.03 | 1.03 | 1.30 | 1.44 | 1.35 | 1.48 | 1.92 | 0.32 | 0.17 | 0.29 |
| | (2.98)*** | (2.55)** | (3.24)*** | (2.79)*** | (3.31)*** | (2.91)*** | (2.51)** | (0.40) | (0.35) | (0.52) |
| State capacity$_{t-1}$ | -0.54 | -0.12 | -0.47 | -0.08 | 0.10 | -0.23 | -12.64 | 7.73 | -0.54 | -0.07 |
| | (-0.92) | (-2.41)** | (-0.64) | (-1.37) | (0.24) | (-2.68)*** | (-0.68) | (2.49)** | (-0.76) | (-1.16) |
| Political stability$_{t-1}$ | | | -0.53 | -0.66 | -0.53 | -0.67 | -0.52 | -0.63 | -0.55 | -0.69 |
| | | | (-1.52) | (-1.40) | (-1.52) | (-1.45) | (-1.47) | (-1.43) | (-1.62) | (-1.62) |
| Economic pressure$_{t-1}$ | | | 0.04 | -0.01 | 0.04 | -0.02 | 0.04 | -0.00 | 0.03 | -0.02 |
| | | | (1.16) | (-0.34) | (1.18) | (-0.50) | (1.15) | (-0.08) | (1.10) | (-0.55) |
| Pressure by agricultural sector$_{t-1}$ | | | -0.06 | -0.09 | -0.06 | -0.08 | -0.06 | -0.12 | -0.06 | -0.07 |
| | | | (-1.14) | (-0.98) | (-1.26) | (-0.96) | (-1.10) | (-1.80)* | (-1.18) | (-0.80) |
| Pressure by industrial sector$_{t-1}$ | | | -0.04 | -0.04 | -0.04 | -0.04 | -0.05 | -0.04 | -0.03 | -0.03 |
| | | | (-1.15) | (-0.67) | (-1.04) | (-0.82) | (-1.25) | (-0.82) | (-0.90) | (-0.66) |
| Corruption$_{t-1}$ | | | -0.00 | 0.05 | -0.01 | 0.07 | -0.02 | 0.08 | -0.02 | 0.07 |
| | | | (-0.03) | (0.24) | (-0.03) | (0.33) | (-0.09) | (0.35) | (-0.10) | (0.34) |
| Political regime$_{t-1}$*State capacity$_{t-1}$ | | | | | -0.73 | 0.20 | | | | |
| | | | | | (-0.68) | (1.92)* | | | | |
| ln economic development$_{t-1}$*State capacity$_{t-1}$ | | | | | | | 3.43 | -1.68 | | |
| | | | | | | | (0.73) | (-2.42)** | | |
| ln economic development squared$_{t-1}$*State capacity$_{t-1}$ | | | | | | | -0.23 | 0.09 | | |
| | | | | | | | (-0.79) | (2.32)** | | |
| Political regime $_{t-1}$*ln economic development$_{t-1}$ | | | | | | | | | -24.83 | -20.86 |
| | | | | | | | | | (-2.43)** | (-1.80)* |
| Political regime $_{t-1}$*ln economic development squared$_{t-1}$ | | | | | | | | | 1.62 | 1.46 |
| | | | | | | | | | (2.54)** | (2.05)** |
| Constant | 119.49 | 143.33 | 141.36 | 181.05 | 145.25 | 181.61 | 180.07 | 82.81 | 69.77 | 114.02 |
| | (4.18)*** | (4.52)*** | (4.33)*** | (4.36)*** | (4.28)*** | (4.41)*** | (3.56)*** | (1.27) | (1.94)* | (2.64)*** |
| Observations | 1,140 | 874 | 699 | 526 | 699 | 526 | 699 | 526 | 699 | 526 |
| Countries | 115 | 113 | 102 | 89 | 102 | 89 | 102 | 89 | 102 | 89 |
| F-statistic | 5.62 | 5.42 | 4.90 | 4.48 | 4.79 | 4.47 | 4.66 | 5.77 | 4.72 | 5.09 |
| Adjusted $R^2$ | 0.25 | 0.28 | 0.24 | 0.27 | 0.24 | 0.28 | 0.25 | 0.29 | 0.26 | 0.31 |
| Effects | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed |
| State capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity |
| Interaction effect | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes |

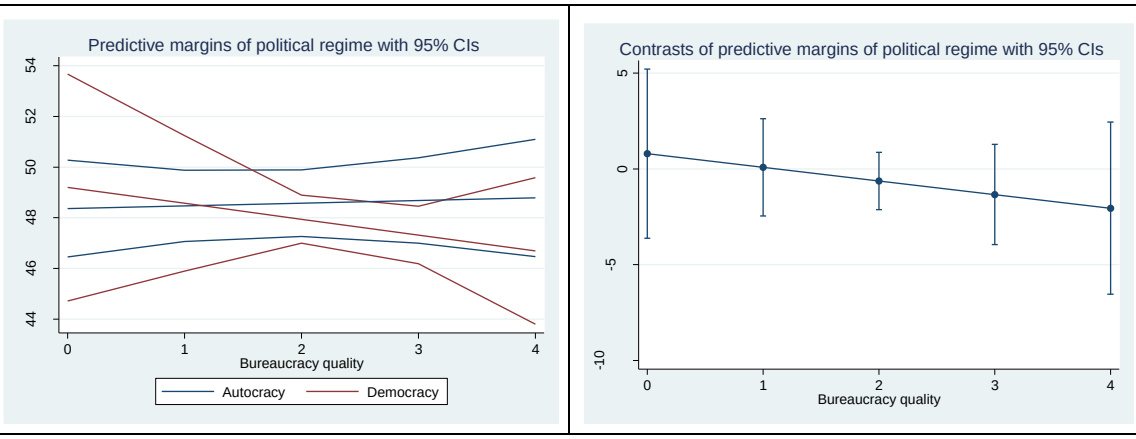
Note: ***, **, * denote significance at 1, 5, and 10 per cent, respectively. t-statistics are reported below the coefficient estimates. Standard errors clustered at country level. Year-specific time dummies to capture worldwide trends not reported. The adjusted R-square reports the proportion of within-unit variation explained, due to the use of fixed effects.

Source: Authors

Figures 2a and 2b examine the interaction effect between political regime and state capacity in more depth. The interaction effects seem to lack the common level of statistical significance. Still, trends can be identified. Figure 2a illustrates the interaction effect for the proxy "bureaucratic capacity" (left), and the difference in predictive margins for democratic and autocratic regimes (right). The figure to the left shows a negative correlation between greater bureaucracy quality and reaching environmental goals for democratic regimes, but a slightly positive correlation for autocratic settings. The figure to the right illustrates this difference between the two regime types. At the lowest level of bureaucratic capacity, the effect of being a democracy compared to being an autocracy is positive but then vanishes as bureaucratic quality increases. For moderate and high levels, the effect of being a democracy is slightly negative.

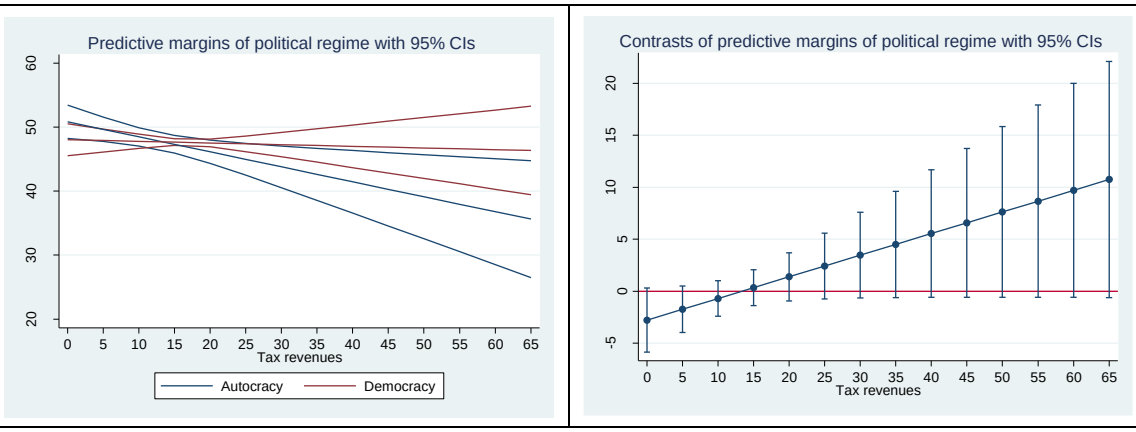
Figure 2b illustrates the same interaction effect for the proxy "tax capacity" (left), and the difference in predictive margins for democratic and autocratic regimes (right). We see that greater tax capacity negatively impacts reaching environmental goals for both types of political regimes: The stronger a state, the less likely it is to reach environmental goals. However, both plots show that this effect is more moderate for democracies. Whether states are more democratic or autocratic does not really matter with regard to the environment, if their state capacity is low. Our results suggest that, as capacity grows, this relationship changes: a state that is becoming a capable democracy seems to be less harmful to the environment than a state that is becoming a capable autocracy.

**Figure 2a: Testing the effects of political regime, conditional on state capacity (bureaucratic quality)**




Source: Authors

**Figure 2b: Testing the effects of political regime, conditional on state capacity (tax revenues)**

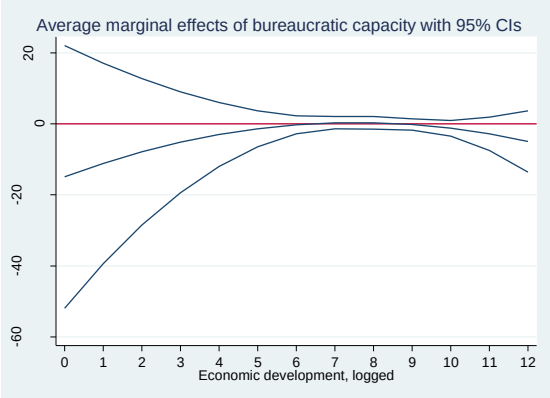


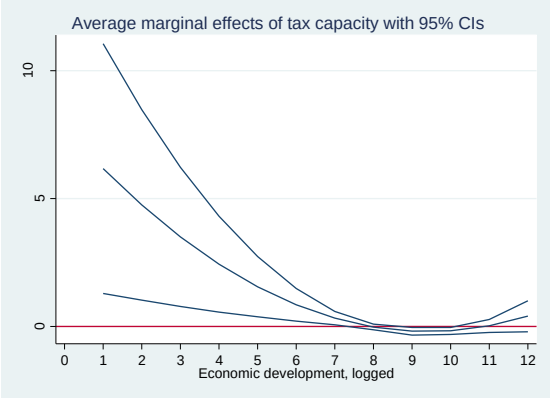

Source: Authors

In Columns 7 and 8 (of Table 3), we controlled for the interaction effect between economic development and state capacity. The level of economic development indicates the (financial) opportunities for provisioning public goods, while the level of state capacity indicates the capability to implement related policies. In line with our previous results, the interaction between economic development and bureaucratic quality is statistically insignificant, while the interaction between economic development and tax revenues is significant, mirroring the U-shaped relationship of Columns 1 and 2.

Figure 3 visualises the interaction effect between economic development and the two proxies for state capacity: bureaucracy quality (left) and tax revenues (right). The interaction effects are curved because the underlying estimations include both the simple and the squared term of economic development. The effect of bureaucratic capacity decreases with economic development, as does the effect of taxing capacity. At similar levels of economic development, the effect of state capacity is zero, to then reappear at the very high end of economic development. The difference between the two proxies is, at first sight, that low bureaucratic quality has a decreasingly positive effect on reaching environmental targets, while low tax revenues have a decreasingly negative effect on reaching environmental targets. Yet, judging by the associated statistical significance indicated by 95 per cent confidence intervals, the effect is only significant for the proxy tax revenue when income per capita is lower than approximately USD 1,808 (exp(7.5)) which still comprises a large set of countries.[11] This suggests that, all else being equal, at low levels of per capita income, a greater tax ratio helps in reaching environmental targets.

**Figure 3: Testing the effects of state capacity, conditional on economic development**



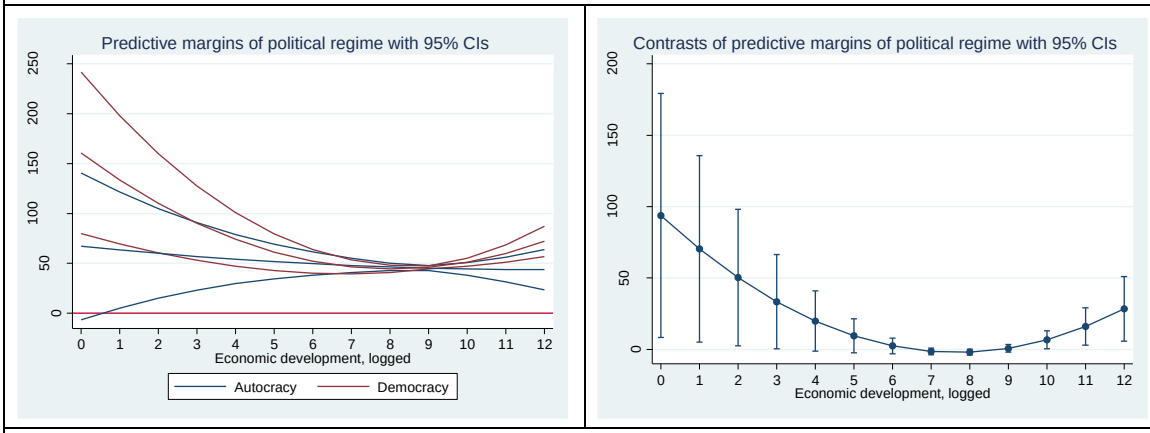

Source: Authors

Columns 9 and 10 (Table 3) present the results of the models, including the interaction between political regime and economic development. In these models, the multiplicative term turns out to be statistically significant. The results suggest a U-shaped relationship that

11 Using data from the World Development Indicators for the year 2010, the following countries had a GDP per capita (constant 2010 USD) below USD 1,900: Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Congo (DRC), Côte d'Ivoire, Djibouti, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, India, Kenya, Kiribati, Kyrgyz Republic, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Moldova, Mozambique, Myanmar, Nepal, Nicaragua, Niger, Pakistan, Papua New Guinea, Rwanda, São Tomé and Principe, Senegal, Sierra Leone, Solomon Islands, Sudan, Tajikistan, Tanzania, Timor-Leste, Togo, Uganda, Uzbekistan, Vietnam, Yemen, Zambia, and Zimbabwe.

is further illustrated in Figure 4. The interaction between political regime and economic development on the left shows a difference between democratic and autocratic regimes, most pronounced at lower and higher levels of economic development. Given the overlapping curves, it is helpful to have a closer look at the figure to the right that clearly shows the difference in predictive margins for democratic and autocratic regimes. At very low levels of economic development, a democratic regime has a pronounced more positive effect on reaching environmental targets than an autocratic regime. This difference decreases with increasing economic development and seems to diminish entirely at moderate levels of economic development. Only in very developed economies, does the positive effect of democracies compared to autocracies reappear, albeit at a smaller scale. While the interaction effect between regime type and economic development follows a clear, albeit asymmetrical, U-shape for democracies, for autocracies the line is just slightly curved. Hence the level of economic development seems to have less of an influence on reaching environmental targets in autocracies than in democracies. An intuitive interpretation is that, in autocracies, preferences by the ruling elite remain fairly steady regardless of economic development, whereas people's preferences in democracies seem to depend rather strongly on the state of economic development.

**Figure 4: Testing the effects of political regime, conditional on economic development**




Source: Authors

In addition to our baseline model, we also include a more time-sensitive model. Table 4 presents the results when we use three-year moving averages for our dependent variable because changes in an explanatory variable are not likely to immediately translate into a change in the dependent variable. For example, changes in the level of economic development will not have a direct effect on the environment: the impact will likely only become visible and measurable after some time. Taking the average value of three years, a standard procedure in the empirical literature, the results for the baseline model do not change (Table 4, Columns 1 and 2).

Controlling for other factors, political stability has a consistent, significantly negative effect on reaching environmental targets. This suggests that stable political conditions are not necessarily used by the government to pursue environment-friendly policies in the medium term.

With the three-year moving averages, none of the interaction effects between political regime and state capacity remain statistically significant (Table 4, Columns 5 and 6). All

else being equal, greater state capacity has a significantly negative effect. Perhaps, as for political stability, the bureaucratic capacity to implement policies and the tax capacity to finance policies are not necessarily used to implement and finance environment-friendly policies. The results also show that greater pressure from the industrial sector is correlated with lower achievements in terms of environmental targets, which supports our conjecture. The results for the interaction effect of economic development and state capacity (Table 4, Columns 7 and 8) are no longer significant. The correlation between the economic structure and reaching environmental targets is negative: an economically more important agricultural or industrial sector is negatively associated with environmental targets. The results of the interaction between political regime and economic development (Table 4, Columns 9 and 10) are similar to Table 3.

**Table 4: Regression results (with moving averages)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dependent variable: Ecosystem vitality (three-year moving averages) | | | | | | | | | |
| Political regime$_{t-1}$ | -0.33 | -0.04 | -0.13 | 0.23 | -2.26 | -1.19 | -0.17 | 0.22 | 63.85 | 32.13 |
| | (-0.55) | (-0.10) | (-0.16) | (0.30) | (-1.40) | (-0.89) | (-0.22) | (0.28) | (1.54) | (0.84) |
| ln economic development$_{t-1}$ | -16.25 | -19.09 | -21.74 | -28.23 | -20.05 | -27.96 | -36.19 | -15.92 | -7.83 | -17.77 |
| | (-2.69)*** | (-2.87)*** | (-3.31)*** | (-3.47)*** | (-2.95)*** | (-3.44)*** | (-3.21)*** | (-1.14) | (-1.05) | (-2.44)** |
| ln economic development squared$_{t-1}$ | 0.95 | 0.99 | 1.26 | 1.51 | 1.18 | 1.52 | 2.17 | 0.87 | 0.37 | 0.82 |
| | (2.81)*** | (2.61)** | (3.33)*** | (3.33)*** | (3.05)*** | (3.34)*** | (3.05)*** | (1.14) | (0.85) | (1.95)* |
| State capacity$_{t-1}$ | -0.49 | -0.12 | -0.44 | -0.06 | -1.27 | -0.15 | -16.86 | 4.79 | -0.49 | -0.06 |
| | (-0.87) | (-2.42)** | (-0.57) | (-1.19) | (-2.71)*** | (-2.00)** | (-1.05) | (1.53) | (-0.65) | (-1.22) |
| Political stability$_{t-1}$ | | | -0.69 | -0.91 | -0.68 | -0.93 | -0.68 | -0.90 | -0.66 | -0.88 |
| | | | (-1.90)* | (-1.95)* | (-1.88)* | (-1.99)** | (-1.88)* | (-2.00)** | (-1.87)* | (-2.02)** |
| Economic pressure$_{t-1}$ | | | 0.02 | -0.01 | 0.02 | -0.01 | 0.02 | 0.00 | 0.03 | -0.01 |
| | | | (1.44) | (-0.30) | (1.27) | (-0.46) | (1.48) | (0.07) | (1.77)* | (-0.29) |
| Pressure by agricultural sector$_{t-1}$ | | | -0.07 | -0.13 | -0.07 | -0.12 | -0.08 | -0.14 | -0.07 | -0.10 |
| | | | (-1.51) | (-1.64) | (-1.43) | (-1.54) | (-1.51) | (-2.09)** | (-1.48) | (-1.40) |
| Pressure by industrial sector$_{t-1}$ | | | -0.02 | -0.06 | -0.02 | -0.07 | -0.03 | -0.07 | -0.01 | -0.05 |
| | | | (-0.64) | (-1.58) | (-0.81) | (-1.78)* | (-0.88) | (-1.81)* | (-0.37) | (-1.51) |
| Corruption$_{t-1}$ | | | -0.07 | -0.04 | -0.06 | -0.04 | -0.10 | -0.02 | -0.11 | -0.05 |
| | | | (-0.37) | (-0.16) | (-0.35) | (-0.12) | (-0.52) | (-0.07) | (-0.63) | (-0.19) |
| Political regime$_{t-1}$*State capacity$_{t-1}$ | | | | | 1.07 | 0.11 | | | | |
| | | | | | (1.49) | (1.25) | | | | |
| ln economic development$_{t-1}$*State capacity$_{t-1}$ | | | | | | | 4.62 | -1.02 | | |
| | | | | | | | (1.12) | (-1.46) | | |
| ln economic development squared$_{t-1}$*State capacity$_{t-1}$ | | | | | | | -0.31 | 0.05 | | |
| | | | | | | | (-1.19) | (1.37) | | |
| Political regime$_{t-1}$*ln economic development$_{t-1}$ | | | | | | | | | -17.71 | -10.31 |
| | | | | | | | | | (-1.76)* | (-1.10) |
| Political regime$_{t-1}$*ln economic development squared$_{t-1}$ | | | | | | | | | 1.20 | 0.78 |
| | | | | | | | | | (1.98)* | (1.37) |
| Constant | 114.66 | 137.09 | 140.91 | 179.57 | 134.36 | 177.90 | 197.45 | 122.04 | 86.27 | 139.39 |
| | (4.19)*** | (4.51)*** | (4.78)*** | (4.70)*** | (4.33)*** | (4.66)*** | (4.44)*** | (1.90)* | (2.67)*** | (4.17)*** |
| Observations | 1,243 | 943 | 789 | 579 | 789 | 579 | 789 | 579 | 789 | 579 |
| Countries | 115 | 113 | 102 | 92 | 102 | 92 | 102 | 92 | 102 | 92 |
| F-statistic | 5.61 | 5.63 | 5.40 | 5.49 | 6.92 | 5.11 | 5.23 | 5.70 | 5.92 | 5.93 |
| Adjusted $R^2$ | 0.30 | 0.34 | 0.32 | 0.38 | 0.32 | 0.38 | 0.33 | 0.39 | 0.35 | 0.41 |
| Effects | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed |
| State capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity |
| Interaction effect | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes |

Note: ***, **, * denote significance at 1, 5, and 10 percent, respectively. t-statistics are reported below the coefficient estimates. Standard errors clustered at country level. Year-specific time dummies to capture worldwide trends not reported. The adjusted R-square reports the proportion of within-unit variation explained, due to the use of fixed effects.

Source: Authors

*Robustness tests*

With regard to the type of proxy regime, some countries have not seen any alternation in power and are therefore classified as dictatorships in the dataset (risking type II errors, a false negative). As recommended by Cheibub et al. (2010), we double-checked our results by recoding these cases as democracies, risking type I errors (a false positive) to test the sensitivity of our results. As the table in Appendix A.4 shows, the coefficient for political regime turns out to be significantly negative in several specifications, suggesting that democratic countries perform worse than autocratic countries in reaching environmental targets. Despite some changes in significance, the results are by and large the same.

In order to test how sensitive our results were to the proxy used for regime, we re-estimated our regressions with a commonly used measure of political regimes: Polity IV. The Polity IV Project classifies political regimes on a 21-point scale from -10 (strongly autocratic) to +10 (strongly democratic) (Marshall, Jaggers, & Gurr, 2011).[12] We used the summary Polity IV score (polity2) and recoded it into an ordinal variable with three categories: autocracy (-10 to -6), anocracy (-5 to +5), and democracy (+6 to +10).

We agree with Cheibub et al. (2010, p. 68) that alternative measures of political regime differ significantly in terms of "their theoretical grounding and operationalization and […] should not be treated as interchangeable". We decided to follow common practice and estimate our models with the alternative measure, Polity IV; the results for the Polity IV model are reported in Appendix A.5.[13] As the correlation matrix shows, the different measures for political regime are correlated with a coefficient of r=0.7645. Even with this alternative indicator, the results remain similar. Two changes, however, are noteworthy when we use Polity IV data. First, the interaction effect between tax capacity and political regime becomes insignificant (Table A.5, Column 6). Second, the interaction effect between economic development and political regime becomes insignificant, when using the proxy taxing capacity (Column 10). On one hand, these discrepancies reveal how sensitive the results are to the proxy used, while on the other, the fact that changing key proxies causes only moderate alternation in our models shows that the results are generally robust.

## 5 Discussion and conclusions

In this article, we have examined the extent to which the political regime, economic development, and state capacity contribute to reaching environmental goals at the country level. Empirical tests were performed on a sample of 132 countries over ten years (2000-2010). We started the analysis by looking at the individual effects of our three core

12 In this dataset, democracy is regarded to consist of: i) the ability of citizens to express their preferences through institutions; ii) institutional constraints on the executive's exercise of power; and iii) guaranteed civil liberties for all citizens. Authoritarian regimes are characterized by: i) the suppression of competitive political participation; ii) a chief executive who comes to power through a regularised selection process by a group of elites; and iii) the chief executive's power has no or only a few institutional constraints.

13 Other measures of democracy are available and have been widely used in the literature (such as political rights and civil liberties by Freedom House). However, we prefer to use the Polity IV index for our robustness checks because of how it differs methodologically and conceptually from the Democracy-Dictatorship dataset.

explanatory variables and identified the following trends: Whether a country's regime is democratic or autocratic matters much less than we expected for reaching environmental targets. Yet we confirmed the level of economic development as one influential factor: Environmental targets are less likely to be reached at lower levels but increasingly attained at higher levels. Using two alternative proxies, we were not able to find any evidence that greater state capacity per se contributes positively to the pursuit of environmental protection. The study further illustrates the challenge of finding an adequate proxy for state capacity that takes into account the heterogeneity of countries and is not too closely correlated with economic development.

Going beyond the individual effects, our analysis included the detailed assessment of possible interaction effects between our three core explanatory variables. First, the effect of political regime, conditional on the capacity of the bureaucratic apparatus to implement policy, revealed a slight difference between the two regime types, albeit not at conventional levels of statistical significance. Conditional on taxing capacity, democratic regimes perform better at reaching environmental targets than autocratic regimes, already at relatively low tax levels. This evidence suggests that the regime type in itself is not important, but rather only in combination with the level of state capacity. Democratic regimes appear to do a better job in reaching environmental targets, particularly at very low levels of bureaucratic capacity and already at relatively low levels of taxing capacity than autocratic regimes.

Secondly, the effect of state capacity, conditional on the level of economic development, illustrated how strongly the results depend on that proxy. The bureaucratic and administrative capacity to implement environment-friendly policies seems to matter. Particularly – everything else equal – at low levels of per capita income, a greater tax ratio helps in reaching environmental targets.

Analysis of the third interaction effect showed interesting differences between autocratic and democratic regimes in terms of reaching environmental targets, given the same level of economic development. Being democratic helps in particular at very low levels and, on a smaller scale, at high levels of economic development. At moderate levels of economic development, political regime type has no statistically significant effect. In other words, the level of economic development has a much more pronounced influence on the environmental politics of democracies than in autocracies.

In sum, neither a democratic regime, with all its possibilities for citizens to participate, nor the pure ability or capacity of the state alone, automatically translates into greater environmental protection. The policy implication is that simply giving people a voice is not sufficient to ensure environment-friendly policies; rather the interaction between the three key factors is decisive. Being democratic is helpful for reaching environmental targets when the ability to implement and fund public policies is relatively low; in the latter case, the positive relationship increases with greater funding possibilities. Being democratic also helps with regard to environmental protection at very low and high levels of per capita income, while it is not important at moderate levels of per capita income. Democracies might be at the forefront when it comes to providing public goods like health and education. They are, however, as our results show, no "angels" and autocracies are no "demons" per se when it comes to protecting the environment.

## References


Acemoglu, D., Ticchi, D., & Vindigni, A. (2011). Emergence and persistence of inefficient states. *Journal of the European Economic Association, 9*(2), 177-208. doi:10.1111/j.1542-4774.2010.01008.x

Arvin, M. B., & Lew, B. (2011). Does democracy affect environmental quality in developing countries? *Applied Economics, 43*(9), 1151-1160.

Barrett, S., & Graddy, K. (2000). Freedom, growth, and the environment. *Environment and Development Economics, 5*(4), 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*(2), 281-308.

Beckerman, W. (1992). Economic growth and the environment: Whose growth? Whose environment? *World Development, 20*(4), 481-496.

Beeson, M. (2010). The coming of environmental authoritarianism. *Environmental Politics, 19*(2), 276-294.

Bernauer, T., & Koubi, V. (2009). Effects of political institutions on air quality. *Ecological Economics, 68*(5), 1355-1365.

Böhringer, C., & Jochem, P. E. P. (2007). Measuring the immeasurable – a survey of sustainability indices. *Ecological Economics, 63*(1), 1-8.

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. *Political Analysis, 14*(1), 63-82. doi:10.1093/pan/mpi014

Bueno de Mesquita, B., Smith, A., Siverson, R. M., & Morrow, J. D. (2003). *The logic of political survival*. Cambridge, MA: MIT Press.

Cao, X., & Ward, H. (2015). Winning coalition size, state capacity, and time horizons: An application of modified selectorate theory to environmental public goods provision. *International Studies Quarterly, 59*(2), 264-279. doi:10.1111/isqu.12163

Chadwick, B. P. (1995). Fisheries, sovereignties and red herrings. *Journal of International Affairs, 48*(2), 559–584.

Cheibub, J. A., Gandhi, J., & Vreeland, J. (2010). Democracy and dictatorship revisited. *Public Choice, 143*(1-2), 67-101. doi:10.1007/s11127-009-9491-2

Cingolani, L. (2013). *The state of state capacity: A review of concepts, evidence and measures* (UNU-MERIT Working Paper Series 2013-053). Maastricht: United Nations University (UNU-MERIT).

Cingolani, L., Thomsson, K. & de Crombrugghe, D. (2015). Minding Weber more than ever? The impacts of state capacity and bureaucratic autonomy on development. *World Development, 72,* 191-207. DOI: 10.1016/j.worlddev.2015.02.016

Cole, M. A. (1999). Limits to growth, sustainable development and Environmental Kuznets Curves: An examination of the environmental impact of economic development. *Sustainable Development, 7*(2), 87-97. doi:10.1002/(SICI)1099-1719(199905)7:2<87::AID-SD102>3.0.CO;2-5

Cole, M. A., & Neumayer, E. (2004). Examining the impact of demographic factors on air pollution. *Population and Environment, 26*(1), 5-21. doi:10.1023/B:POEN.0000039950.85422.eb

Congleton, R. D. (1992). Political institutions and pollution control. *The Review of Economics and Statistics, 74*(3), 412-421.

de Bruyn, S. M., & Heintz, R. J. (1999). The Environmental Kuznets Curve hypothesis. In J. C. J. M. v. d. Bergh (Ed.), *Handbook of environmental and resource economics* (pp. 656–677). Cheltenham: Edward Elgar.

Deacon, R. T. (2009). Public good provision under dictatorship and democracy. *Public Choice, 139*(1/2), 241-262.

Dinda, S. (2004). Environmental Kuznets Curve hypothesis: A survey. *Ecological Economics, 49*(4), 431-455. doi:10.1016/j.ecolecon.2004.02.011

Ehwarieme, W., & Cocodia, J. (2011). Corruption and environmental degradation in Nigeria and its Niger delta. *Journal of Sustainable Development in Africa, 13*(5), 34-48.

Emerson, J. W., Hsu, A., Levy, M. A., Sherbinin, A. d., Mara, V., Esty, D. C., & Jaiteh, M. (2012). *2012 Environmental Performance Index and pilot trend Environmental Performance Index.* Retrieved from http://epi.yale.edu/sites/default/files/2012_epi_report.pdf

Esty, D. C., & Porter, M. E. (2005). National environmental performance: An empirical analysis of policy results and determinants. *Environment and Development Economics, 10*(4), 391-434.

Fredriksson, P. G., Neumayer, E., Damania, R., & Gates, S. (2005). Environmentalism, democracy, and pollution control. *Journal of Environmental Economics and Management, 49*(2), 343-365. doi:http://dx.doi.org/10.1016/j.jeem.2004.04.004

Fukuyama, F. (2004). The imperative of state-building. *Journal of Democracy, 15*(2), 16.

Fukuyama, F. (2013). Commentary: What is governance? *Governance: An International Journal of Policy, Administration, and Institutions, 26*(3), 347-368. doi:10.1111/gove.12035

Galbraith, K. (8 February 2012). Should plastic bags be banned? *The New York Times*. Retrieved from http://www.nytimes.com/2012/02/09/business/energy-environment/should-plastic-bags-be-banned.html?pagewanted=all&_r=0

Gassebner, M., Lamla, M. J., & Sturm, J.-E. (2011). Determinants of pollution: What do we really know? *Oxford Economic Papers, 63*(3), 568-595. doi:10.1093/oep/gpq029

Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The Quarterly Journal of Economics, 110*(2), 353-377.

Hanson, J. K. (2015). Democracy and state capacity: Complements or substitutes? *Studies in Comparative International Development, 50*(3), 304-330. doi:10.1007/s12116-014-9173-z

Hanson, J. K., & Sigman, R. (2013). Leviathan's latent dimensions: Measuring state capacity for comparative political research (APSA 2011 Annual Meeting Paper 31). Retrieved from https://ssrn.com/abstract=1899933

Hendrix, C. S. (2010). Measuring state capacity: Theoretical and empirical implications for the study of civil conflict. *Journal of Peace Research, 47*(3), 273-285. https://doi.org/10.1177/0022343310361838

Klick, J. (2002). Autocrats and the environment or it's easy being green (George Mason Law & Economics Research Paper 02-16). Retrieved from https://ssrn.com/abstract=311063. doi: http://dx.doi.org/10.2139/ssrn.311063

Lake, D. A., & Baum, M. A. (2001). The invisible hand of democracy: Political control and the provision of public services. *Comparative Political Studies, 34*(6), 587-621. doi:10.1177/0010414001034006001

Li, Q., & Reuveny, R. (2006). Democracy and environmental degradation. *International Studies Quarterly, 50*(4), 935-956. doi:10.1111/j.1468-2478.2006.00432.x

Marshall, M. G., Jaggers, K., & Gurr, T. R. (2011). *Polity iv project: Political regime characteristics and transitions, 1800-2011*. Vienna, VA: Center for Systemic Peace.

Midlarsky, M. I. (1998). Democracy and the environment: An empirical assessment. *Journal of Peace Research, 35*(3), 341-361.

Moldan, B., Janoušková, S., & Hák, T. (2012). How to understand and measure environmental sustainability: Indicators and targets. *Ecological Indicators, 17*(0), 4-13.

Müller-Fürstenberger, G., & Wagner, M. (2007). Exploring the environmental Kuznets hypothesis: Theoretical and econometric problems. *Ecological Economics, 62*(3-4), 648-660. doi: http://dx.doi.org/10.1016/j.ecolecon.2006.08.005

Murdoch, J., Sandler, T., & Sargent, K. (1997). A tale of two collectives; sulphur and nitrogen oxides emissions reduction in europe. *Economica, 64*(254), 281-301.

Neumayer, E. (2002). Do democracies exhibit stronger international environmental commitment? A cross-country analysis. *Journal of Peace Research, 39*(2), 139-164. doi:10.1177/0022343302039002001

Neumayer, E., Gates, S., & Gleditsch, N. P. (2002). Environmental commitment, democracy and inequality: A background paper to the World Development Report 2003 (World Development Report background paper 27847). Washington, DC: World Bank.

Niemeijer, D. (2002). Developing indicators for environmental policy: Data-driven and theory-driven approaches examined by example. *Environmental Science & Policy, 5*(2), 91-103.

North, D. C. (1981). *Structure and change in economic history*. New York: Norton.

OECD (Organisation for Economic Co-operation and Development), & JRC (Joint Research Centre)/European Commission. (2008). *Handbook on constructing composite indicators. Methodology and user guide*. Paris: Authors.

Olson, M. (1993). Dictatorship, democracy, and development. *The American Political Science Review, 87*(3), 567-576.

Panayotou, T. (1993). *Empirical tests and policy analysis of environmental degradation at different stages of economic development* (Working Paper WP238). Geneva: International Labour Office (ILO).

Pellegrini, L., & Gerlagh, R. (2006). Corruption, democracy, and environmental policy: An empirical contribution to the debate. *The Journal of Environment & Development, 15*(3), 332-354. doi:10.1177/1070496506290960

Povitkina, M. (2015). *Democracy, bureaucratic capacity and environmental performance* (Working Paper Series 2015, 13). Göteborg: University of Gothenburg, The Quality of Government Institute (QOG).

PRS Group Inc. (2012). *International country risk guide.* Retrieved from http://www.prsgroup.com/ICRG_methodology.aspx

Saisana, M., & Saltelli, A. (2012). Appendix ii: Preliminary sensitivity analysis. In J. W. Emerson, A. Hsu, M. A. Levy, A. d. Sherbinin, V. Mara, D. C. Esty, & M. Jaiteh (Eds.), *2012 environmental performance index and pilot trend environmental performance index* (pp. 92-97). New Haven: Yale Center for Environmental Law and Policy.

Savoia, A., & Sen, K. (2015). Measurement, evolution, determinants, and consequences of state capacity: A review of recent research. *Journal of Economic Surveys, 29*(3), 441-458. doi:10.1111/joes.12065

Schaffer, M. E., & Stillman, S. (2010). *Xtoverid: Stata module to calculate tests of overidentifying restrictions after xtreg, xtivreg, xtivreg2 and xthtaylor: Software component provided by Boston College Department of Economics in its series Statistical Software Components with number S456779*. Retrieved from http://ideas.repec.org/c/boc/bocode/s456779.html

Scruggs, L. (2003). *Sustaining abundance. Environmental performance in industrial democracies*. Cambridge: Cambridge University Press.

Selden, T. M., & Song, D. (1994). Environmental quality and development: Is there a Kuznets Curve for air pollution emissions? *Journal of Environmental Economics and Management, 27*(2), 147-162.

Shafik, N. (1994). Economic development and environmental quality: An econometric analysis. *Oxford Economic Papers, 46*(Supplement 1), 757-773. doi:10.1093/oep/46.Supplement_1.757

Smith, R. J., Muir, R. D. J., Walpole, M. J., Balmford, A., & Leader-Williams, N. (2003). Governance and the loss of biodiversity. *Nature, 426*, 67-70 (06 November). Retrieved from http://www.nature.com/nature/journal/v426/n6962/full/nature02025.html

Soifer, H., & vom Hau, M. (2008). Unpacking the strength of the state: The utility of state infrastructural power. *Studies in Comparative International Development, 43*(3/4), 12.

Spilker, G. (2013). *Globalization, political institutions and the environment in developing countries*. New York: Routledge.

Steinmetz, K. (30 September 2014). California becomes first state to ban plastic bags. *TIME*. Retrieved from http://time.com/3449887/california-plastic-bag-ban/

Stepping, K. (2013). *Challenges for measuring the state of the environment in developing countries* (Discussion Paper 25). Bonn: German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE).

Stern, D. I. (2004). The rise and fall of the Environmental Kuznets Curve. *World Development, 32*(8), 1419-1439. doi: http://dx.doi.org/10.1016/j.worlddev.2004.03.004

Torras, M., & Boyce, J. K. (1998). Income, inequality, and pollution: A reassessment of the Environmental Kuznets Curve. *Ecological Economics, 25*(2), 147-160.

Ward, H., Cao, X., & Mukherjee, B. (2013). State capacity and the environmental investment gap in authoritarian states. *Comparative Political Studies, 47*(3), 309-343. doi:10.1177/0010414013509569

World Bank. (2014a). *World Development Indicators (WDI)*. Retrieved from http://data.worldbank.org/data-catalog/world-development-indicators

World Bank. (2014b). *Worldwide Governance Indicators (WGI)*. Washington, DC: Author.

Wurster, S. (2013). Comparing ecological sustainability in autocracies and democracies. *Contemporary Politics, 19*(1), 76-93.

# Appendix

| **Table A.1: List of countries in EPI 2012 sample** | |
|---|---|
| Countries | Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Cambodia, Cameroon, Canada, Chile, China, Colombia, Congo, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Côte d'Ivoire, Dem. Rep. Congo, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Macedonia, Malaysia, Malta, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, Netherlands Antilles, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russia, Saudi Arabia, Senegal, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Ukraine, United Arab Emirates, United Kingdom, United States of America, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe |
| Continents | Africa: 27, Asia: 29, Europe: 12, Americas: 21, Oceania: 0; |
| Income categories | low-income countries: 16, lower-middle-income countries: 32, upper-middle-income countries: 41 |
| Source: Authors | |

**Table A.2: Correlation matrix**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Political regime, Cheibub (1) | 1 | | | | | | | | | | | |
| Political regime, Cheibub recoded (2) | 0.6116* | 1 | | | | | | | | | | |
| Political regime, Polity IV (3) | 0.7645* | 0.6732* | 1 | | | | | | | | | |
| ln economic development (4) | 0.3250* | 0.0883* | 0.2562* | 1 | | | | | | | | |
| ln economic development squared (5) | 0.3194* | 0.0832* | 0.2525* | 0.9970* | 1 | | | | | | | |
| State capacity (Bureaucracy quality) (6) | 0.4509* | 0.3453* | 0.4224* | 0.7561* | 0.7637* | 1 | | | | | | |
| State capacity (Tax revenues) (7) | 0.2066* | 0.3160* | 0.3709* | 0.3433* | 0.3390* | 0.4885* | 1 | | | | | |
| Political stability (8) | 0.3767* | 0.2826* | 0.2725* | 0.6313* | 0.6341* | 0.6124* | 0.4163* | 1 | | | | |
| Economic pressure (9) | -0.1260* | -0.0536* | -0.1391* | -0.1043* | -0.1039* | -0.1549* | -0.1453* | -0.1105* | 1 | | | |
| Pressure by agricultural sector (10) | -0.2629* | -0.1291* | -0.2873* | -0.8395* | -0.8195* | -0.6200* | -0.4254* | -0.5172* | 0.1263* | 1 | | |
| Pressure by industrial sector (11) | -0.2197* | -0.1709* | -0.2080* | 0.2903* | 0.2745* | -0.0303 | 0.0101 | -0.04 | 0.1152* | -0.3534* | 1 | |
| Corruption (12) | -0.3702* | -0.2935* | -0.3630* | -0.5364* | -0.5537* | -0.6658* | -0.4205* | -0.6283* | 0.1338* | 0.3972* | 0.1090* | 1 |

Source: Authors

**Table A.3: Descriptive statistics of variables**

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Ecosystem vitality | 1,463 | 46.67 | 11.87 | 10.72 | 71.47 |
| Ecosystem vitality (3-year moving average) | 1,729 | 46.62 | 11.86 | 10.94 | 71.07 |
| Political regime (Cheibub) | 2,653 | 0.58 | 0.49 | 0 | 1 |
| Political regime (Cheibub recoded) | 2,441 | 0.79 | 0.41 | 0 | 1 |
| Political regime (Polity IV) | 2,700 | 2.36 | 0.76 | 1 | 3 |
| Economic development | 2,956 | 11,169 | 13,078 | 101 | 77,987 |
| ln economic development | 2,956 | 8.61 | 1.29 | 4.61 | 11.26 |
| ln economic development squared | 2,956 | 75.72 | 22.06 | 21.29 | 126.88 |
| State capacity (Bureaucracy quality) | 2,155 | 2.18 | 1.14 | 0 | 4 |
| State capacity (Tax revenues) | 1,595 | 16.78 | 7.54 | 0.12 | 61.02 |
| Political stability | 2,433 | -0.07 | 1.00 | -3.32 | 1.67 |
| Economic pressure | 3,089 | 4.18 | 5.74 | -41.30 | 106.28 |
| Pressure by agricultural sector | 2,732 | 15.74 | 14.58 | 0.03 | 96.58 |
| Pressure by industrial sector | 2,744 | 29.70 | 12.93 | 1.88 | 100 |
| Corruption | 1,634 | 3.13 | 1.28 | 0 | 6 |

Source: Authors

**Table A.4: Regression results (Political regime recoded)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dependent variable: Ecosystem vitality | | | | | | | | | |
| Political regime$_{t-1}$ | -0.94 | -0.05 | -1.49 | -0.95 | 11.55 | -2.25 | -1.52 | -1.00 | 139.31 | 34.72 |
| | (-2.59)** | (-0.11) | (-4.33)*** | (-2.38)** | (2.41)** | (-1.89)* | (-4.34)*** | (-2.62)** | (3.39)*** | (0.56) |
| ln economic development$_{t-1}$ | -16.50 | -16.43 | -19.22 | -21.65 | -21.09 | -21.45 | -42.90 | -14.86 | 14.39 | -10.82 |
| | (-2.07)** | (-1.62) | (-1.70)* | (-1.64) | (-1.90)* | (-1.63) | (-1.64) | (-0.74) | (1.00) | (-0.55) |
| ln economic development squared$_{t-1}$ | 0.95 | 0.86 | 1.14 | 1.17 | 1.23 | 1.18 | 2.53 | 0.84 | -0.91 | 0.46 |
| | (2.14)** | (1.55) | (1.81)* | (1.62) | (1.98)* | (1.64) | (1.69)* | (0.76) | (-1.15) | (0.41) |
| State capacity$_{t-1}$ | -0.28 | -0.14 | -0.42 | -0.06 | 6.05 | -0.15 | -38.14 | 5.03 | -0.39 | -0.05 |
| | (-0.41) | (-2.64)*** | (-0.47) | (-0.94) | (2.81)*** | (-1.95)* | (-0.93) | (1.58) | (-0.45) | (-0.77) |
| Political stability$_{t-1}$ | | | -0.08 | -0.10 | -0.08 | -0.13 | -0.05 | -0.11 | -0.13 | -0.21 |
| | | | (-0.22) | (-0.28) | (-0.25) | (-0.35) | (-0.15) | (-0.31) | (-0.37) | (-0.57) |
| Economic pressure$_{t-1}$ | | | -0.01 | -0.06 | -0.01 | -0.06 | -0.00 | -0.04 | -0.01 | -0.06 |
| | | | (-0.25) | (-1.28) | (-0.28) | (-1.32) | (-0.05) | (-1.06) | (-0.36) | (-1.28) |
| Pressure by agricultural sector$_{t-1}$ | | | -0.01 | -0.00 | -0.02 | 0.01 | -0.03 | -0.06 | -0.00 | 0.01 |
| | | | (-0.20) | (-0.01) | (-0.36) | (0.06) | (-0.42) | (-0.68) | (-0.03) | (0.10) |
| Pressure by industrial sector$_{t-1}$ | | | -0.06 | -0.05 | -0.05 | -0.05 | -0.06 | -0.06 | -0.05 | -0.05 |
| | | | (-1.38) | (-0.95) | (-1.28) | (-0.99) | (-1.50) | (-1.20) | (-1.37) | (-0.93) |
| Corruption$_{t-1}$ | | | 0.19 | 0.26 | 0.20 | 0.27 | 0.20 | 0.27 | 0.17 | 0.27 |
| | | | (1.02) | (1.12) | (1.05) | (1.14) | (1.02) | (1.13) | (0.91) | (1.17) |
| Political regime$_{t-1}$*State capacity$_{t-1}$ | | | | | -6.55 | 0.10 | | | | |
| | | | | | (-2.65)*** | (1.15) | | | | |
| ln economic development$_{t-1}$*State capacity$_{t-1}$ | | | | | | | 9.13 | -1.06 | | |
| | | | | | | | (0.96) | (-1.47) | | |
| ln economic development squared$_{t-1}$*State capacity$_{t-1}$ | | | | | | | -0.54 | 0.05 | | |
| | | | | | | | (-0.99) | (1.35) | | |
| Political regime$_{t-1}$*ln economic development$_{t-1}$ | | | | | | | | | -35.52 | -10.52 |
| | | | | | | | | | (-3.49)*** | (-0.68) |
| Political regime$_{t-1}$*ln economic development squared$_{t-1}$ | | | | | | | | | 2.22 | 0.75 |
| | | | | | | | | | (3.52)*** | (0.78) |
| Constant | 116.39 | 123.84 | 128.88 | 147.63 | 125.70 | 146.29 | 229.04 | 114.94 | -8.25 | 105.97 |
| | (3.21)*** | (2.66)*** | (2.49)** | (2.42)** | (2.66)*** | (2.40)** | (2.00)** | (1.26) | (-0.12) | (1.21) |
| Observations | 941 | 745 | 566 | 453 | 566 | 453 | 566 | 453 | 566 | 453 |
| Countries | 97 | 96 | 84 | 77 | 84 | 77 | 84 | 77 | 84 | 77 |
| F-statistic | 5.76 | 6.41 | 385.56 | 8.70 | . | 1347.64 | 78.66 | 9.76 | 72.25 | 5.31 |
| Adjusted $R^2$ | 0.31 | 0.34 | 0.32 | 0.34 | 0.32 | 0.34 | 0.32 | 0.35 | 0.33 | 0.35 |
| Effects | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed |
| State capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity |
| Interaction effect | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes |

Note: ***, **, * denote significance at 1, 5, and 10 percent, respectively. t-statistics are reported below the coefficient estimates. Standard errors clustered at country level. Year-specific time dummies to capture worldwide trends not reported. The adjusted R-square reports the proportion of within-unit variation explained, due to the use of fixed effects.

Source: Authors

**Table A.5: Regression results (Polity IV)**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dependent variable: Ecosystem vitality | | | | | | | | | |
| Anocracy$_{t-1}$ | 0.64 | 0.92 | 0.15 | -0.03 | -1.41 | -0.15 | 0.16 | -0.07 | 103.91 | 56.49 |
| | (0.76) | (1.19) | (0.17) | (-0.03) | (-0.57) | (-0.09) | (0.17) | (-0.07) | (1.67)* | (0.64) |
| Democracy$_{t-1}$ | 0.76 | 0.75 | 0.71 | 0.06 | 1.35 | -2.18 | 0.72 | 0.01 | 142.80 | 100.55 |
| | (0.79) | (0.98) | (0.72) | (0.06) | (0.48) | (-1.26) | (0.72) | (0.01) | (2.21)** | (1.26) |
| ln economic development$_{t-1}$ | -17.23 | -21.22 | -23.96 | -31.56 | -26.02 | -31.56 | -31.92 | -8.79 | 8.52 | -7.05 |
| | (-2.82)*** | (-3.15)*** | (-3.16)*** | (-3.37)*** | (-3.38)*** | (-3.44)*** | (-2.59)** | (-0.60) | (0.55) | (-0.31) |
| ln economic development squared$_{t-1}$ | 0.99 | 1.08 | 1.42 | 1.65 | 1.52 | 1.68 | 1.93 | 0.44 | -0.58 | 0.10 |
| | (3.03)*** | (2.79)*** | (3.35)*** | (3.08)*** | (3.55)*** | (3.20)*** | (2.54)** | (0.55) | (-0.64) | (0.07) |
| State capacity$_{t-1}$ | -0.60 | -0.09 | -0.45 | -0.08 | -0.41 | -0.22 | -9.93 | 8.54 | -0.48 | -0.07 |
| | (-1.03) | (-2.42)** | (-0.65) | (-1.30) | (-0.24) | (-1.45) | (-0.52) | (2.67)*** | (-0.69) | (-1.08) |
| Political stability$_{t-1}$ | | | -0.66 | -0.84 | -0.63 | -0.87 | -0.65 | -0.79 | -0.74 | -0.92 |
| | | | (-1.77)* | (-1.73)* | (-1.71)* | (-1.79)* | (-1.74)* | (-1.75)* | (-2.01)** | (-1.88)* |
| Economic pressure$_{t-1}$ | | | 0.03 | -0.01 | 0.04 | -0.02 | 0.03 | 0.00 | 0.03 | -0.02 |
| | | | (0.95) | (-0.24) | (1.08) | (-0.36) | (0.94) | (0.07) | (0.91) | (-0.41) |
| Pressure by agricultural sector$_{t-1}$ | | | -0.05 | -0.09 | -0.07 | -0.08 | -0.05 | -0.13 | -0.06 | -0.10 |
| | | | (-0.99) | (-1.03) | (-1.20) | (-0.99) | (-0.95) | (-1.98)* | (-1.20) | (-1.11) |
| Pressure by industrial sector$_{t-1}$ | | | -0.05 | -0.05 | -0.04 | -0.06 | -0.05 | -0.05 | -0.03 | -0.04 |
| | | | (-1.21) | (-0.85) | (-1.08) | (-0.99) | (-1.28) | (-1.00) | (-0.87) | (-0.77) |
| Corruption$_{t-1}$ | | | -0.04 | 0.01 | -0.03 | 0.04 | -0.05 | 0.04 | 0.01 | 0.06 |
| | | | (-0.24) | (0.04) | (-0.16) | (0.16) | (-0.27) | (0.17) | (0.05) | (0.28) |
| Anocracy$_{t-1}$*State capacity$_{t-1}$ | | | | | 0.93 | 0.02 | | | | |
| | | | | | (0.57) | (0.13) | | | | |
| Democracy$_{t-1}$*State capacity$_{t-1}$ | | | | | -0.37 | 0.18 | | | | |
| | | | | | (-0.22) | (1.06) | | | | |
| ln economic development$_{t-1}$*State capacity$_{t-1}$ | | | | | | | 2.75 | -1.86 | | |
| | | | | | | | (0.57) | (-2.59)** | | |
| ln economic development squared$_{t-1}$*State capacity$_{t-1}$ | | | | | | | -0.19 | 0.10 | | |
| | | | | | | | (-0.62) | (2.50)** | | |
| Anocracy$_{t-1}$*ln economic development$_{t-1}$ | | | | | | | | | -26.69 | -15.72 |
| | | | | | | | | | (-1.75)* | (-0.73) |
| Anocracy$_{t-1}$*ln economic development squared$_{t-1}$ | | | | | | | | | 1.70 | 1.06 |
| | | | | | | | | | (1.83)* | (0.83) |
| Democracy$_{t-1}$*ln economic development$_{t-1}$ | | | | | | | | | -36.25 | -27.08 |
| | | | | | | | | | (-2.30)** | (-1.37) |
| Democracy$_{t-1}$*ln economic development squared$_{t-1}$ | | | | | | | | | 2.29 | 1.79 |
| | | | | | | | | | (2.40)** | (1.48) |
| Constant | 119.98 | 147.89 | 148.73 | 198.88 | 158.74 | 197.75 | 179.40 | 93.73 | 16.91 | 101.31 |
| | (4.17)*** | (4.93)*** | (4.26)*** | (4.61)*** | (4.47)*** | (4.67)*** | (3.52)*** | (1.41) | (0.26) | (1.07) |
| Observations | 1,208 | 926 | 673 | 503 | 673 | 503 | 673 | 503 | 673 | 503 |
| Countries | 112 | 109 | 99 | 86 | 99 | 86 | 99 | 86 | 99 | 86 |
| F-statistic | 5.88 | 5.39 | 4.64 | 4.56 | 4.11 | 4.29 | 4.85 | 6.89 | 4.70 | 4.57 |
| Adjusted $R^2$ | 0.26 | 0.30 | 0.25 | 0.28 | 0.25 | 0.29 | 0.25 | 0.30 | 0.26 | 0.31 |
| Effects | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed | Fixed |
| State capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity | Bureaucratic capacity | Tax capacity |
| Interaction effect | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes |

Note: ***, **, * denote significance at 1, 5, and 10 percent, respectively. t-statistics are reported below the coefficient estimates. Standard errors clustered at country level. Year-specific time dummies to capture worldwide trends not reported. The adjusted R-square reports the proportion of within-unit variation explained, due to the use of fixed effects. Political regime: Polity IV, recoded as autocracy, anocracy and democracy; autocracy is the reference level.

Source: Authors

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