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DEMOCRACY AND ECONOMIC DEVELOPMENT

Investigating the effects on the marine environment

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ABSTRACT

Is democracy favorable or adverse for the environment? While some studies find democracy to increase the likelihood of achieving sustainable development, others propose that democracy rather has negative effects on the environment. This paper contributes explicitly to this debate, but also adds insights from research arguing that the effects of democracy are conditioned by surrounding institutions. More specifically, building on this literature, we argue that the way democracy works – whether it is an instrument for collective action beneficial to the environment or an instrument for patronage and clientelism – depends on levels of economic development. The overall objective of the article is to test this proposition empirically. Using the Marine Trophic Index as a proxy for overfishing, we investigate the impact of democracy on the health of the marine environment in a global sample from 1972 to 2006. The analysis provides interesting insights regarding the conditional role of economic development. We report negative effects of democracy in settings of low gross national income, while this pattern is reversed when economic development has reached a certain threshold. Finally, we discuss how democracy affects the prospects for sustainable development and based on our conclusions offer suggestions for future studies in this field of research.

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Introduction

In a growing body of literature, scholars debate the effect of democracy on environmental degradation. While some studies find democracy to increase the likelihood of, e.g., sustainable development, others claim that democracy has negative effects, alternatively only appears to have positive effects on the management of some specific resources (Scruggs, 2009; Li and Reuveny, 2006; Midlarsky, 1998; Arvin and Lew, 2011).

This article, however, argues that the debate over democracy's virtuous or vicious effects may be partly misinformed. More specifically, we assert that there are substantial reasons to believe that the effect of democracy on the environment is fundamentally conditioned by level of economic development. This proposition originates from the literature on modernization and democratic consolidation, where it is typically argued that in societies lacking economic development, the governance logic is quite different from that in more affluent countries (Leftwich, 1993; Collier, 2009; Kapstein and Converse, 2008; Keefer, 2007; Zakaria, 2003; Lipset, 1959). Accordingly, if not preceded or accompanied by institutions that generate economic development (such as rule of law and the protection of property rights), the instrumental mechanisms of democracy cannot be expected to automatically strengthen collective action, civil society, political culture, or other factors held to be indispensable to foster accountability, political participation, and, in the end, sustainable development. Without such complementary institutions there are serious concerns that democracy in many cases may be no more than an empty shell, in fact potentially opening up yet other arenas for exploitation, patronage, and clientelism (Collier, 2009, 2007; Keefer 2007; Walker 1999). This argument also highlights the importance of sequencing. While democracy in the well-developed parts of the world was commonly preceded by rule of law and constitutional liberalism, many of today's developing states are forced to complete the construction of the modern state project while at the same time competing in general elections (Zakaria, 2003; Collier, 2009; Diamond, 2008; Persson and Sjöstedt, 2010). Moreover, in low-income settings, democracy is often imposed from outside, implying that there might be severe legitimacy problems and little correspondence between formal and informal institutions, which in turn might imply that democracy does not have as positive effects in low-income settings as in more affluent societies (see Bratton, 2008; Helmke and Levitsky, 2006; Pritchett and Woolcock, 2004).

Taken together, there are substantial reasons to believe that the way democracy works – i.e., whether it is an instrument for collective action beneficial to the environment or an instrument

for patronage, clientelism, and redistribution to the ruler's closest allies – depends on level of economic development.

The aim of this paper is to investigate whether level of democracy affects the marine environment and, if so, whether this impact differs depending on national levels of economic development.

In order to test the relationship between democracy and the marine environment empirically, we use the Marine Trophic Index as a proxy for overfishing and available data measuring democracy as the independent variable. The empirical analysis is in many ways more ambitious than previous tests in the literature, with a sample of 148 countries and the health of their marine environment over the years 1972-2006. Hence, we have a larger sample size across both more countries and years than normally used in this literature. Our findings provide interesting insights regarding the conditional role of development, thus developing the claim recently made by Scruggs (2009), arguing that previous studies have not adequately taken into account the role of economic development. We report negative effects of democracy in settings of low gross national income and positive effects when economic development has reached a certain threshold. Moreover, we contribute by adding knowledge of *when* democracy can be expected to generate positive environmental outcomes.

The remaining article is organized as follows. In Section 2 we explore the theoretical origins of our argument and provide an overview of the debate over the relationship between democracy and the environment. Section 3 specifies the empirical model and spells out the methodological considerations. The statistical analysis then follows in Section 4 and, finally, Section 5 provides conclusions and implications.

Theoretical framework

The effect of democracy on the environment is heavily debated. While some scholars argue that democracy increases the likelihood of successful collective action and sustainable development, others hold that democratic systems tend to fall prey to the public's unwillingness to adopt environmentally sound policies. According to the latter perspective, democracy either needs to be exchanged for a more authoritarian political system with the capacity to reorient society away from unsustainable development paths (Ophuls, 1977; Heilbronner, 1974; also see Paehlke, 1995) or should be guided by more deliberative and participatory ideals (Dryzek, 1987, 1992; Folke et al., 2003; Nadasty, 2007). The scholars holding that democracy is beneficial for the environment instead tend to argue that democracy is an efficient coordination mechanism and that democratic

values and procedures, e.g., freedom of speech and freedom of information, increase the likelihood of sustainable development (Achterberg, 1993; Lafferty and Meadowcroft, 1995; Barrett and Graddy, 2000; Jagers 2007).

The arguments proposed in this debate are as contrasting as compelling. Li and Reuveny (2006) list five causal mechanisms for why democracy might *improve* environmental performance: 1) political rights and freedom will often lead to public awareness and environmental action, 2) systems with electoral accountability will be more responsive to the influence on policy from environmentalists, 3) due to the dominating principles of rule of law, aversion to war and respect for life, democracies tend to produce less environmental destruction than autocracies, 4) the elite in an autocratic society will be less pro-environmental than the public mass, and 5) relatively short time horizons of autocratic leaders will tend to promote overexploitation. Moreover, though, the same authors also list four mechanisms for why democracy may *worsen* environmental degradation: 1) the (unlimited) freedom in a democracy will lead to unchecked behavior by overharvesting individuals, 2) autocracies can impose strict regulations on population growth, 3) democracies are often market economies where corporate interests have more influence than environmentalists, and 4) in democracies leaders will enact election-winning policies and thus tend to promote policies supporting the employment of voters rather than the environment.

This debate has spurred numerous empirical investigations studying the relationship between the level of democracy and the quality of the environment. While some studies indicate a positive correlation between democracy and environmental quality (Neumayer, 2002; Li and Reuveny, 2006; Wurster, 2011; Jagers and Sjöstedt 2011), others find negative correlations or no relationship at all (Midlarsky, 1998). For example, Li and Reuveny's (2006) find that higher levels of democracy reduce CO_2 and NO_x emissions and lead to less water pollution, less land degradation, and lower deforestation rates. In a comprehensive overview of this growing literature, Scruggs (2009) finds 58 published studies that directly deal with the impact of democracy on measures of environmental performance. When performing an empirical test of these propositions, the author, interestingly, points to the role of economic development: "[Our results] raise doubts about the environmental efficacy of democracy. The limited evidence that we do find to support a positive democratic effect is accounted for more by economic change (specifically the collapse of the Eastern bloc), not political liberalization. Economic wealth and the speed of economic growth (or decline) have the most consistent impact on environmental performance" (Scruggs, 2009:2).

When it comes to the relationship between economic development and the environment, empirical findings are equally confused and conflicting. The well-known Environmental Kuznets

Curve, named after S. Kuznets' proposed inverted U-shaped pattern between income inequality and economic growth (Kuznets, 1955, 1965, 1966), has been the subject of substantial debate and scrutiny. Yet, research is still far from reaching consensus over its validity. An inverted U-shaped relationship between economic development and the environment was for example found in cross-country studies of air pollution, such as CO_2, NO_x, and SO_2, as well as of energy use, clean water, urban sanitation, nitrates, suspended particulate matter, waste, and deforestation (Shafik and Bandyopadhyay, 1992; Cole Rayner and Bates, 1997; Galeotti and Lanza, 1999; Panayotou Sachs and Peterson, 1999; Bhattarai and Hammig, 2000; Kallbekken, 2000; Ehrhardt-Martinez et al., 2002). At the same time, a number of studies have demonstrated an N-shaped pattern for the relationship between income and CO_2, NO_x, SO_2, and smoke (Grossman and Krueger, 1993, 1995; Selden and Song, 1994). Moreover, scholars have discovered a linear logarithmic pattern, implying that an increase in emissions is strongly correlated with income, but that further improvements in environmental quality does not necessarily depend on further economic growth (Bruyn, Bergh and Opschoor, 1998). Other scholars instead address the issue of reverse causality, assuming that it is environmental degradation that causes income to decrease (Stern et al., 1996), since economic activities depend on environmental resources and that their unsustainable use "reduce[s] the capacity of generating material production in the future" (Arrow et al., 1995).

Taken together, the effects of democracy on the environment, as well as the effects of economic development on the environment, or even the effects of democracy on economic development and vice versa, are obviously subjects of considerable controversy and disagreement. In an attempt to contribute to these research fields, we set out to perform a more fine-grained empirical analysis, including levels of economic development and democracy in a joint analysis. Taking a departure in the discussion on causal mechanisms by Li and Reuveny (2006), we argue that there are reasons to believe that these mechanisms function differently depending on surrounding institutions and especially levels of economic development. The five mechanisms of positive impact of democracy might be more functioning when economic development is high. Conversely, the four negative effects of democracy might very well be better functioning when economic development is low. In order to develop this argument, we *are theoretically informed by the well-established – yet in this context partly overlooked – literature on modernization and democratic consolidation. This literature holds that* low-income settings per definition lack institutions stimulating economic development, and that in the absence of such institutions democracy might be a less effective way to govern. In short, if not preceded by a constitution, rule of law or secure property rights generating economic development, democracy does not necessarily function as an instrument of collective action, but rather risks being used as an instrument of patronage and clientelism (Leftwich, 1993;

Zakaria, 2003; Keefer, 2007; Walker, 1999, Diamond 2008, 2007). Moreover, in low-income settings, democracy is often imposed from abroad, lacking legitimacy and correspondence between informal and formal institutions, which induces leaders to act for their short-term survival rather than engaging in the provisioning of long-term public goods such as protection of the environment. This in turn makes the legitimacy of the system decrease even more. In addition, without welfare improvements, citizens tend to distrust the democratic system and risk ending up engaging in patronage and clientelism themselves (Collier, 2009; Kapstein and Converse, 2008; Keefer 2007). In sum, this literature holds that *the workings of democracy differ significantly depending on levels of economic income, and* if democracy does not deliver, its positive effects as an instrument for collective action will hence be absent. We thus have reason to believe that the causal mechanisms discussed by Li and Reuveny (2006) are in fact conditioned by democratic consolidation, and more specifically, the institutional arrangements prevailing at different levels of economic development.

The case of marine resources

A focus on marine resources when investigating the effect of democracy during different stages of economic development is appropriate in many respects. For example, being a fungible natural resource, it accentuates many of the governance challenges associated with common pool resources (Ostrom, 1990). Fisheries are in fact often used as textbook illustrations of common pool resource problems and the importance of collective action mechanisms such as democracy or other governance arrangements. Yet, empirical studies on the effect of democracy on the marine environment are scant, and demonstrate conflicting results (Jagers and Sjöstedt, 2011). Similarly, the effect of economic development on marine resources is far from settled empirically. In a study on the relationship between income and marine resource exploitation in Turkey over time, Kamanlioglu (2011) finds an inverted N-shaped relationship between the deterioration of marine environmental quality and economic growth. However, the author points out that such a pattern is shaped by country-specific factors. Sabah (2011), on the other hand, finds an N-shaped relationship between economic development and coral reef bleaching. Clausen and York (2008a, 2008b) report, however, that the rise of per capita income leads to the decline of the marine trophic level, without further improvement of the indicator at higher income levels.

In the next section, we further specify how we proceed in testing the impact of democracy and economic development on the marine environment.

The investigation

The health of marine ecosystems is determined by various factors in a complex and interlinked system (UN-DESA 2008). More specifically, in order to operationalize this concept, we use a well-established indicator, the Marine Trophic Index (MTI). This measurement captures to what extent countries "fish down the food chain" within their exclusive economic zones. Pressure on fisheries from harvesting tends to affect fish at the top of the food chain as humans often target larger predatory fishes (Pauly 2005; Pauly and Watson, 2005; Pauly and Palomares, 2005). The MTI is calculated by assigning a number to each species according to its location in the food chain, where carnivores receive higher and herbivores receive lower numbers. The measure averages the trophic levels from the overall catch, based on a dataset of commercial fish landing compiled by the Food and Agricultural Organization of the United Nations (FAO). Lower values of the index mean that catches consist of smaller fish. A negative trend in this measurement is thus a proxy measure for overfishing and that "fisheries are not being sustainably managed" (Sea Around Us, 2011). Overfishing affects the marine ecosystem health as overexploited fish stocks lead to the loss of biodiversity and ecosystems stability. The index has been criticized for not adequately reflecting the true situation in marine ecosystems as it is built on the catches of commercial species, excluding the impact of unregistered fishing (Branch et al., 2010; Caddy et al., 1998). However, there exist few alternative measures of overfishing. The MTI is widely used by researchers and remains the most well-established measure for marine trophic stability across countries and time (Clausen and York, 2008a; Emerson et al., 2010; Pauly and Watson; 2005). The MTI is also considered to be "a measure for overall ecosystem health and stability" and was included as such in the 2010 Environmental Performance Index (Emerson et al., 2010).

In order to measure the main independent variable of the study, i.e., the degree of democracy in a country at a given point in time, we use one of the most established regime type indicators – the Freedom House/Polity index. This index reflects two important composites of regimes – political rights and civil liberties (Freedom House, 2010). Political rights measure whether elections in the country are free and fair, whether political rights are equal to all members of the society and the competitiveness of political participation. The civil liberties value includes an assessment of freedom of the press, of academic freedom, of freedom of public and private discussions, of freedom for NGOs' operations, of rule of law, of an independent judiciary and other relevant aspects (Lonardo, 2011). The average value of political rights and civil liberties in turn serves as an approx-

imation of the level of democracy in a country. In the present study we will use an imputed version of this index, designed especially for time-series analysis, covering a broader sample using imputed values for the cases where data was initially missing. The imputed version of the index is available for the period 1972-2009 and varies from 0 to 10, where 10 corresponds to the most democratic regimes (Teorell et al., 2011).

Following the reasoning of, for example, Li and Reuveny (2006), we include a measure of a country's openness to and engagement in world trade as a control variable. A country's openness to world trade is held to relate to environmental outcomes in several ways. For example, it has been argued that trade and globalization encourages establishment of higher environmental standards according to the demands from markets and also promotes technologies and innovations of a higher standard (Esty and Gentry, 1997; Vogel, 1995; Porter and Linde, 1995; Braithwaite and Drahos, 2000). However, others have argued in line with the hypotheses of the "race to the bottom," holding that countries fearing to lose competitiveness will dismantle environmental standards (Sheldon, 2006). In addition, Daly (1993) and Meadows et al. (1972) conclude that trade has negative effects on the environment, since it raises production levels and GDP, which in turn negatively affects the environment. Indeed, empirical investigations show both positive (Frankel and Rose, 2005; Antweiler et al., 2001) and negative (e.g., Managi, 2004) correlations between openness to trade and environmental quality and they also find different effects of trade openness on different pollutants between country groups (Managi et al., 2008). The indicator of openness to trade is taken from Penn World Trade (Heston, Summers and Aten, 2009), and measures total trade as a percentage of GDP in constant 2005 prices. The data covers the years 1950-2007. The variable required log-transformation to correct for its skewed distribution.

In addition, following Delgado et al. (2003), who discuss the impact from growing human populations on the pressure put on fisheries, we include a control variable for the size of a country's population. The data on population is taken from the World Bank database for the years 1971-2010, and is measured in numbers of inhabitants. The variable is logarithmically transformed due to its skewed distribution.

Of all the gears used in harvesting marine fish resources, bottom trawls and dredges are recognized as considered to be the most destructive ones (Watson et al., 2004, 2006). They cause chronic disturbances in coastal waters and lead to changes in trophic structures (Jennings et al., 2001). We therefore include a control for trawling intensity in our analysis. We use the Coastal Shelf Fishing Pressure Index, developed by the Environment Performance Index (2012). The index

measures intensity of gears operating in the coastal waters. The unit of measurement is metric tons of catch from trawling and dredging gears in a country for a given time divided by the area of its Exclusive Economic Zone (EEZ) in square km. The data is available for 1950-2006. Due to its skewed distribution, the variable is logarithmically transformed.

Following our theoretical argument of the impact of democracy on environmental performance at different stages of economic development, we want to control for national income levels at a given time. The measure we use is real GDP per capita in constant 2005 prices, chain series (Heston, Summers and Aten, 2009). Chain series remove effects from price changes and include only the values of production volumes, which is very useful for the time-series analysis (Teorell et al., 2011). The indicator is available from 1950 to 2007 and is log-transformed due to its skewed distribution.

In order to model different stages of economic development for countries, we divide nations at different points in time into groups according to their gross national income (GNI) per capita, following the World Bank methodology (World Bank, 2011). Low-income countries have a GNI below $1,005 per capita, lower middle-income countries have a GNI between $1,006 and $3,975 per capita, upper middle-income countries have a GNI between $3,976 and $12,275 per capita, and high-income countries have a GNI above $12,276 per capita (World Bank, 2011). GNI per capita is calculated with the World Bank Atlas Method, which allows for smoothing exchange rate fluctuations when comparing countries. This measure does not account for "welfare and success in development," but is recognized as "the best single indicator of economic capacity and progress" (World Bank, 2011).

Specification and methodology

In order to model the impact of our independent variables on changes in MTI across countries and years, we use time-series cross-sectional (TSCS) analysis. Since we are interested in changes of trophic levels and not the absolute levels as such, the dependent variable is here measured as the first difference of MTI instead of annual values.

We make sure to deal with problems inherent to TSCS data. The Hausman test confirms the existence of unobserved unit heterogeneity, indicating that country-specific effects are correlated with our independent variables. This implies that a random effects model will be inconsistent when applied to our data and confirms the necessity to use a fixed effects model for correct estima-

tion (Greene, 1997). A Dickey-Fuller test for a unit root in a time series sample shows that our data is stationary. Potential autocorrelation of the data is initially dealt with by using the first difference of MTI. The Wooldridge-Drukker test confirms that autocorrelation disappears after performing differencing of the dependent variable.

In order to make sure that independent variables are measured before the change in the dependent variable takes place, we use a one-year lag of all the independent variables in our models. We use one-year lags in combination with the first differencing of the dependent variable, as used by Bohrnstedt (1969, cited in Liker, 1985, p.87).

As mentioned, the raw data of openness to trade, population, GDP per capita and trawling intensity required logarithmic transformation before inclusion into the model due to skewed distribution. Based on the discussion above and after the necessary adjustments to our model, our final specification can be presented in the following equation:

$$\Delta MTI_{it} = \alpha_i + \beta_1 D_{i,t-1} + \beta_2 logO_{i,t-1} + \beta_3 logP_{i,t-1} + \beta_4 logG_{i,t-1} + \beta_5 logT_{i,t-1} + \varepsilon_{it};$$

where i corresponds to each country in the sample and t refers to the year. $\Delta MTI_{it} = MTI_{it} - MTI_{i,t-1}$ and corresponds to the change in the marine trophic index for a given country in a given year, α_i is an intercept term for i, β_j (j=1,2,3,4,5) denotes the coefficients to be estimated, D_{it} is a Freedom House/Polity index for democracy for a given country in a given year, O_{it} is openness to trade (country, year), P_{it} stands for population (country, year), G_{it} refers to real GDP per capita for a certain country in a given year, T_{it} is trawling intensity in the EEZ of each country per year, and ε_{it} is an error term for each unit of analysis.

The equation will be estimated using generalized least squares (GLS) with a fixed effect and robust standard errors per country and per year (Wooldridge, 2002). An alternative way to estimate the equation would be to use OLS regressions with panel-corrected standard errors as suggested by Beck and Katz (1995). However, taking into account the necessity to include fixed-effects estimation into our model and control for significant but unobservable unit-specific effects, we have to give preference to the GLS regression, since introducing fixed-effects specification into Beck and Katz's model in our case is problematic.

The MTI assigns values for each major marine coast or island colony of a nation. For this reason some problems arose in our analysis, since our independent variables are measured at the national level and are not available specifically for coastal regions or island colonies of a nation.

Hence, seven countries (the U.S., Turkey, Indonesia, Malaysia, Japan, Saudi Arabia, and Russia) have several MTI scores – one for each of their coastlines - while having only one national value of independent variables to correspond to them. This is also the case for sixty-seven island-colonies, where MTI values are available but there are no corresponding values of the independent variables. We therefore chose to exclude these cases from the analysis. In doing so, considerable variance in our dependent variable is lost, but we still consider our strategy of excluding cases a safer option than alternative approaches. An alternative strategy would have been to average the values of MTI for countries with several coastlines in order to obtain a single national score for the dependent variable to correspond with other variables. Another strategy would have been to impute data for independent variables to the regions or islands-colonies with no regional measures. However, both of these other strategies have obvious problems. The strategy of creating average values of MTI for coastal regions would distort the data. The strategy of imputing data for the coastal regions or colonies, might not correspond to reality and may thus produce misleading results.

The results presented in the next section follow the model described above. However, we also performed a number of alternative estimations. We tested several lag structures. Using different lags of the independent variables in time indicated that the one-year lag produced the most significant results. Since previous studies found a U-shaped relationship between GDP and environmental outcomes (e.g., Grossman and Kreuger, 1993, 1995) as well as between democratic development and environment (e.g., Buitenzorgy and Ancev, 2011), we also tried a similar model but with squared values of those variables included. However, the results were similar to those presented in the tables. Granger causality testing seems to confirm that no reversed causality exists between our dependent and independent variables.

Results and analysis

In this section we empirically explore the relationship between levels of democracy and annual changes in the marine trophic index during different stages of economic development. We first apply our equation to the whole sample to investigate the relationship between our variables of interest on the global scale and across time. In order to find out whether democracy exerts an influence on the changes in marine trophic levels during different stages of economic development, we then explore this relationship in different income groups.

Table 1 presents the results from our multivariate model on the global sample over all available years. The unit of analysis is country-year and the sample includes 142 marine coastal states over the years 1972-2006. The analysis shows that democracy is significantly and negatively correlated with changes in marine trophic levels. According to this pattern, less democratic countries tend to have less healthy marine ecosystems. However, when we proceed to divide countries based on their income, we can note some more detailed trends, not visible in the first analysis.

TABLE 1. THE INFLUENCE OF DEMOCRACY ON CHANGES IN MARINE TROPHIC LEVELS

DV: Differenced MTI	Model 1	Model 2	Model 3	Model 4	Model 5
Democracy	-0.00220**	-0.00226**	-0.00301***	-0.00298***	-0.00269**
	(0.000792)	(0.000774)	(0.000854)	(0.000845)	(0.000907)
Openness to trade		0.00218	0.000177	0.00111	-0.00334
		(0.00505)	(0.00480)	(0.00590)	(0.00715)
Population			0.0196*	0.0199*	0.0210*
			(0.00779)	(0.00789)	(0.00818)
GDP per capita				-0.00329	-0.00345
				(0.00741)	(0.00660)
Trawling intensity					0.00314
					(0.00290)
Constant	0.0122**	0.00338	-0.284*	-0.263*	-0.251*
	(0.00447)	(0.0213)	(0.123)	(0.122)	(0.125)
Observations	4,255	4,133	4,100	4,100	4,015
R-squared	0.001	0.001	0.002	0.002	0.003
Number of countries	142	138	137	137	137

*Robust standard errors in parentheses, *** p<0.001, ** p<0.01, * p<0.05. Groups are divided based on GNI per capita in 2010 constant US dollars. All the independent variables are lagged 1 year. Openness to trade, population, GDP per capita and trawling intensity are log-transformed.*

Table 2 reports our findings related to the impact of democracy on the changes in marine trophic levels throughout the countries' economic development. We aim at finding different thresholds of economic development where countries display different effects of democracy on the changes in MTI. We keep the classification from the World Bank of low-, lower middle-, upper middle-, and high-income countries, but also aim to show differences within these categories (World Bank, 2011). A full list of countries and years when they are included in each of the groups is available in Appendix 1.

TABLE 2. THE INFLUENCE OF DEMOCRACY ON CHANGES IN MARINE TROPHIC LEVELS THROUGHOUT THE COUNTRIES' ECONOMIC DEVELOPMENT PROCESSES

	Low-income countries	**Lower middle-income countries**		**Upper middle-income countries**	**High income-countries**	
DV: Differenced MTI	1	2	3	4	5	6
	GNI/c<$1005	$1005< GNI/c <$2000	$2000< GNI/c <$3975	$3975<GNI/c <$12275	$12275< GNI/c <$20000	GNI/c> $20000
Democracy	-0.00170	-0.0121***	-0.00293	0.00679	0.00422	0.0749**
	(0.00102)	(0.00360)	(0.00348)	(0.00540)	(0.0454)	(0.0212)
Openness to trade	-0.00543	0.0201	-0.0128	-0.00789	-0.0920	-0.00149
	(0.0137)	(0.0356)	(0.0286)	(0.0168)	(0.0943)	(0.0425)
Population	0.0164*	0.0376	-0.000622	-0.0333	0.0858	0.0415
	(0.00781)	(0.0433)	(0.0512)	(0.0526)	(0.0833)	(0.0390)
GDP per capita	-0.00717	-0.00995	0.0107	-0.0371	0.207	0.0855
	(0.00897)	(0.0656)	(0.0424)	(0.0352)	(0.112)	(0.0581)
Trawling intensity	-0.00396	0.00121	0.0234	0.0112	0.0107	0.0123
	(0.00491)	(0.00894)	(0.0210)	(0.0146)	(0.0274)	(0.00706)

Constant	-0.190	-0.502	0.0912	0.869	-3.023	-2.200
	(0.167)	(0.795)	(0.989)	(0.709)	(1.914)	(1.111)
Observations	1,299	543	563	600	219	253
R-squared	0.002	0.011	0.015	0.009	0.038	0.036
Number of ccode	82	70	68	59	29	24

*Robust standard errors in parentheses, *** p<0.001, ** p<0.01, * p<0.05. Groups are divided based on GNI per capita in 2010 constant US dollars. All the independent variables are lagged 1 year. Openness to trade, population, GDP per capita and trawling intensity are log-transformed.*

Column 1 presents the results for the countries in the lowest income group, classified by the World Bank as *low income countries*. The results in Column 1 show that the impact of democracy on our dependent variable is not significant in countries where the gross national income is below 1,005 USD per capita. In the lower middle-income group, the picture is a bit more complex. Looking at Column 2, the effect of democracy is negative and significant in the group of countries with a GNI between 1,006 and 2,000 USD per capita are included. Yet, another cluster of countries within the lower middle-income group, where GNI is between 2,000 and 3,975 USD per capita, display insignificant results, as shown in Column 3.

As presented in Column 4, democracy shows no significant effect on changes in the health of the marine environment in the *upper middle-income* countries. The results indicate that at these development stages a country's level of democracy does not seem to be a strong predictor of the subsequent change in the health of its marine environment. However, the results are contrastingly different when we proceed to analyze countries with higher levels of economic development.

Columns 5 and 6 report the results of our analysis for *high-income* countries with a GNI exceeding 12,275 USD per capita. It is evident from these results that democracy does not exert a significant effect on the marine environment in groups where the GNI per capita is between 12,276 and 20,000 USD. However, an interesting finding is that a positive and significant effect is visible among the countries with a GNI exceeding 20,000 USD per capita.

In sum, the empirical analysis shows negative effects of democracy in the poorer section of the lower middle-income countries, no significant effects in the upper middle-income countries, and positive effects in the richest of the high-income countries. In all, this lends some support to the theoretical argument made in this article, i.e., that the effect of democracy on the marine environment is conditioned by economic development and, more specifically, the institutions that are

often missing in low-income settings while they are relatively well established at higher development stages.

The sizes of the effects of our measure of democracy on the changes in MTI are, however, generally quite small, yet significant in certain groups of income. Thus, they should be interpreted with care. The explained variance is often low in a first difference model, a fact that is evident in the tables above.

Conclusions

With the point of departure in theories about democratic consolidation and sequencing, this article argues that the debate over democracy's virtuous or vicious effects on the environment may be partly misinformed. More specifically, we argue that there are substantial reasons to believe that the way democracy works – whether it is an instrument for collective action beneficial to the environment or an instrument for patronage, clientelism and redistribution to the ruler's closest allies – fundamentally depends on level of economic development. As such, we hypothesize that if not preceded or accompanied by institutions that generate economic development, democracy may in fact not be more than an empty shell, potentially even opening up yet other arenas for exploitation, patronage and clientelism.

These theoretical propositions partly gain support in our empirical investigations. When we analyze the effect of democracy on the changes in MTI in the entire sample of 142 countries across 34 years, we find a negative effect, indicating that democratic regimes tend to have a negative impact on the marine environment. However, we contribute by advancing the analysis to study the effect of democracy at different stages of economic development. The strongest and most straightforward result is that democracy has a significant negative effect on the health of marine ecosystems during early stages of economic development, but as we climb the income ladder the effect turns positive. That is, there are negative effects of democracy in settings of low gross national income and positive effects when the economic development has reached a certain threshold. Until a country becomes an upper middle-income country, democracy seems to have a negative effect on the health of the marine environment, but the effect then turns positive and is significant for the richest countries with a GNI per capita exceeding 20,000 USD.

Although these findings lend support to the theoretical claims about democracy's different effects, future studies ought to look closer into the *specific mechanisms* producing these outcomes. For

example, is it the institutions normally accompanying economic development – such as rule of law or property rights protection – that make democracy have different effects during different stages of economic development? Or, is it rather economic development *per se* that affects resource use and exploitation patterns in society? That is, while we have strong theoretical reasons to believe that democracy is more likely to work as an instrument for collective action in settings where other fundamental collective action problems involved in the process of state building and development have already been solved, the exact blending, pacing and sequencing of institutional reforms necessary to foster sustainable development and stewardship of natural resources remain to be explored.

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APPENDIXES.

Appendix 1: Cases classified on the basis of GNI per capita.

Low-income countries with GNI per capita below 1,005 USD

Albania 1986-999
Algeria 1972-1976
Angola 1987-2004
Bangladesh 1974-2006
Barbados 1972
Bosnia and Herzegovina 1996
Brazil 1972-1975
Solomon Islands 1992-1996, 2000-2006
Cambodia 1995-2006
Cameroon 1972-2006
Cape Verde 1988-1992
Sri Lanka 1972-2003
Chile 1975-1977
China 1972-2001
Colombia 1972-1979
Comoros 1983-2006
Congo 1972-2004
Congo, Democratic Republic 1972-2006
Costa Rica 1972- 1976, 1982
Benin 1972-2006
Dominica 1979-1980
Dominican Republic 1972-1980, 1986-1991
Ecuador 1972-1992
El Salvador 1972-1991
Equatorial Guinea 1987-1999
Eritrea 1994-2004
Fiji 1972-1975
Djibouti 1992-2005
Gabon 1972-1973
Georgia 1994-2003
Gambia 1972-2006
Ghana 1972-2006
Kiribati 1978-1992
Grenada 1979
Guatemala 1972-1991
Guinea 1986-2006
Guyana 1972-2004
Honduras 1972-2000
Kenya 1972-2006
Korea, South 1972-1977
Liberia 1972-2006
Madagascar 1972-2006
Malta 1972
Mauritania 1972-2006
Mauritius 1978
Mexico 1972 -1973
Morocco 1972-1990
Mozambique 1983-2006
Oman 1972-1974
Vanuatu 1981-1989
Nicaragua 1972-2006
Nigeria 1972-2006
Pakistan 1973-2006
Panama 1972-1975
Papua New Guinea 1975-2006
Peru 1972- 1990
Philippines 1972-1994
Guinea-Bissau 1974-2006
Timor-Leste 2006
St Vincent and the Grenadines 1979-1983
Sao Tome and Principe 2005-2006
Senegal 1980-2006
Seychelles 1976-1977
Sierra Leone 1972-2006
Vietnam 1989-2006
Somalia 1979-1990
South Africa 1973
Sudan 1972-2006
Suriname 1992
Syria 1972-2000
Thailand 1972-1987
Togo 1972-2006
Tonga 1983-1988
Trinidad and Tobago 1972
Tunisia 1972-1979
Ukraine 1995-2003

India 1972-2006
Iran 1972-1974
Cote d'Ivoire 1972-2006
Jamaica 1972-1986
Jordan 1977
Egypt 1972-1996
Tanzania 1990-2006
Uruguay 1972-1973
Samoa 1984-1994
Yemen 1992-2006

Appendix 1. Cont.

Low middle-income countries with GNI per capita between 1,005 and 2,000 USD per capita

Albania 2000-2003
Algeria 1977-2003
Angola 2005-2006
Antigua and Barbuda 1981
Argentina 1972-1978
Barbados 1973- 1977
Bosnia and Herzegovina 1997- 2002
Brazil 1976-1988
Belize 1981-1989
Solomon Islands 1997-1999
Bulgaria 1985-2002
Cape Verde 1993-2004
Sri Lanka 2004-2006
Chile 1972-1974, 1978-1989
China 2002- 2005
Colombia 1980-1994
Congo 1983-2006
Costa Rica 1977-1988
Dominican Republic 1981-1995
Ecuador 1979-2003
El Salvador 1992-1999
Equatorial Guinea 2000-2001
Fiji 1976-1992
Djibouti 2006
Gabon 1974
Georgia 2004-2006
Kiribati 1993-2006
Greece 1972
Grenada 1986- 1989
Guatemala 1980-2004
Guyana 2005- 2006
Honduras 2001-2006
Iran 1975-2003
Ireland 1972
Jamaica 1975- 1994
Jordan 1978- 2002
Korea, South 1978-1981
Lebanon 1990-1993
Latvia 1994
Lithuania 1994
Maldives 1997-1998
Malta 1973-1977
Mauritius 1979-1988
Mexico 1974-1988
Morocco 1991-2005
Oman 1975
Namibia 1989-2002
Vanuatu 1990-2006
Panama 1976-1989
Papua New Guinea 1993-1996
Peru 1981-2001
Philippines 1995-2006
Poland 1992
Portugal 1972-1976
Romania 1989-2002
St Kitts and Nevis 1981-1984
St Lucia 1983-1988
Seychelles 1978-1981
Singapore 1972-1974
South Africa 1974-1979
Spain 1972-1973
Suriname 1977-2002
Syria 1978-2006
Thailand 1988-2002
Tonga 1989-2005
Trinidad and Tobago 1973-1975
Tunisia 1980- 1995, 2002
Ukraine 1994, 2004-2006
Egypt 1997-2006
Uruguay 1974-1987
Venezuela 1972-1974
Samoa 1990-2004

Appendix 1. Cont.

Low middle-income countries with GNI per capita between 2,000 and 3,975 USD

Albania 2004-2006
Algeria 1981-2006
Argentina 1974-2004
Australia 1972
Bahamas 1973-1978
Barbados 1978-1983
Belgium 1972
Bosnia and Herzegovina 2003-2006
Brazil 1989-1995, 1999-2005
Belize 1990-2006
Bulgaria 1983-2006
Cape Verde 2005-2002
Croatia 1993-1995
Denmark 1972
Dominica 1994-2003
Dominican Republic 1996-2006
Ecuador 2004-2006
El Salvador 2000-2005
Equatorial Guinea 2002-2004
Estonia 1991-1999
Fiji 1993-2006
Finland 1972-1973
France 1972
Gabon 1975-2003
Greece 1973-1977
Grenada 1990-2002
Guatemala 2005-2006
Iceland 1972
Iran 1981-2006
Ireland 1973-1978
Israel 1972-1978
Italy 1972-1976
Jamaica 1995-2005
Jordan 1983-2006
Korea, South 1983-1988
Kuwait 1972-1973
Lebanon 1994-1997
Latvia 1995-2002
Lithuania 1995-2002
Maldives 1999-2006
Malta 1978-1986
Mauritius 1989-2002
Mexico 1980-1997
Morocco 2006
Oman 1976-1980
Namibia 1994-2006
Netherlands 1972
New Zealand 1972-1973
Norway 1972
Micronesia 1993-2006
Marshall Islands 1998-2006
Panama 1983-2003
Peru 1996-2006
Poland 1993-1996
Portugal 1977-1987
Romania 2003-2005
St Lucia 1989-2001
St Vincent and the Grenadines 1995-2005
Seychelles 1983-1988
Singapore 1975-1979
South Africa 1980-2004
Spain 1974-1978
Suriname 1979-2006
Thailand 1993-2006
Tonga 2006
Trinidad and Tobago 1976-1995
Tunisia 1996- 2006
United Kingdom 1972-1975
Uruguay 1980-1992
Venezuela 1975-2003
Samoa 2005-2006

Appendix 1. Cont.

Upper middle-income countries with GNI per capita between 3,975 and 12,275 USD

Antigua and Barbuda 1988-2006
Argentina 1992-2006
Australia 1973-1988
Bahamas 1979-1995
Bahrain 1983-2002
Barbados 1984-1999, 2002
Belgium 1973-1987
Brazil 1996-1999, 2006
Brunei 1989
Canada 1972-1983
Chile 1995-2006
Costa Rica 2003-2006
Croatia 1996-2006
Cyprus 1983-1994
Denmark 1973-1979, 1983-1985
Equatorial Guinea 2005-2006
Estonia 2000-2006
Finland 1974-1986
France 1973-1986
Gabon 1976-2006
Greece 1978-1981, 1983-1995
Grenada 2003-2006
Iceland 1973-1979, 1982, 1984-1985
Ireland 1979-1991
Israel 1979-1992
Italy 1977-1987
Jamaica 2006
Korea, South 1989-2002
Kuwait 1974-1975
Lebanon 1998-2006
Latvia 2003-2006
Libya 2002-2006
Lithuania 2003-2006
Malta 1987-2003
Mauritius 2003-2006
Mexico 1993-2006
Montenegro 2006
Oman 1981-2006
Netherlands 1973-1986
New Zealand 1974-1993
Norway 1973- 1979
Palau 1994-2006
Panama 2004-2006
Poland 1997-2006
Portugal 1988-2002
Romania 2006
St Kitts and Nevis 1995-2006
St Lucia 1999-2006
St Vincent and the Grenadines 2006
Seychelles 1989-2006
Singapore 1980-1990
Slovenia 1992-2002
South Africa 2005-2006
Spain 1979-1990
Sweden 1972-1978
Trinidad and Tobago 1980-2005
United Arab Emirates 1975
United Kingdom 1976-1987
Uruguay 1993-2006
Venezuela 1981-1983, 2000-2006

Appendix 1. Cont.

High-income countries with GNI per capita between 12,275 and 20,000 USD

Australia 1989-1995, 2001-2002
Bahamas 1996-2004
Bahrain 2003-2006
Belgium 1988-1991
Brunei 1990-2004
Canada 1984-1992
Cyprus 1995-2004
Denmark 1980-1988
Finland 1987-1988, 1993-1994
France 1987-1990
Germany 1990
Greece 1996-2004
Iceland 1980-1981, 1983, 1986-1987
Ireland 1992-1996
Israel 1993-2004
Italy 1988- 1991, 1994-1995, 2002
Korea, South 2003-2006
Kuwait 1976-2002
Malta 2004-2006
Netherlands 1987-1991
New Zealand 1994-2003
Norway 1980-1987
Portugal 2003-2006
Singapore 1991-1993
Slovenia 2003-2006
Spain 1991-2003
Sweden 1979-1987
Trinidad and Tobago 2006
United Arab Emirates 1976, 1978, 1982, 1985-1996, 1998-2000
United Kingdom 1988-1995

High-income countries with GNI per capita above 20,000 USD

Australia 1996-2000, 2003-2006
Bahamas 2005-2006
Belgium 1992-2006
Brunei 2005-2006
Canada 1993-2006
Cyprus 2005-2006
Denmark 1989-2006
Finland 1989-1992, 1995-2006
France 1991-2006
Germany 1991-2006
Greece 2005-2006
Iceland 1988-2006
Ireland 1997-2006
Israel 2005-2006
Italy 1992-2006
Kuwait 2003-2006
Netherlands 1992-2006
New Zealand 2004-2006
Norway 1988-2006
Singapore 1994-2006
Spain 2004-2006
Sweden 1988-2006
United Arab Emirates 1977, 1979-1981, 1983-1984, 1997, 2001-2004
United Kingdom 1996-2006