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Does Democracy Lead to a Better Environment? Deforestation and the Democratic Transition Peak

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Abstract The relationship between democracy and environment is subject to controversy. Some scientists find that democracy has a positive impact in reducing environmental disruption. Other scholars claim that democracy tends to accelerate environmental degradation. By using deforestation rates as a proxy for environmental disruption, we suggest that both sides might be right. Our quantitative analysis has three important outcomes. First, there is evidence of an inverted U-shaped relationship between deforestation and democracy. Second, countries in democratic transition experience the highest deforestation rates, compared to non-democracies and mature democracies. Third, in explaining deforestation rates democracy has larger explanatory power than income. This last result implies that in reducing deforestation rates the emphasis should not only be on economic development but even more on democratization.

Keywords Deforestation · Democracy · Economic development · Environmental degradation · Environmental kuznets curve · Political development

JEL Classification Q56 · Q23

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1 Introduction

The relationship between democracy and environmental protection has been subject to fierce, yet inconclusive, academic debates in among others political sciences, natural resource management studies and social geography. Controversies relate to two points. First, scholars disagree how important democracy is in explaining levels of environmental deterioration. Roberts and Parks (2007) conclude that democracy had almost no impact on national pollution levels of CO_2. Scruggs (1998) also finds an insignificant relation between democracy and three environmental indicators (dissolved oxygen demand, fecal coliform and particulates emissions), once controlled for income inequality. Others have discovered significant relationships between levels of democracy and environmental protection. Second, among the group that considers democracy to be an important variable in explaining environmental deterioration, there exists diverging evidence how democracy relates to environmental deterioration. Several scholars, such as Payne (1995), Barrett and Graddy (2000), Farzin and Bond (2006) and Torras and Boyce (1998), argue that democratization makes citizens better informed, better organized, and better enabled to protest, and thus makes states and political entrepreneurs more responsive to demands for environmental protection. Others have provided contrasting evidence, showing that democratization speeds levels of environmental degradation (Midlarsky 1998). Most scholars from both sides implicitly or explicitly model a linear relationship between level of democracy and environmental intrusions, whether it has a positive or negative correlation.

The field of deforestation has proven to be a scientific battleground for these positions. On one hand, Didia (1997), Li and Reuveny (2006) and Shandra (2007), among others, find that democracy has a positive impact in reducing deforestation. They argued that the democratization through the instrument of political and civil liberties are powerful in protecting the environmental resource-base. Policy makers in democratic countries whose citizens are concerned about environmental problems will be required to demonstrate stronger environmental commitment to address these concerns. On the other hand, Midlarsky (1998) and Martinez et al. (2002) find that political democracy speeds up rather than slows down the rate of deforestation. Midlarsky argued that, *first*, concerning budget constraints, democracies may not be responsive to environmental imperatives but to more pressing issues of the economic sustenance of major portions of the voting public. *Second*, corporations and environmental groups can fight each other to a standstill, leaving a decision-making vacuum. Furthermore, Neumayer (2002) said that it might be easier in autocracies than in democracies to constrain environmentally damaging economic activities as well as population growth.

It is most likely that income measures (or levels of GDP) are the intervening variables, and most studies control their models for income levels. How to explain these contrasting findings? Different interpretations and explanations have been given, among which the role of control variables (mainly GDP) or the poor quality of our indicators for democracy and/or environmental outcomes. But can it be that both positive and negative relations between democracy and deforestation are valid, but for different phases of a transition process from a totalitarian regime to full democracy? Deforestation rates would then peak at the transition process to democracy.

In investigating the relation between economic development and environmental deterioration, scholars have coped with similar contrasting evidence: some found a positive relation between economic development and environmental deterioration, others a negative one. One solution was to model the relationship not as a linear one, but as an inverted U-shaped, now better known under the concept of Environmental Kuznets Curve (EKC). Environmental deterioration rises in early stages of development, and reduces as the economy develops

beyond a certain point. Cropper and Griffiths (1994) were the first to test the EKC hypothesis for deforestation, by investigating 64 developing countries in Africa, Asia, and Latin America. They found statistically significant EKCs for Latin America and Africa, but insignificant for Asia. Panayotou (1993) found an EKC relationship for deforestation, sulfur dioxide, oxides of nitrogen, and suspended particulate matter. Bhattarai and Hammig (2001) reported EKCs for deforestation for a sample of 66 countries from Latin America, Asia, and Africa, using datasets from the World Resources Institute. Martinez et al. (2002), who examined 1980–1995 deforestation data for a sample of 74 less-developed countries in Africa, Asia, and Latin America, found a strong inverted-U EKC with a turning point at GDP per Capita US$ 1,150 in 1980 dollars. Could such a model also hold for the relationship between democracy and deforestation?

Most of these EKC studies on the relation between economic development and deforestation acknowledge the role of policies and institutions. Whether deforestation rates decline or not, and when and how it happens, also depends on government policies, civil society institutions, and the completeness and functioning of markets. But, to the best of our knowledge, there has been no empirical testing carried to compare the relative explanatory power of economic development and of democracy for deforestation rates. General conclusion in the literature remains that EKC is confined to the relationship between income and environmental degradation.

Using existing data sets on deforestation, economic development and democracy, this paper aims at investigating and modelling the relation between deforestation and democracy, and compared the explanatory power of democracy (political development) versus that of income (economic development). By doing so, we relax and broaden the interpretation of EKC by using political development indicator (democracy index) in addition to economic development (income level) in their relationships with environmental degradation (deforestation).

2 Democracy and Deforestation

Democracy is a heavily debated concept. With reference to nation states Dahl (1998) emphasizes the responsiveness of the government to the preferences of its citizens as a key characteristic of democracy. Historically democratic institutions have emerged in waves of democratization. A wave of democratization is characterized by national transitions from non-democratic to democratic regimes that occur within a specified period of time and that significantly outnumber country transitions in the opposite direction during that period of time (Huntington 1991). Beginning in 1974, we are still in the 'third wave' of democratic transition, characterized by the defeat of dictatorial or totalitarian rulers in South America, Eastern Europe and parts of Africa.

Democracy is not an easy variable to measure. There exist three widely used democracy indices for measuring levels of democracy of a country: the Polity index (developed by the Integrated Network for Societal Conflict Research of the University of Maryland; Marshall and Jaggers 2002), the Freedom House index (2000), and the Vanhanen Index (2005). Each index provides every year an annual democracy score for a country. Each of these indices is built upon a number of variables, but the kind of variables included and the scales of democracy used are different between the three indices (Munck and Verkuilen 2002). Thus, the indices vary in terms of how close they are to the minimum definition of democracy, which usually refers to four criteria: (a) the existence of regular, free, equal and general elections,

(b) real legislative representation, (c) separation of legislative, executive and judicial powers and (d) recognition of certain civil rights.

The three indices do share two features: (i) they are limited to a procedural understanding of democracy, and do not pay attention to more substantial interpretations of democracy, such as deliberative democracy (Elster 1998),[1] and (ii) they assume that democracy can and should be recorded in categories or even metrically, rather than dichotomously.[2] We have tested the relationships between democracy and deforestation for all three indices, and outcomes were largely similar. We will report here only on outcomes using the Polity index. We use average annual democracy values over the period 1990–2000.

3 Empirical Model

The data were collected for 177 countries. The dependent variable in this analysis is the *rate of deforestation*, based on the average annual rate of change in forest cover from 1990 to 2000. Forest cover change is the net change in total forest area, including natural forest areas and forest plantations. That means that deforestation can be compensated by reforestation. Data are obtained from the Food and Agricultural Organization (FAO 2001).[3]

Our main independent variable is the level of democracy. As we explained above, we chose the Polity index as the proxy of democracy level. The polity measure ranges from −10 (autocratic) to +10 (democratic). The annual values over the period 1990–2000 are averaged to assure a coherent framework when we use the dependent variable (the rate of deforestation) that refers to the same period. We expect that the relationship between democracy and the rate of deforestation takes the inverted U-shaped curve. An EKC relation is found if the sign on the linear term of democracy variable is positive, and that on democracy-squared is negative with both parameters being statistically significant.

A number of control variables have been used in our deforestation modeling exercises: education, income, rural population, land area and control of corruption (see Table 1). Education may infer better enforcement of laws and regulations, better public participation in the political process, and better environmental awareness (Bhattarai and Hammig 2001). We use *secondary school enrollment* as the proxy of education level in the regression model. We expect that deforestation to be inversely related to the education level; higher levels of education suggest that a country is more likely to protect their forests.

Rural population is measured as the proportion of rural population over total population. Meyer et al. (2003) noted that the level of rural population may contribute to deforestation through agriculture. Agrarian societies are typically characterized by relatively high levels of rural population. Agriculture, not forestry, is the primary contributor to employment in these societies. Thus, it can be expected that countries with highly populated rural areas, with high levels of agricultural output, tend to have higher rates of deforestation.

Land area (in hectares) is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. We expect that

[1] Ideas of deliberative democracy rely strongly on citizen *deliberation* to make sound policy. In contrast to conventional ideas of *democracy*, in which procedures and representation stand central, deliberative democracy advocates argue that legitimate laws and policies can arise only through public deliberation by the people.

[2] Those three democracy indices highly correlate with each other with coefficient of correlations ranging from 0.84 to 0.93.

[3] FAO regularly reports the world's deforestation data at 10 year intervals.

Table 1 List of independent and control variables included in modeling

Variable	Description	Year	Unit	Source
Democracy	Level of democracy, measured by Polity index (PI)	(Average of) 1990–2000	Index	World Development Indicators (The World Bank 2005)
Education	Percentage of eligible adult population enrolled in secondary schools	(Average of) 1990–2000	%	World Development Indicators (World Bank 2005)
Rural population	Proportion of rural population, 1995	1995	%	World Development Indicators (World Bank 2005)
Land area	Country's total area (transformed by logarithm transformation to correct skewness)		Ha	FAO (2001)
Control of corruption	Control of corruption index (−2.5–+2.5)	(Average of) 1990–2000	Index	World Development Indicators (World Bank 2005)
Income	Gross domestic product (GDP) per capita, based on purchasing power parity (PPP)	1995	000 US$	World Development Indicators (World Bank 2005)

deforestation and the land area are related positively, which means that bigger countries would experience higher rate of deforestation.

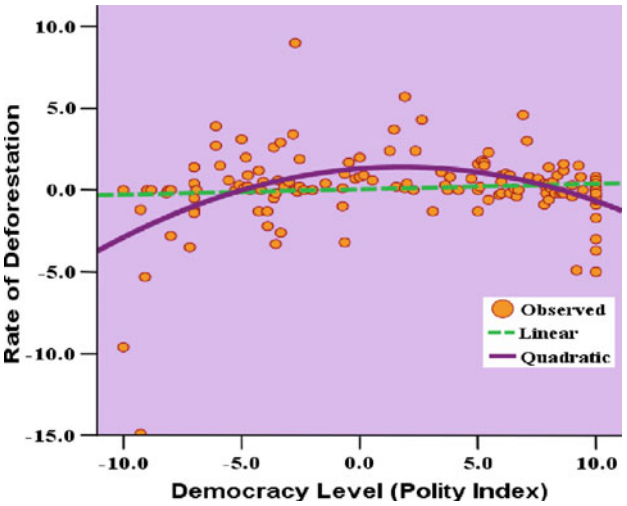
GDP per capita based on purchasing power parity (PPP) is chosen as income variable for this study. PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. The relationship between income and the deforestation rate is expected to reveal the existence of an inverted U-shaped-EKC. Data are in constant 1995 US dollars.

The World Bank Control of Corruption index measures perceptions of corruption, conventionally defined as the exercise of public power for private gain. The index takes a range from around −2.5 to 2.5. Higher or positive values indicate greater corruption control. We expect that deforestation and the corruption index are related negatively; a reduction in corruption would increase the stringency of environmental regulations.[4]

We do not include forest stock as control variable. Forest stock has a very high correlation with the dependent variable (deforestation rate). If we include forest stock as control variable in our models, then all of other independent variables (democracy, income, education, etc) become insignificant.[5]

[4] See Meyer et al. (2003), Fredriksson and Svensson (2003), Pellegrini and Gerlagh (2006) and Welsch (2004).

[5] Other scientists who work on this area encounter the same problem. Meyer et al. (2003) do not include forest area in their regression models of deforestation. Li and Reuveny (2006) even use forest area (as share of land area) as dependent variable, not as control variable. Shandra (2007)includes forest stock in his deforestation regression models, but then some important variables such as GDP, GDP square, Polity, Government Expenditures and Domestic Investment appears insignificant in the models.



	Linear	Quadratic
R-sq	0,90%	19,30%
df	155	154
F	1,43	18,34
p	0,23	0,00
b0	0,05	1,32
b1	0,03	0,11
b2		-0,03

Fig. 1 Scatter plot and curve estimation of deforestation rate against level of democracy

4 Empirical Result

Figure 1 that plots the level of democracy (using the Polity index) against annual deforestation rate visually indicates an EKC relationship. The curve estimation of democracy in Fig. 1 takes the form of an inverted-U-shaped. The R-square of the quadratic model is significantly higher than the R-square of the linear model, which outcome is similar when using the other two democracy indices. It also has the expected sign: positive for the linear term (b_1) and negative for the quadratic term (b_2).

OLS (ordinary least squares) regression results are reported in Table 2, using 7 models, with different control variables included.[6] Model 1 only includes the Polity democracy variable, both in linear and quadratic form, and thus equals the situation in Fig. 1. The turning point of this model is 1.78, which in polity index scale indicates a transition from autocratic to democratic polity, which confirms our EKC model for Democracy and deforestation.[7] Model 2–5 include various control variables in order to test the robustness of the inverted U-shaped relationship between democracy and deforestation. Model 6 and 7 exclude democracy as a variable, but include income and income square. These two models are designed to (i) investigate the effect of excluding democracy and (ii) compare the explanatory power of democracy and income in explaining deforestation rates. From these seven models, we have chosen Model 3 as the Best Model based on R-square and significance of the coefficients of the independent and control variables. Models with the highest R-square and the most significant variables are considered most appropriate.

[6] If we visually observe the scatter plot between democracy and deforestation (Fig. 1), Bahrain and Qatar seems to be outliers, because they have very high level of reforestation. To determine whether those visual outliers influence the regression results or not, we must apply a statistical formal test. Hat-value statistic is commonly used for this purpose. We will discuss about this later on.

[7] Polity index is ranging from −10 to 10. Add-operation transformation (e.g. to the new range 0–20) is not necessary since this type of transformation does not change the data variance. Regression analysis based on data variance. Any transformations that do not change the data variance will never change the regression results.

Table 2 Estimation results from OLS regression using Polity index for democracy

Independent variables	Model 1	Model 2	Model 3 (best)	Model 4	Model 5	Model 6	Model 7
	$N = 157$	$N = 126$	$N = 126$	$N = 119$	$N = 119$	$N = 130$	$N = 159$
Constant	1.316st	−1.982	−1.884	−0.316	−0.683	−2.342	1.611
	(0.000)***	(0.181)	(0.187)	(0.362)	(0.659)	(0.171)	(0.000)***
Democracy	0.111	0.171	0.169	0.164	0.162		
	0.318	*0.472*	*0.466*	*0.457*	*0.451*		
	(0.000)***	(0.000)***	(0.000)***	(0.000)*s**	(0.000)***		
Democracy-sq	−0.031	−0.011	−0.012	−0.014	−0.011		
	−0.483	*−0.162*	*−0.174*	*−0.220*	*−0.177*		
	(0.000)***	(0.130)	(0.068)*	(0.067)*	(0.160)		
Education		−0.028	−0.029	−0.034	−0.031	−0.010	
		−0.337	*−0.347*	*−0.433*	*−0.394*	*−0.117*	
		(0.003)***	(0.001)***	(0.001)***	(0.002)***	(0.384)	
Rural population		0.029	0.029	0.029	0.023	0.031	
		0.281	*0.282*	*0.301*	*0.239*	*0.304*	
		(0.008)**	(0.007)***	(0.008)***	(0.057)*	(0.024)**	
(Log) Land area		0.527	0.522	0.404	0.377	0.443	
		0.164	*0.163*	*0.134*	*0.125*	*0.154*	
		(0.021)**	(0.021)**	(0.076)*	(0.100)	(0.067)*	
Control of corruption		−0.071					
		−0.030					
		(0.792)					
Income (PPP)				0.040	−0.096	−0.118	−0.374
				0.141	*−0.342*	*−0.389*	*−1.230*
				(0.300)	(0.450)	(0.378)	(0.000)***
Income-sq					0.004	0.004	0.011
					0.397	*0.392*	*0.956*
					(0.264)	(0.293)	(0.001)***
F-statistic	18.338	15.496	18.727	13.020	11.367	7.269	15.254
p-value	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
R^2	19.3%	43.9%	43.8%	41.1%	41.8%	23.1%	16.4%
Adjusted R^2	18.2%	41.0%	41.5%	37.9%	38.1%	19.9%	15.3%

Values in the first, second and third rows of each independent variables are unstandardized coefficients (normal), standardized coefficients (italics) and p-values (in parentheses), respectively
*, **, *** denote levels of statistical significance at 10, 5 and 1% respectively

In Model 1 the adjusted R-square is 18.2%: democracy alone is able to explain more than 18% of the variation within deforestation rates. The addition of other explanatory and control variables in Model 2–5 significantly improves the model, reflected in higher adjusted R-squares: 38–42%. Furthermore, removing the Democracy variable (Model 6) reduces the explanatory value (reduction of adjusted R-square to 20%).

The results from these regression analyses also show that education level is an important factor explaining deforestation rate. This variable appears significant in all models. Larger percentage of rural population leads to higher deforestation rate. Log land area appears significant in models 2, 3, 4, and 6: bigger countries are associated with higher rate of deforestation. Control of corruption never performs significant, thus, starting from Model 3, we removed this variable from the remaining models.

5 Income or Democracy?

Income lost its significance if we put it as independent variable together with Democracy. Model 7 suggests that it is only when all other independent variables are removed from the model that Income and Income-square becomes statistically significant in explaining deforestation. The magnitude (as reflected by the standardized coefficient) of Democracy in Model 2–5 consistently appears as the largest one, compared to all other independent variables. Furthermore, the adjusted R-square of Model 1 (Pure Democracy) is higher than the adjusted R-square of Model 7 (Pure Income). It can be concluded that democracy is more powerful in explaining deforestation rates than income. Comparing the adjusted R-square from Model 5 (includes all variables) with the much lower one from Model 6 (which excludes the democracy variable) shows that excluding the democracy variable strongly reduces the explanatory power of the model. In other words, democracy is an important factor that should be taken into account to explain the rate of deforestation of countries.

Furthermore, income and income square are jointly significant in Model 7 with negative sign for the linear term and positive sign for the quadratic term suggesting that the relationship between deforestation rate and income is the form of U-shaped and *not* inverted U-shaped curve. Meyer et al. (2003) also found a U-shaped relationship between the rate of deforestation and PPP-weighted GDP per capita. Similarly, Li and Reuveny (2006) found a U-shaped relationship between forest area (as share of land area) and PPP-weighted GDP per capita.

It should be noted that democracy and income are significantly correlated, but not high (with correlation coefficient 0.486). This might point to the problem of multicollinearity with our regression model.

Hence, we tested the Model 3 and 4 for three potential problems: multicollinearity, the influence of cases that lie far outside the model, and homoscedasticity. The variance inflation factor (VIF) value for all significant variables of both models are <5, so multicollinearity is not likely to play a role. The maximum hat-values for both models are <0.2, thus outliers (countries with extreme deforestation rates) are not significantly influencing the results.[8] Finally, the homoscedasticity assumption for both models is satisfied, considering that 95% of the residuals fall between -2 and $+2$.

6 Democratic Transition as Deforestation Acceleration

We further substantiate our model of an inverted U-shaped relation between level of democracy and deforestation by showing that young or weak democracies have the worst rate of

[8] Hat-value is used to identify cases which influence the regression model more than others. The hat-value statistic varies from 0 (no influence on the model) to 1 (completely determines the model). Cases with hat-values under 0.2 are not a problem (Garson 2006). However, the evidence of EKC for Democracy is still robust even if we exclude outliers (Bahrain and Qatar) from our observations.

Table 3 Cluster analysis between level of democracy and deforestation

Clusters	N	Example states	Average polity	Average instability	Average deforestation rate
Traditional monarchies (TM)	9	Bahrein, Bhutan, Morocco, Saudi Arabia	−8.92	0.39	−4.14
Totalitarian regime/protectorate (TOT)	6	Cuba, North Korea, Vietnam, Bosnia-herzegovina	−6.63	0.83	−0.23
Authoritarian regime (AR)	37	Congo, Pakistan, Sudan, Peru	−4.70	2.69	0.56
Restricted democratic practice (RDP)	14	Mexico, Senegal, Yemen, Egypt	−2.49	2.88	0.66
Weak democracy (DEM-W)	54	Bangladesh, Benin, South Korea, Panama, Hungary	0.14	5.87	0.64
Strong democracy (DEM-S)	38	Costa Rica, India, Sweden, Venezuela	9.10	0.31	−0.19
Total	158				
ANOVA *F*-test			0.000***	0.000***	0.000***
Brown-Forsythe test			0.000***	0.000***	0.004***

*, **, *** denote levels of statistical significance at 10, 5 and 1%, respectively

deforestation. To test this, a two-step cluster analysis is used to distinguish mature and young democracy countries based on three attributes: (i) Freedom House's type of political practice, (ii) polity average 1980–2000,[9] and (iii) polity instability, represented by the standard deviation of polity average 1980–2000.[10]

The Freedom House classifies Political Practice in seven types: Democracy, Restricted Democracy, Monarchy, Authoritarian, Totalitarian, Colonial and Protectorate (Table 3). The Freedom House's Democracy Century Survey (1999) reported that close to 60% countries of the world have been democracies by the year 1999.

As the result of two-step cluster analysis, the category of Democracy Countries (the largest in number of countries) was further distinguished in mature/strong democracies and young/weak democracies. In contrast to strong democracies, weak democracies have a low Polity index and high instability. The 54 weak democratic countries are located in Eastern Europe and also include other former authoritarian and totalitarian countries that have become democracies within the last 10–25 years. In addition, the category of Colonialism is empty and the two Protectorates joined the cluster of Totalitarian regimes. Figure 2 (panel A) provides the results for this cluster analysis, showing an inverted U-shaped relation between democracy levels of these six clusters, and levels of deforestation. The ANOVA *F*-test and Brown-Forsythe test perform significant result ($p < 0.001$) for this cluster analysis (Table 3).

A second cluster analysis was performed, using 3 clusters. Three groups of countries were constructed: Non-democratic countries (consisting of most AR, TM, TOT and RDP countries and six DEM-W countries), Transitional countries (71% of all DEM-W countries, ten AR and six RDP countries) and Mature Democracies (79% are DEM-S countries and eight

[9] We expand the period of democracy variables (which is Level of Democracy and Instability) to the period of 1980–2000. It should be considered that the functioning of democratic institution will take some time more than only 10 years.

[10] Number (i) is categorical variable, while number (ii) and (iii) are continuous variable.

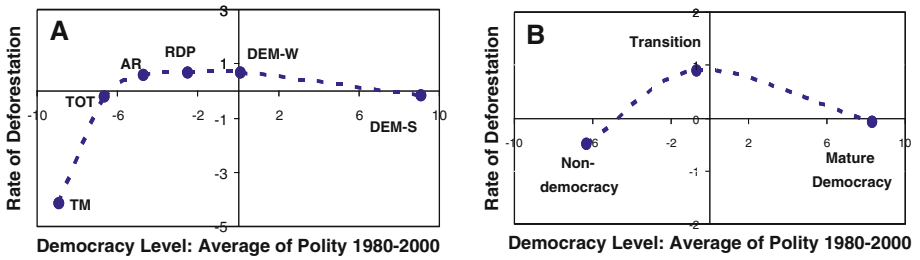


Fig. 2 Result of cluster analysis using 6 clusters (**a**) and 3 clusters (**b**)

DEM-W countries). Besides the democracy indicators, the rate of deforestation variable is also used for this clustering. Figure 2 (panel B) plots the average deforestation rate of each cluster and shows even clearer an inverted-U-shaped EKC. On average, deforestation rates are relatively low in Non-Democracies and Mature Democracies but high in the Transitional countries.

7 Conclusion

As a contribution to the current research on democracy and environment, this study posits three important findings. *First*, this study provides evidence of an EKC relationship between deforestation and democracy. The EKC relationship between deforestation and democracy suggests that in earlier stages of democracy, deforestation rates increase as countries move toward higher levels of democracy. However, after reaching a certain level of democracy, more democracy leads to a lower rate of deforestation. *Second*, this study provides empirical evidence suggesting that deforestation rates would be relatively low under autocracy or mature democracy, and deforestation rates are higher under semi-democracies or transitional countries: the democratic transition peak. Those two results imply that strengthening democratic institutions for transition countries and semi-democracies is favorable for forest protection and reforestation. *Third*, this study also suggests that democracy is more significant than income as a determinant of deforestation. This result implies that, for future research on underlying causes of deforestation, one should also consider political development rather than only focus to economic development to explain the dynamics of deforestation.

Why do countries in democratic transition experience the worst rate of deforestation, even worse than non-democratic countries? It seems that the specific situation of a weakening state with a still immature civil society comes together in states in democratic transition. Environmental regulations become unenforceable, while no counter-veiling power has been developed sufficiently strong to balance a weakened state (Andersen 2002; Weidner 2002). In non-democracies the state is often much stronger, while the civil society sector is much weaker developed. As argued by Neumayer (2002), the "strong" state can effectively function and easily control and constrain its "weak" citizens and companies from engaging in any environmentally damaging activities. At the other end, when countries in democratic transition move toward mature democracies, an active civil society develops countervailing power through transparency, the media, associations and NGOs, and accountability mechanisms.

This research provides evidence for the powerfulness of democracy (compared to income) in explaining deforestation. This balances too economic determinism explanations and shows that governance regimes matter. But the two are of course not independent, as we found in

our analysis. And many authors have investigated the relationship between democracy, and income and other economic parameters, with varying outcomes (cf. Acemoglu et al. 2008; Doucouliagos and Ulubaşoğlu 2008). Especially for environmental indicators and time series where an economic EKC falls together with a democracy EKC, our model will be strong. But from the literature we know that economic-environment EKCs are in numerous cases not found, or even a contrasting U shaped model is likely. Hence, it would be worthwhile to also test the democracy-environment EKC and the democratic transition peak model for more time intervals and more environmental indicators. Then we know how robust this democratic transition peak model really is.

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