

Democracy and Environmental Protection:
An Empirical Analysis

Lyle Scruggs
lyle.scruggs@uconn.edu
University of Connecticut

Introduction

During the 1990s environmental economists, sociologists, and political scientists, started to pay attention to the impact of fundamental political institutions on environmental performance. The first results indicated that democratic forms of government improved environmental quality (Congleton, 1992). Subsequent work, largely confirmed this view, but with some exceptions (Midlarsky 1998, Barrett and Graddy 2000). This work is part of a large and growing interest in the effects of political institutions on economic outcomes and human well-being.

Studies relating political regimes and environmental outcomes are subject to two broad criticisms.¹ First, they do an inadequate job of conceptualizing and measuring “environmental policy performance,” focusing on only one or two specific environmental problem—e.g., sulfur dioxide emissions, deforestation, lead content of gasoline.. Second, most of these studies contain some basic methodological flaws that impugn their empirical results.

This paper provides advances on both of these fronts. First, we provide a systematic evaluation of the studies addressing the relationship between democracy and

¹ Characterizations of the literature here stem from a comprehensive review of the empirical literature on the impact of democratic institutions on environmental performance through early 2008. In that review, we found 58 published studies that directly deal with the effect of democratic institutions on some type of environmental performance. The overwhelming majority of these are published in peer-reviewed journals (37), edited volumes (6), or working paper series (6).

national performance measures. We critically evaluate previous work, and use eight indicators that provide a broader indication of environmental performance than any single measure can. Second, we provide a corrective to existing empirical models by taking into account recent democratic *history*, not simply the contemporaneous democracy score, when evaluating national performance. Third, we evaluate the statistical robustness of previous findings and their substantive significance. Finally, we go beyond the current attention to the effect of regime on the levels pollution, and assess whether or not democracy actually delivers *improvements over time* in overall performance.

The results, to summarize, 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. These results do not show that democracy is bad for the environment, but they do suggest exercising caution in promoting democratization as a cure for environmental woes.

Democracy and environmental quality: the argument and evidence

When Grossman and Krueger (1995) established that the relationship between per capita income and environmental degradation was an inverted U (the so-called Environmental Kuznets Curve), they asserted that the link between income and environmental quality would not be automatic, but would operate via public policy responses that were ultimately induced by popular support for greater environmental quality. Since then, an

emerging literature on environmental economics and environmental politics has started to pay attention to the political factors of environmental performance.

Grossman and Krueger's argument is functionalist: rising demand for environmental protection generates its own supply. However, political economists have long noted collective action and market failure problems that characterize policies to limit environmental pollution. One is incomplete and imperfect markets in pollutants. A second is incomplete information about the causes and effects of the problems themselves. A third problem is that a socially efficient response requires the selection of a *public* policy that is decided by some collective choice mechanism. This last, in particular, is the entrée for investigation of the effects of different political regimes.

Why Democracy?

One reason for believing that democracy improves environmental performance is the assertion that democratic institutions facilitate the mobilization and expression of new demands. The free flow of information that characterizes democracy (*vis-à-vis* autocracy) is also argued to facilitate policy learning (Barret and Graddy, 2000, Midlarsky, 1998). Another reason that democracy is argued to improve environmental quality is that it provides more public goods than autocracy does (Congleton, 1992; Deacon, 1999). While governments of all types may provide public goods, governments tend to do so balancing the costs and benefits that are *politically* relevant. In democracies, the controlling group is the entire citizenry, and political balancing equates marginal cost and marginal benefit to the median citizen. Since most modern environmental problems *emerge* as a negative by-product of increased demands placed on the natural environment by human numbers

and affluence, democracy may be viewed in the whole as constituting an effective social feedback mechanism. Because control of resources is more concentrated in the autocracy, the elite group can be expected to bear a disproportionately large ratio of public goods costs to benefits. Thus, autocracies will, on average, support fewer environmental protection goods. Even if environmental protection benefits are normal or superior goods- in higher demand as income grows- an elite group is likely to enjoy only a small fraction of economy-wide benefits from increased provision (Deacon, 2003: 12).²

Yet another argument advanced for the superiority of democracy is that democratic decision-making incorporates a longer time horizon, and hence lower discount rates (Congleton, 1992: 417; Deacon, 1999:10-12). However, autocratic regimes are not necessarily less stable than democracies. And, it is not obvious that having to be responsive to demands of more people encourages short run sacrifice for long run sustainability. (The differential costs of losing power – e.g., summary execution versus quiet retirement—may favor more peaceful transitions of power in democracies.) Mass democracy as a means of governing human societies is pervasive now, but hardly so historically.

Empirically, a number of papers over the last two decades report an empirical association between democracy and better environmental indicators of atmospheric and water pollution (Congleton, 1992; Murdoch et al., 1997; Torras and Boyce, 1998; Barret and Graddy 2000; Carlsson and Ludstrom, 2003; Li and Reuveny, 2006); conservation

² This formal relationship is not really iron-clad. If, for example, environmental protection is a normal good, an autocracy would provide a socially *excessive* amount of environmental protection. Moreover, the claim that autocratic elites would just adopt private provision of environmental protection also does not follow. Any level of protection still has public good characteristics. Without the autocratic government as a coordinating mechanism, voluntary provision might be suboptimal for the elite compared with public provision.

(Neumayer, 2002, Gates et al., 2003); deforestation (Ehrhardt-Martinez, 2002; Li and Reuveny, 2006); soil degradation (Li and Reuveny, 2006); and participation on environmental international agreements (Congleton, 1992; Neumayer, 2002; Gates, et al., 2003).

In this paper, we understand performance as measured outcomes on a number of common environmental problems. This understanding of environmental performance refers to the results of human responses to human-induced environmental pollution problems (Scruggs, 1999: 11). It does not refer to commitments as such. An example of environmental outcomes versus symbolic commitment would be the actual levels (or the reduction) of carbon dioxide emission in a given country in contrast with the signature of the Kyoto protocol (Buttel 2000; Fisher and Freudenberg 2004: 161). We use the terms environmental performance and environmental outcomes in the paper as interchangeable terms since both denote the same orientation toward actual and measurable environmental quality.

A critique of existing studies

The literature on political determinants of environmental performance contains two shortcomings. First, since 1990, more than thirty studies that we located have used different environmental indicators to assess whether political factors contribute to better environmental performance. These indicators include: *carbon monoxide* (Neumayer, 2003); *smoke* (Torras and Boyce, 1998; Barret and Graddy, 2000; Binder and Neumayer, 2005); *heavy particles* (Torras and Boyce, 1998; Barret and Graddy, 2000; Binder and Neumayer, 2005; Esty and Porter, 2005); *Chlorofluorocarbon (CFCs)* (Congleton, 1992;

Murdoch and Sandler, 1997; Murdoch et al., 1997); *sulfur dioxide* (Murdoch and Sandler, 1997; Murdoch et al., 1997; Torras and Boyce, 1998; Barret and Graddy, 2000; Neumayer, 2003; Binder and Neumayer, 2005; Esty and Porter 2005); *greenhouse gas (GHG) emissions* (Murdoch and Sandler, 1997; Midlarsky, 1998; Congleton, 1992; Carlsson and Lundstrom, 2003; Neumayer, 2003; Jorgenson, 2006; Li and Reuveny, 2006); *biological and chemical oxygen concentration in water* (Barret and Graddy, 2000; Li and Reuveny, 2006); *fecal concentration in water* (Torras and Boyce, 1998; Barret and Graddy, 2000); *lead content of gasoline* (Decon, 1999; Fredrikson et al., 2005); *deforestation* (Midlarsky, 1998; Ehrhardt-Martinez et al., 2002; Li and Reuveny, 2006; Shandra, 2007); *soil erosion* (Midlarsky, 1998); and *land protected from development* (Midlarsky, 1998; Neumayer, 2002; Gates, *et al.*, 2003).

More recently, we have seen the development of multi-dimensional indicators of environmental protection. The *Environmental Sustainability Index* (ESI) relies on more than 20 “elements of environmental sustainability” (e.g., Esty and Porter, 2005; Li and Reuveny, 2006; Fredicksson and Wollscheid, 2007), while the *Ecological Footprint Index* (EF) (e.g., York et al., 2003) relies on bio-physical measures of sustainability (Wackernagel et al., 1999).

A pervasive problem in comparing regime performance internationally is the “information gap” (Srebotnjak, 2007: 409). The amount of environmental data available is much greater in developed countries. Perhaps for this reason, most of the previous articles using larger samples rely on only one or two indicators of environmental

performance³. Two exceptions are Midlarsky (1998) and Li and Reuveny's (2006). Both of these studies use larger samples and a group of environmental indicators representing different aspects of environmental quality. Midlarsky (1998) finds no evidence of democracies improving soil erosion by chemicals, and freshwater availability, and even negative effects of democracies over CO₂, deforestation, and soil erosion by water. The study only finds a positive effect of democracy on protected land. Li and Reuveny (2006), in turn, find a positive effect of democracies in reducing CO₂, Nitrogen oxides and the level of organic pollution in water, and also a positive effect of democratic regimes in reducing rates of deforestation and reducing the share of degraded land. They also find a positive effect of democracy over the percentage of forested area.

Both these studies mirror the broader literature in analyzing democratic performance on pollutants individually. That is, they regress democracy on each individual pollutant, and infer from several positive partial correlations that democracies have good environmental performance vis-à-vis non-democracies. An important limitation of this approach is that it does not establish that democracies *are any better* on *multiple* dimensions of environmental quality at the same time. If progress on multiple single dimensions does not translate into performance on multiple dimensions, this would imply that democracies simply had higher variance in performance.⁴

Here we evaluate whether democratic regimes are associated with *change* on eight indicators of environmental performance between 1990 and 2000. The eight

³ We are omitting a couple of studies that use larger samples but address international environmental *commitments* and not indicators of environmental performance as dependent variable such as Neumayer (2002), Gates, et al. (2003), and Roberts (2004).

⁴ Such a pattern would arguably be *worse* for long-run sustainability, because bio-physical systems cannot be assumed to have unconstrained substitutability among its constituent factors (economic theory conventionally assumes infinite substitutability among inputs). That a country has very low deforestation rates and very high water pollution may be more at risk of ecological breakdowns than a country with moderate rates of both.

indicators selected are: Carbon Monoxide (CO), Biochemical Oxygen Demand (BOD), Sulfur Dioxide (SO₂), Nitrogen Oxides (NO), Carbon Dioxide (CO₂), Methane (CH₄), Protected Areas, and Forest Area.⁵ We selected these indicators based on data availability, and because they seem to be representative of three different aspects of environmental quality: land, water, and air.⁶ CO and BOD are representatives of environmental issues localized in which public health of human communities are at stake. CO₂ and methane emissions represent two greenhouse gasses that impact the global commons. Protected areas and forest areas are two representative indicators of land conservation. Though they do reflect a diverse set of environmental conditions and represent an improvement on the literature to date, they are not an exhaustive list. This fact ultimately limits our inferences about whether good performance on all of these truly constitutes sustainability.

1. National/Local Pollution Democracies are supposed to be attentive to local demand. As such, democracy should contribute to better environmental performance in specific cases what a) public concerns are high, and b) pollution directly affects the population. Unfortunately, the literature does not offer conclusive evidence in this regard. Barret and Graddy (2000) found that political freedom improves air and water quality in countries. Torras and Boyce (1998) found that democracy in low-income countries only had a positive effect on a few pollutants—smoke, heavy particles, and dissolved oxygen-- and found weaker effects of democracy if the sample was restricted to

⁵ Data on pollutants were downloaded from the World resources Institute's Earthtrends database (WRI 2008).

⁶ For example, Murdoch and Sandler (1997: 297) showed that environmental pollutants may face different strategic behavior. European countries had different environmental performance in reducing sulfur and nitrogen oxides during the 1980s due mostly to the different character of collective problem associated to each pollutant.

rich countries. In the same vein, Binder and Neumayer (2005), in a sample of about 17 countries found weak evidence that democracy was associated with lower pollution in such areas as sulfur dioxide, smoke and heavy particles.

Li and Reuveny (2006), using emissions data for over 100 countries, found that levels of conventional types of air and water pollution were sensitive to how democracy was measured. While the levels of NO and BOD become less threatening for human health when democratic institutions were measured by a continue scale, they were not correlated when democracy was measured as a dichotomous variable. This particular result raises the question of whether full-fledged democracy, is necessary for pollution control, or whether a limited amount of liberalization is sufficient to promote environmental goals.

2. Global Hazards A second class of environmental problems are those that are not public goods confined to the national level, but are global in nature. Climate change or ozone depletion are good example. With these types of problems, no national polity bears a large share of both the costs and benefits of the hazard. Moreover, these problems are intergenerational. Neumayer (2002: 144) suggests that these types of pollution problems can be easily externalized to future populations and other countries. Esty and Porter (2005: 407) go so far as to say that when harms have a significant transboundary dimensions they constitute “super externalities.”

While these accounts suggest that global commons problems might be hard for everyone to regulate, it is important to note that such problems generate attention even if it is “irrational” for states to regulate them unilaterally. The tragedy of the commons implies that individual voters in a democracy stand in the same relation to national

pollution problems (mere externalities in Esty and Porter's language) as national-states do to super externalities; it is not strictly rational for people to vote to regulate them.⁷

As with more localized problems, the existing evidence for benign effects of democracy on international environmental problems is mixed. Midlarsky (1998) and Carlsson and Lundström (2003) found that democracies do not have a positive effect on emissions of carbon dioxide. However, Li and Reuveny (2006) do find such an effect. Regarding other greenhouse gasses, such as methane, Congleton (1992) showed that democracies have lower levels of methane emissions, but Jorgenson (2006) did not find any association.

3. Nature Conservation The value that societies give to protecting the environment is not only based on concern about direct effects on human health, but also on a broader appreciation of aesthetic/spiritual or "option" value. A third class of environmental problem is conservation. Examples of this type of environmental policy are those targeting the loss of species biodiversity and habitat. Cross-national surveys show that individuals do express a positive value for environmental conservation (Inglehart 1995, Bloom 1995, Israel 2004, Inglehart and Wewelzer 2005). Insofar as democracies are more sensitive to the global discourse about environmental protection values (since ideas flow more freely in these regimes), democracies would have a stronger commitment to long-term environmental conservation. This would lead us to predict that democracies will tend to produce more nature conservation.

In the case of deforestation rates, a common measure of conservation policy, cross-national studies are (once again) inconclusive. Neumayer (2002), using a large

⁷ This begs the question of why we should expect any person or government to support and enforce limits to environmental pollution that are not in individual self-interests. Of course, this is a question one could ask of most public policies that provide public goods.

sample of more than 150 countries, found that democracy was correlated with land area under protected status. Midlasky (1998) found that democracies had poorer environmental performance in this regard. Ehrhardt-Martinez (2002) showed that democracies do improve forestation, but only when they have strong state capacity. Shandra (2007) did not find any correlation between democracy and rates of deforestation, although he did find that a greater presence of international NGOs in a country is associated with less deforestation in a sampling of developing countries.

Preliminary results: unconditional effects of political freedom on environmental performance

As noted in the introduction, an important limitation of existing empirical work on the effects of democracy on environmental quality is that it fails to address the question of whether democracies really are (or have been) any more effective at addressing environmental problems *over time*. Existing evidence is based on empirical models estimating the *level* of pollution based on deviations from a conditional mean. Li and Reuveny (2006), for example, present estimated effects of democracy which suggested that the level of CO₂ emissions per capita are noticeably lower in democracies. Yet mean emissions per capita are in reality twice as high in democracies (7.5 versus 3.5 in 2000), *and the difference has grown larger over time*. (They were 6.0 versus 4.8 in 1990.)

Taking conditional effects the way that multiple regression does may lead scholars to overlook what is of interest to policy makers, e.g., can we expect that having more democracies in the world will really lead to reduced pollution. Many reported

estimates turn out to be very sensitive to the precise specification of control variables, rendering them suspect, and practically useless.

A good example of how the use of conditioning control variables can make a mockery of progress is official US climate change policy under the Bush administration. The stated policy was to reduce greenhouse gas emission *intensity* (i.e., emissions *per unit of GDP*) by 18% between 2002 and 2012. By that standard, the US has been quite successful over the years. Of course, judging our emissions relative to the size of our economy is highly misleading. The temperature of the planet is not affected by the size of our economy, but by the size of our greenhouse gas emissions. Achieving lower GHG intensity only requires that economic growth rises *faster* than emissions rise. Almost infinite emissions are acceptable under this standard as long as GDP reaches infinity first.⁸ Even more shocking is that the stated US target for intensity reductions in the future is *lower than historic trends*.

Furthermore, many of the predictions from existing results contain extrapolations from “thinly populated” areas of the parameter space. There are not many poor stable democracies or rich, stable autocracies, nor is there much historical depth in our time series of pollution around the world. It is also undeniable that large increases in pollution have occurred within the last century, occurred among the now rich democracies as they were becoming rich (and often while they were democratic), and have occurred with technologies that were not available fifty or one hundred years ago.

These facts make it more pressing to ask not whether democracies have higher or lower levels of pollution now (or in the recent past) or whether current democracies

⁸ Technically, one can make the same argument about our study since we are looking at emissions per person. However, unlike GDP, people do expect and advocate that human population stop growing in the near future. Virtually no policymakers suggest that we stop growing the economy.

increase their emissions more slowly than non-democracies, but whether or not existing democracies are more likely to reduce emissions over time.

Do democracies exhibit better environmental performance?

Levels of environmental performance A first cut at the question of whether democracies enjoy better environmental performance is to ask whether democracy and environmental pollution measured at some time t are correlated. This is the typical approach in the existing literature,⁹ But it is a poor one. (As we suggest later, specifying models this way unfairly biases results in favor of finding a democratic effect.) Democracy works to bolster environmental protection is via free dissemination of new interests, mobilization of voters (or leaders), etc. All of this culminates in better environmental conditions. This means that the causal mechanisms by which democracy works will have considerable lags. The upshot of this point is that if we see a country become a democracy and simultaneously cut its pollution emissions dramatically, there is something besides democracy at work.

To more correctly infer evidence of a democracy effect, we suggest that comparing national pollution levels at time t with recent democratic *history*, say over the proceeding 10 years. This specification is still somewhat crude—we ultimately might

⁹ See, for example, Congleton 1992 and Fredriksson, et al 2005. Some works using cross-sectional time series (e.g, Li and Reuveny 2006, Bernauer and Koubi 2004) specify the effect of democracy as simultaneous or with a very short lag structure of a year. Barret and Graddy (2000) defend a four-year moving average “to reflect the expected lag between changes in freedoms and changes in environmental quality.” Such a short lag misspecifies democracy’s theoretical effect on environmental policy processes in countries we are familiar with.

want to argue that a disruption in any regime might produce a rupture in the regulatory regime leading spike in pollution- but we think it is a step in the right direction.

The first column in Table 1 provides the bi-variate correlation between seven of our eight environmental performance measures in 2000 against each country's average Freedom House and the Polity scores between 1972 and 2000. (Forested area is excluded because data was not available.) Differences between Freedom House and Polity results are very small. Since lower Freedom House scores indicate greater political freedom, a positive correlation coefficient suggests that democracies have better pollution performance, except for the variable Protected Area, where a positive correlation indicates better democratic performance.

The second part of Table 1 shows mean pollution values for democracies and non-democracies, respectively. We scored democracy 1 when the country's average Freedom House score in the 1972-2000 period is 6 or less.¹⁰ A list democracies and non-democracies is in Appendix 1. Using the Polity scores would make little difference in our results, because there are only a few cases that are not classified as (non) democracies on both scales.

¹⁰ Though the level of democracy necessary to be proclaimed free by the Freedom House is 4 in each given year, using a score of four to define a democracy is more indicative of a country being a "continuous" democracy in the period rather than "average" democracy. (One could use some number of years as a "free country" as an alternative criteria.)

Table 1: Unconditional Effects for Environmental Performance Levels

	Correlation w.		Democracies Only			Non-Democracies			p-value for difference of means
	Avg FHScore '72-'00	obs	mean	variance	obs	mean	variance	obs	
CO per capita (2000)	.03	167	.27	.46	69	.32	.54	106	.55
NOs per capita (2000)	-.18	167	.04	.03	69	.03	.05	106	.16
SO ₂ per capita (2000)	-.14	167	.04	.04	69	.03	.05	106	.01
CO ₂ per capita (2000)	-.25	164	6.3	4.9	69	3.6	7.4	97	.01
CH ₄ per capita (2000)	-.05	160	1.5	1.5	65	1.4	1.7	96	.70
BOD concentration/1000 (2000)	.08	73	252	434	44	319	1116	32	.71
Protected area (% of total area) (%)	-.25	165	14.7	11.6	68	11.1	12.1	104	.05

Notes: lower FH score = more democratic; democracies = avg. FH score >6

These results provide little evidence that democracies have less impact on the environment than do non-democracies. All of the correlations are low. Most coefficients are in the wrong direction, suggesting that, if anything, more political freedom implies more pollution, directly contradicting the majority of existing results. For several high profile pollutants, sulfur dioxide and carbon dioxide, democracies have significantly *higher* levels of pollution. The one piece of evidence of better performance consistent with a democratic boost is the extent of legally protected territory.

Improvement in environmental indicators The lackluster unconstrained effects of democracy are not the only basis for doubting existing empirical evidence purporting to show that democracies are better at reducing pollution. Another problem is methodological. As shown in Figure 1, the distribution of pollution levels is not normally distributed.¹¹ Neither logging the values nor differencing alone corrects the problem. However, taking the percentage change in these indicators (i.e., $(X_{2000}-X_{1990})/X_{1990}$) does

¹¹ Our reanalysis of results in previous studies suggests that these problems are pervasive. The effects we are pointing out are generally *not* eliminated by the conditioning data (i.e., the explanatory variables).

produce series that (mostly) bear some semblance of normal distribution, as shown in Figure 2.¹²

An additional advantage of using the difference of logs transformation is that we can ask whether or not democracies were more likely *actually reduce* pollution more effectively. Environmental problems are comparatively recent political issues, and their importance is politically (and sometimes scientifically) contested. Pollution levels are driven by many structural factors that predate concern about pollution control.

Table 2 repeats the analysis in Table 1 using the percentage differences in our measures of environmental performance. (For protected area, we simply use the difference in protected areas, since they are already expressed as a share of total area.) We now can include the percentage change in forested area as a variable. Its expected correlation with the Freedom house (Polity) measures democracy, like protected area, is negative rather than positive.

The results suggest slightly better evidence in favor of the better environmental performance of democracies vis-à-vis non-democracies. The correlation coefficients are consistent with better performance for more democratic countries for six of the eight indicators. Correlations using the Polity measure of democracy have the right sign in five of the eight measures.

¹² None of these transformations result in variables that pass standard tests for normality. This reinforces our decision to rely on counts of improvements rather than interval change measures.

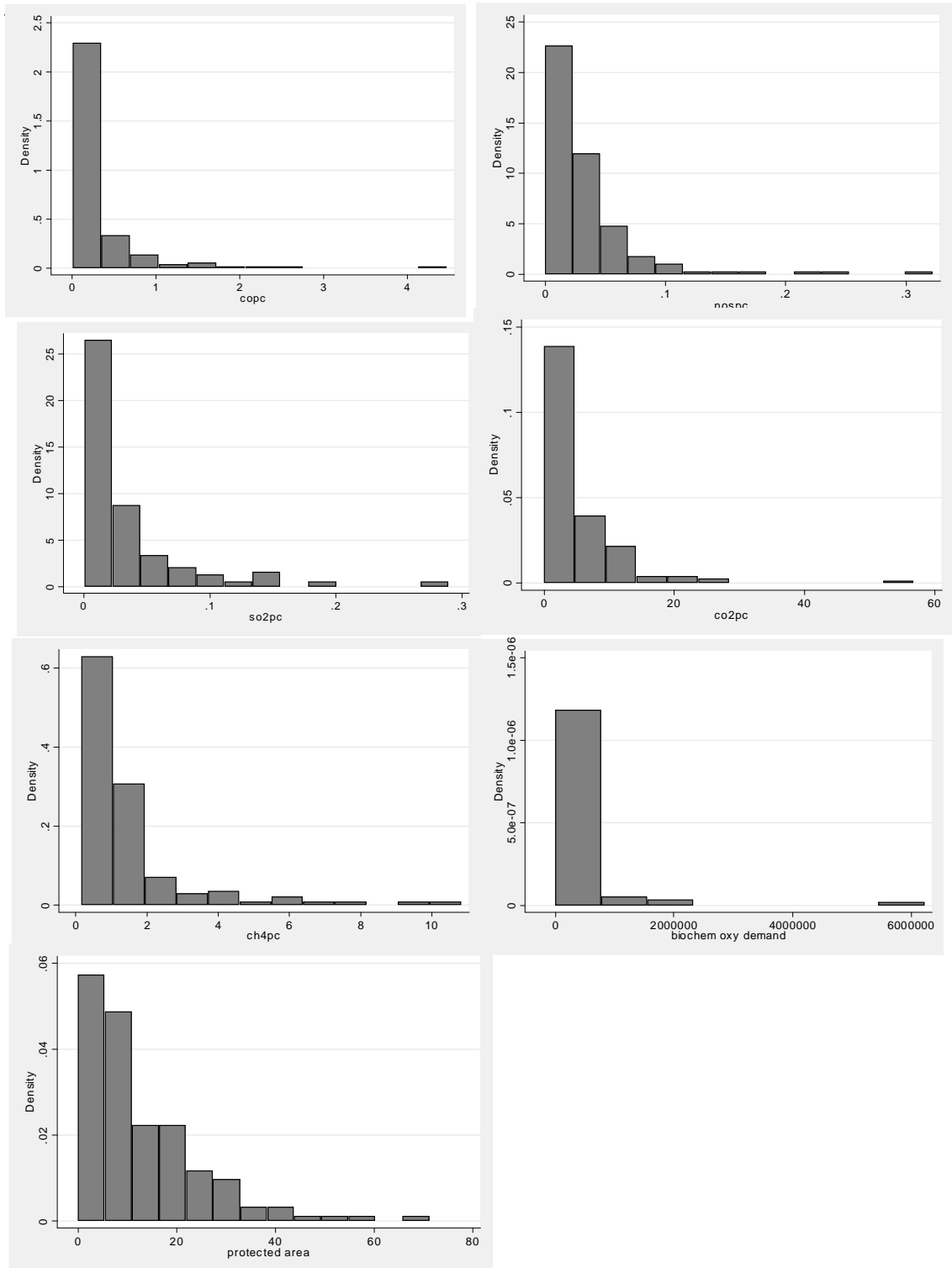


Figure 1: Distribution of Pollution Indicators for 2000: CO per capita, Nox per capita, SO2 per capita, CO2 per capita, NH4 per capita, BOD and % protected area

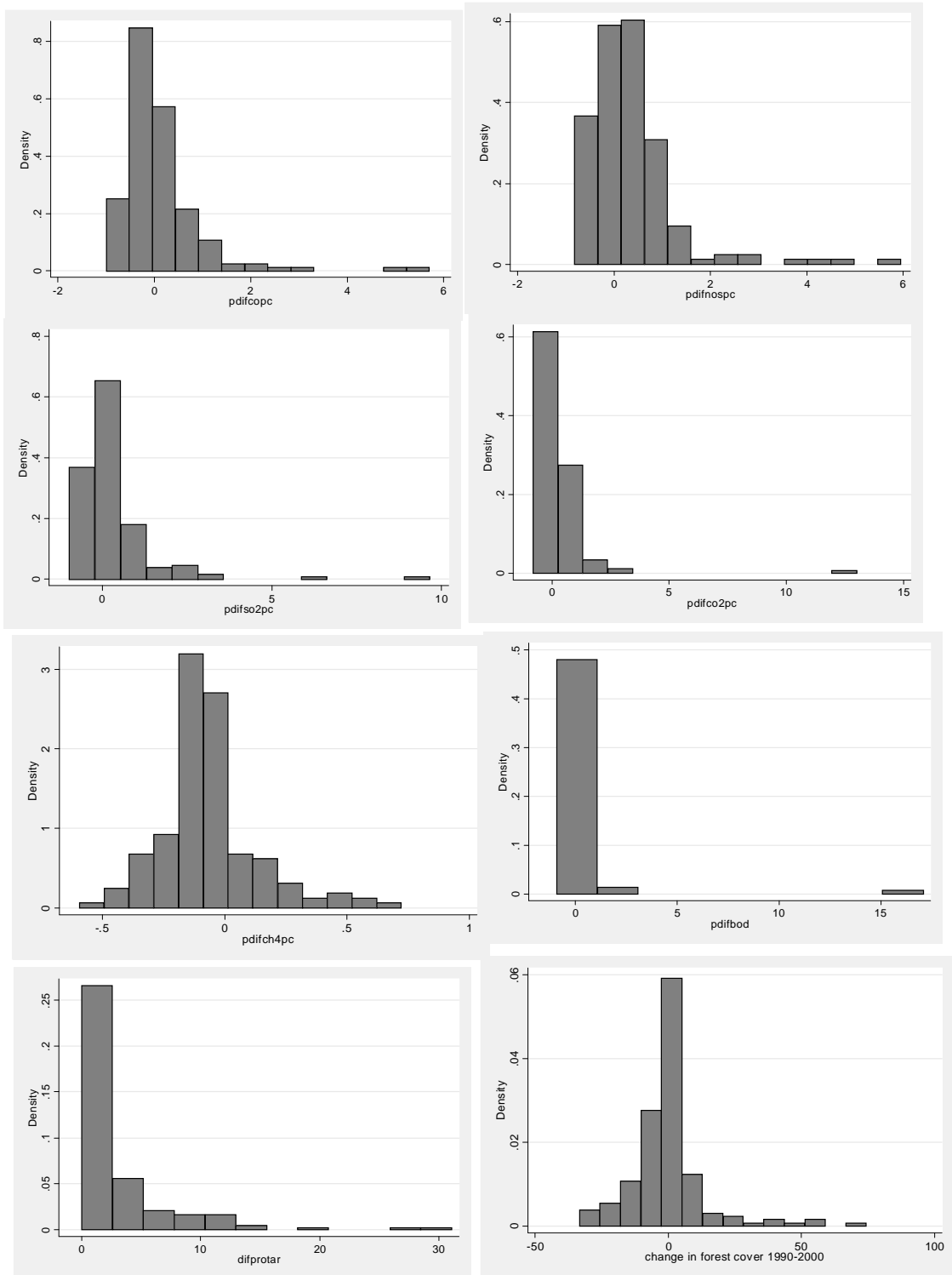


Figure 2: Distribution of Pollution Indicators for 2000: %Δ In CO per capita, %Δ Nox per capita, %Δ In SO2 per capita, %Δ CO2 per capita, %Δ NH4 per capita, %Δ BOD concentration, Δ % Protected Area, % Δ Forested Area

In the second part of Table 2, we show the likelihood that a democracy and a non-democracy improved their performance on these measures between 1990 and 2000. (We make no distinction here regarding the size of the improvement.) We define democracies as in Table 1: average FH score of 6 between 1972 and 2000. For five of the eight indicators, democratic countries are more likely to show improvement; for three, democracies are less likely to do so. Viewed probabilistically, only change in forested area has a difference in likelihood between democracies and non-democracies that is statistically significant at conventional levels.¹³ This suggests that there is little evidence that democracies perform better than non-democracies.

Table 2: Unconditional Effects for Percent Change in Environmental Performance (1990 to 2000)

	Correlation w.		Democracies		Non Democracies		Chi ² p-value for difference
	Avg FH Score '72-'00	obs	% with better performance	obs	% with better performance	obs	
% ΔCO per capita	.04 (-.16)		62.3	69	50.9	106	.14
% Δ NO's per capita	-.08 (.03)	167 (152)	33.3	69	35.8	106	.73
% Δ SO2 per capita	.06 (-.10)		50.7	69	39.6	106	.14
% Δ CO2 per capita	.06 (-.06)	162 (149)	38.2	68	44.8	96	.40
% Δ CH4 per capita	-.01 (-.08)	160 (149)	78.4	65	75.0	96	.61
% Δ BOD concentration	.15 (-.22)	70 (67)	62.8	43	43.3	30	.10
Δ Protected Area Share	-.14 (.12)	160 (145)	100.0	67	100.0	100	na
Δ Forested Area Share	-.19 (.09)	163 (149)	64.2	67	44.1	102	.01

Note: lower (higher) FH (Polity) score = more democratic

Note: Democracies = Avg. FH score >6

Combined environmental performance Existing research on democracy and environmental performance tends to evaluate the correlation using a single pollution indicator at a time. Even if all of these results were consistently in favor of democracy (which they are not), it is not necessarily the case that better performance on each individual indicator implies better performance on a linear combination of these

¹³ Since we are dealing with something very close to the population of countries, we might exercise caution about relying too much on statistical tests like this.

measures. Since what we really want to know in order to infer that democracies boost performance is whether democracies actually do better on a *combination* of measures.

To find out if this is true, we count the number of our indicators in which a country has moved in the right direction. As before, we ignore the size of the change, counting a 10% improvement the same as a 1% improvement. We did not add percentage changes across indicators, or use an index of standardized scores for several reasons. First, the existing indicators are not normally distributed, and contain a number of very large outlying values in the individual series. This raises the prospect that a combined score is effectively due to performance on only one of the eight indicators. Second, this approach will probably reward (or punish) very good (very bad) performance on one measure too much. We are more interested in seeing “balanced” improvements, and most interested in seeing sustainability in all domains. Ideally, we would be able to identify national sustainability conditions based on some normative or objective criteria, and evaluate progress towards those goals, but this requires much more conceptual/theoretical work on sustainability indices.

Table 3 shows the frequency distribution of improvements among democratic and non-democratic countries. Performance 1 includes BOD, which is not available for most of the countries; Performance 2 excludes BOD, significantly increasing the number of cases classified. Democracies are, on average, likely to show improvement in around 1 more measure than non-democracies. Democracies were more likely to achieve “excellent performance”, measured as improvement in 6 of 8 (or 6 of 7) indicator. They are also more likely to avoid very “poor performance,” measured as improvement in three or fewer measures. In the rest of the paper, we rely on the second performance indicator.

Table 3: Frequency Distribution of Environmental Performance Improvements

Count of indicators for which scores improved 1990-2000	Democracies		Non-Democracies	
	Performance Score 1	Performance Score 2 (excl BOD)	Performance Score 1	Performance Score 2 (excl BOD)
0 indicators	0	0	0	0
1 indicator	0	4	3	10
2 indicators	4	12	5	27
3 indicators	9	10	5	17
4 indicators	4	9	3	9
5 indicators	8	8	4	13
6 indicators	4	9	1	8
7 indicators	7	11	0	10
8 indicators	6		5	
Total	42	63	26	94
Mean	5.05	4.20	4.10	3.60
Pr(at least 6)	0.40	0.32	0.23	0.19
Pr(less than 3)	0.31	0.41	0.50	0.57

A Preliminary Summary

It is important to review several findings from this section. First, the results here addressed the *unconditional* impact of democracy, something that has not been widely discussed in previous studies. It is obviously also important to evaluate the effects of democracy in a multivariate setting, and we do this in the next section. Too often, however, analysis jumps straight to estimating multivariate models and conditional effects. These conditional effects can be so fine-grained that they cannot be used as a basis for making any policy recommendations. Second, this section operationalized democracy as the recent *history* of democracy against recent trends environmental performance measures. This is based on the implication from the theoretical literature that there are lagged effects in most causal explanations of how democracy affects

environmental protection, effects which are not well accounted for to date. Third, the results here have emphasized and combined improvements in environmental performance over time. Fourth, our results suggest some reasons to worry that previous results might be unduly affected by extreme values.

Multivariate Analysis of Democracy and Environmental Performance

In this section we specify an empirical model of environmental performance. Our review of the literature indicated a very long list of variables that have served as possible controls in our evaluation of the effects of democracy. Our greatest concern when trying to correctly estimate the impact of democracy, however, is including those controls that are correlated with *both* performance and democracy, yet which are themselves not an *outcomes* of democratic institutions. That is because factors that affect environmental performance, but are not empirically correlated with democracy, should not seriously affect our empirical estimates for democracy.

First, in addition to our democracy measure, our model includes the real total economic growth (not per capita) during the 1990-2000 period. This allows us to test if economic expansion, undermines environmental performance (see Rodrik 2007). Second, we include income per capita in 1990 to control for the possibility that more wealth leads to greater demands to reduce pollution and higher capacity to reduce pollution. And, of course, income per capita is correlated with democracy. While there is widespread controversy as to whether democracy is caused by, or independent of, economic development (Przeworski and Limongi 1997, Acemoglu, et al 2007), there is little to the

argument that greater income is in fact caused by democracy. Data for income and total growth come from the World Bank .

We do not include an income-squared term in the model because our dependent variable is the number of improvements in environmental indicators, not the level of pollution. This should be strictly increasing in income. Poor countries may increase pollution across the board resulting in few improvements. Middle income countries will begin to start cutting some pollutants, so would be expected to have an intermediate number of good scores. Finally, rich countries should be improving on many or all measures.

Finally, we include a measure of economic liberalization. The institutions that facilitate economic output (e.g., property rights and rule of law) are distinct from the institutions of representative democracy (competitive elections and political equality), and may independently affect environmental performance (Barro 1997). But, importantly, liberal economic institutions are correlated with democracy. Economic liberalism is taken from the average “Economic Freedom of the World Scores for 1980-2000 (Gwartney and Lawson 2007).

Environmental pollution, of course, violates assumptions of efficient prices in the market. However, the measures of economic freedom used here capture the broad market orientation of the economy, and thus should serve to indicate the capability to use environmental resources more *efficiently*. Moreover, if economic liberalism is bad for the environment on balance, as some allege, and democracies perform well in spite of generally having liberal economies, then controlling for economic liberalism should strengthen the conditional effect of democracy on performance.

As compliments to the economic growth measure explained above, we include in the regression model indicators of the *change* in both political and economic freedom between the pre-1990s and the 1990s. This allows us to estimate whether or not only the level, but also the change in democracy (or economic liberalism) helps to account for changes in environmental performance. For political freedom we used the difference in the average annual Freedom House scores for between two periods: 1972-1989 and 1990 and 2000. For economic freedom, we used the difference in the average score for 1980, 1985 and 1990 and the average for 1995 and 2000. A higher score implies *more* economic liberalization.

Estimating strategy and results

The estimates reported in the next two tables are computed with OLS with Huber-White standard errors. Summary statistics for variables are given in Appendix 2. In order to get a sense of how sensitive the estimates for democracy are, we show several different specifications. We also report the p-values for tests of normality of estimated residuals; this helps assess whether we can apply the standard interpretations of estimates of coefficient variances. Non-normal errors suggest that coefficient variance estimates are an unreliable basis for evaluating “statistical significance.”

Table 4 provides an initial set of estimates to compare against Li and Reuveny’s (2006) recent contribution to the literature. For the estimates in this table only, democracy is operationalized as the average political freedom score *during the 1990s*, instead of average freedom for 1972-1989. The last column includes a dummy for the former Eastern bloc countries. It foreshadows a claim that we develop later, namely that

the breakup of the Communist bloc is what is essentially driving recent international statistical evidence of a “democracy effect.”

The estimates in Table 4 suggest two things of note. First, the evidence in support of a democracy effect is very weak. Controlling for income per capita reduces the estimated impact of democracy by one-third. More importantly, once we control for the influence of the collapse of the Communist economies, the estimated impact of democracy is reduced by another two-thirds. Indeed, controlling for the collapse of communism explains considerably more variation in performance than the rest of this model. Moreover, only when we include this dummy variable can we trust the estimated parameter variances of all of the coefficients.

Table 4: Regression Results for Environmental Performance

	-1	-2	-3	-4	-5
FH Democracy Score 1990-00	-.112 [.038]***	-.084 [.049]*	-.077 [.050]	-.081 [.050]	-.028 [.037]
GDP per capita (1990)		.035 [.026]	.036 [.026]	.03 [.026]	.069 [.025]***
ln(Population, 1000s)			-.086 [.084]	-.02 [.096]	-.051 [.073]
Trade Intensity (% GDP)				0.005 [.004]	.00 [.003]
Former eastern bloc *dummy)					3.262 [.228]***
Constant	4.647 [.329]***	4.254 [.480]***	4.985 [.889]***	4.012 [1.201]***	3.531 [.845]***
Observations	156	144	144	143	143
R-squared	0.05	0.07	0.08	0.09	0.49
Normality of residuals (sktest)	.00	.00	.00	.00	.12

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Results in the next table, Table 5, estimate our own model. To repeat, that is:

$$\begin{aligned} \text{Performance Score} = & b_0 + b_1 \text{ FH Democracy }_{\text{avg } 1972-2000} + b_2 \text{ GDP p.c.}_{1990} + b_3 \\ & \text{Economic Freedom (avg } 1980-2000) + b_4 \text{ Economic Expansion }_{(\text{GDP } 2000 - \text{GDP} \\ & 1990)} + b_5 \text{ Political Liberalization }_{(\text{avg } 1990-2000 - \text{avg } 1972-1989)} + b_6 + e \end{aligned}$$

The results of this model suggest some apparent contradictions. First, long-standing democracies were not associated with improved environmental performance during the 1990s, but democratization is. All estimates suggest no positive effect of long-term democracy on the level of environmental performance in the 1990s. On the other hand, countries that liberalized politically in this period are expected to see considerable improvements. A country going from the least to the most democratic is expected to see improved performance on about 3 of the seven indicators, on average.

Second, we see some contradictions with the economy as well. Countries with high income are consistently associated with better environmental performance, but countries with greater economic *expansion* tend to have worse environmental performance. A country with a higher income per capita of \$10,000 increases expected performance by one. On the other hand, a 4% annual expansion of the real economy between 1990 and 2000 reduces by approximately one the number of environmental indicators seeing improvement. .

Finally, the effect of economic liberalism and liberalization are consistent, but not definitive. Both greater market openness, and more liberalization are associated with better environmental performance. Both these estimates, however, are not statistically significant.

Table 5: Regression Results

	-1	-2	-3	-4	-5	-6	-7	-8	-9
Avg. FH Score 1972-00	-.027 [.041]	.115 [.058]*	.098 [.077]	.098 [.077]	.081 [.067]	-.008 [.058]	-.007 [.058]	-.025 [.061]	-.029 [.047]
GDP p.c. \$1000's (1990)		.094 [.031]***	.094 [.034]***	.094 [.034]***	.056 [.035]	.073 [.033]**	.077 [.035]**	.064 [.026]**	.07 [.021]***
Economic Freedom Score (1990-2000)			.109 [.263]	.109 [.263]	.515 [.227]**	.22 [.243]	.183 [.256]	.194 [.235]	
Economic Expansion					-.024 [.006]***	-.016 [.007]**	-.016 [.007]**	-.009 [.005]*	-.002 [.003]
Δ FH Score						-.238 [.061]***	-.235 [.063]***	-.064 [.066]	-.022 [.048]
Δ Economic Freedom Score							.079 [.207]	-.023 [.217]	
Former eastern bloc (dummy)								2.453 [.587]***	3.155 [.414]***
Constant	4.025 [0.371]***	2.377 [0.565]***	1.65 [2.026]	1.65 [2.026]	0.251 [1.608]	1.983 [1.557]	2.129 [1.584]	2.112 [1.571]	3.173 [.489]***
Observations	156	144	113	113	113	113	113	113	144
R-squared	0	0.08	0.14	0.14	0.28	0.39	0.39	0.48	0.50
SK-test for normality	.00	.00	.09	.09	.15	.29	.28		

Notes: Lower FH Score= more democratic

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Environmentalism and Democracy or Economic Collapse?

How can we reconcile the fact that long-standing democracies do not seem to experience better environmental performance in the 1990s, but those democratizing recently did perform better; that rich countries perform better, but countries that become richer faster do worse; and countries that are economically liberal and which have liberalized more arguably do consistently better (but not enough better to be certain of these effects)? As suggested earlier, we would argue that the results are due to a relatively unique set of events that simultaneously promote democratization, liberalization, and economic collapse in a number of countries: the end of communism.

The importance of the end of communism is likely to loom large in large-n empirical studies of political, economic, and environmental change, because communist authoritarian regimes (economically and politically illiberal) were particularly bad for the environment. The collapse of these political economies led to massive declines in pollution in all of those countries without a doubt. The question is whether those declines can really be traced to the changing political regimes, or some other aspect of those countries. The fact that it is very hard to differentiate empirically between economic regime change, political regime change, and economic structural change is all the more reason why ignoring those changes biases many recent results in favor of finding a democracy effect that is unwarranted.

Examining column 8 in Table 5, we see that including a dummy variable for the 28 former Eastern European countries in the dataset drastically reduces the absolute values of the estimates for economic expansion, democratization, and economic liberalization. (Only 15 of the 28 former Eastern bloc countries are used in estimating the

coefficients in this model, because there is no economic freedom data for the countries in the former Soviet Union.) There were 24 countries in our dataset whose overall economies in 2000 were smaller than they were in 1990; all but five were in the former Eastern bloc. The few Eastern bloc countries experiencing an absolute economic expansion the 1990s were: Albania, Czech Republic, Hungary, Poland, Slovakia, and Slovenia.

Economic freedom appears to have little or no effect on environmental performance. The reported estimates vary widely but are all positive. Likewise, the effect of economic liberalization of the economy also has no clear effect on performance. An important limitation of the estimates with economic freedom in the model is that data are not available for most of the former Soviet Republics and the former Yugoslavia. For this reason we report a final set of estimates which excludes the economic freedom scores, but includes all of the other variables. These results underscore the point that the main forces driving environmental improvements are the massive changes in Eastern Europe. Moreover, it is the massive collapse of the Eastern European economies, not their political liberalization that explains these countries improved environmental profiles.

Conclusion

Over the years, there have been a surprisingly large number of studies that have examined, in one way or another, the effect of democratic institutions on environmental policy. However, most of these studies have not done a very good job of evaluating the evidence in light of prevailing explanations. Our paper has attempted to correct some of these. The results indicate that there is not much evidence to support the impact of democracy on overall national environmental performance. Whether one examines individual indicators of environmental progress, or a conglomeration of them, we find almost no evidence to suggest that democratic countries, particularly the long-established democracies that the theoretical literature suggests are most likely to perform better, do, in fact, perform better. These “non-results” hold for both unconditional and conditional (i.e., controlling for other factors) performance. The results do suggest that economics is the dominant driver of performance in the period we are examining.

The more sanguine view of democracy expressed past research can be traced to several problems. First, previous cross-national work may have ignored outliers and distributional anomalies in their pollution variables that undermine conventional tests of parameter significance. Second, most previous estimates have looked at the recent levels of pollution in democracies vis-à-vis non-democracies, not at progress in *reducing* environmental stresses. Our results suggest that the effects of democracy are likely due to the fact that most good performing democracies are rich, and wealth is what matters most. Third, previous work has often estimated the effects of democracy as if they were

simultaneous, which seems highly implausible. Actual explanations of the way that democracy works hinge on the idea that democratic institutions are the long-standing rules of the game. Democracies work rather slowly. Fourth, and intimately tied to the previous point, recent research has implicitly given democracy the credit for the environmental improvements in Eastern Europe following the collapse of the Soviet Union. While a number of post-Communist countries became democracies, it is hard to sustain the argument that this coincidence was primarily the result of popular demands for environmental protection. Among other things, these countries experienced contemporaneous economic liberalization and restructuring brought on by the creation of market economies that were as much or more responsible for those changes. Once we control for the unique features of this geo-political anomaly, we cannot sustain the claim that democracy, or democratization improves environmental performance.

Of course, these results should not be taken to suggest that democracy is *incompatible* with good environmental performance. The evidence that we have does not seem to support the old, “neo-Malthusian” line that a “new Leviathan is the solution for environmental scarcity (Ophuls 1976, Heilbroner 1974).

Bibliography

Acemoglu, Daron, Simon Johnson, James Robinson, Pierre Yared. (2007) "Income and Democracy" <http://econ-www.mit.edu/files/1370>

Barret, Scott and Kathryn Graddy (2000). "Freedom, growth and the environment". *Environment and Development Economics* 5: 433-456.

Barro, Robert. (1997) *Determinants of Economic Growth: A Cross Country Analysis*. Cambridge, MA: MIT Press.

Binder, Seth and Eric Neumayer (2005). "Environmental pressure group strength and air pollution: an empirical analysis". *Ecological Economics* 55 (4): 527-538

Bloom, David (1995). "International public opinion on the environment". *Science* 269 (5222): 354-358.

Buttel, Frederick (2000). "World society: the nation state and the environmental protection. Comment to Frank, Hironaka and Schofer". *American Sociological Review* 65: 117-121.

Carlsson, Fredrik and Sussana Lundstrom (2003). "The effects of economic and political freedom on CO2 emissions". Göteborg University department of Economics *Working Papers in Economics* 29.

Clarke, Gerard (1998). "Non-governmental organizations and politics in the developing countries". *Political Studies* XLVI: 36-52.

Congleton, Roger (1992). "Political institutions and political control". *The Review of Economics and Statistics* 74 (3): 412-421.

Deacon, Robert (1999). "Dictatorship, democracy and the provision of public goods". University of California at Santa Barbara Economics *Working Paper* 11-99.

Ehrhardt-Martinez, Karen; Crenshaw, Edward, and J. Craig Jenkins (2002). "Deforestation and the environmental Kuznets curve: a cross national investigation of intervening mechanisms". *Social Science Quarterly* 83 (1): 226-243.

Esty, Daniel and Michael Porter (2005). "National environmental performance: an empirical analysis of policy results and determinants". *Environment and Development Economics* 10: 391-434.

Fredriksson, Per; Neumayer, Eirc; Damamia, Richard and Scott Gates (2005). "Environmentalism, democracy and pollution control". *Journal of Environmental Economics and Management* 49: 343-365.

- Fredriksson, Per and Jim Wollscheid (2007). "Democratic institutions versus autocratic regimes". *Public Choice* 130: 381-393.
- Fisher, Dana and William Freudenberg (2004). "Posindustrialization and environmental quality an empirical analysis of the environmental state". *Social Forces* 83 (1): 157-188.
- Freedom House (2008). <http://www.freedomhouse.org/template.cfm?page>
- Gassebner, Martin; Lamla, Michael and Jan-Egbert Sturm (2006). "Economic, demographic and political determinants of pollutants reassessed: a sensitivity analysis". *CESIFO Working Paper Resources and Environment* 1699,
- Gates, Scott, Gleditsch, Peter and Neumayer, Eric (2002). "Environmental Commitment, Democracy and Inequality. a background paper to World Development Report 2003".
- Grossman, Gene and Alan Krueger (1995), "Economic growth and the environment". *The Quarterly Journal of Economics* 110 (2): 353-377.
- Golder, Matt (2004) Democratic electoral system around the world 1946-2000.. <http://dvn.iq.harvard.edu/dvn/dv/mgolder>
- Gwartney and Lawson 2007
- Heilbroner, Robert. 1974 *An Inquiry into the Human Prospect*. New York: Norton.
- Inglehart, Ronald (1995). Public support for environmental protection: objective problems and subjective values in 43 Societies. *Politics and Society* 28 (1): 57- 71.
- Inglehart, Ronald and Christian Welzer (2005). *Modernization, Cultural Change and Democracy. The Human Development Sequence*. Cambridge: Cambridge University Press.
- Israel, Debra (2004). "International Support for Environmental Protection". *Environment and Development Economics* 9: 757-780
- Jorgensen, Andrew (2006). "Global warming and the neglected greenhouse gas: a cross-national study of the social causes of methane emissions intensity". *Social Forces* 84 (3): 1779-1798.
- Li, Quan and Rafael Reuveny (2006). "Democracy and environmental degradation" *International Studies Quarterly* 50: 935-956.
- Midlarsky, Manus (1998). 'Democracy and the environment: an empirical assessment'. *Journal of Peace Research* 35 (special issue on environmental conflict): 341-361.
- Murdoch, James, Sandler, Todd and Keith Sargent (1997). "A tale of two collectives; sulphur and nitrogen oxides emissions reduction in Europe". *Economica* 64: 281-301.

Murdoch, James and Todd Sandler (1997). "The voluntary provision of a public good. The case of reduced CFC emissions and the Montreal protocol". *Journal of Public Economics* 63: 331-349.

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

Neumayer, Eric (2003). "Are left-wing party strength and corporatism good for the environment. Evidence from panel analysis of air pollution in OECD countries". *Ecological Economics* 45: 213-220.

Ophuls, William. (1976) *Ecology and the Politics of Scarcity*. San Francisco: W H Freeman.

Przeworski, Adam and Fernando Limongi. (1997) "Modernization: Theories and Facts" *World Politics*. 49: 155-83.

Rodrik, Dani. (2007) *One Economics Many Recipes: Globalization, Institutions and Economic Growth*. Princeton University Press.

Scruggs, Lyle (1999). "Institutions and environmental performance in seventeen western democracies". *British Journal of Political Science* 29: 1-31

Shandra, John (2007). "The world policy and deforestation: a quantitative, cross national analysis". *International Journal of Comparative Sociology* 48 (1). 2007: 5-27.

Shandra, John; London, Bruce; Whooley Owen and John Williamson (2004). International nongovernmental organizations and the carbon dioxide emissions in the developing world: a quantitative, cross national analysis. *Sociological Inquiry* 74 (4): 520-545.

Srebotnjak, Tanja (2007). "The role of environmental statisticians in environmental policy: the case of environmental performance". *Environmental Science and Policy* 10: 405-418.

Torras, Mariano and James Boyce (1998). "Income, inequality and the pollution: a reassessment of the environmental Kuznets curve". *Ecological Economics* 25: 147-160.

Wackernagel, Mathis; Onisto, Larry; Bello, Patricia; Callejas, Alejandro; López, Inna, Méndez, Jesús, and Maria Guadalupe Suárez. "National natural capital accounting with the ecological footprint concept". *Ecological Economics* 29: 375-390.

World Resources Institute (2008). <http://earthtrends.wri.org/>

York, Richard, Rosa, Eugene, and Thomas Dietz (2003). 'Footprints on the Earth: the environmental consequences of the modernity'. *American Sociological Review* 68: 279-300.

Appendix 1: Democratic and Non-Democratic Countries (FH Scores 1972-2000 </>6)

<u>Democracies</u>	<u>Non-Democracies</u>		
American Samoa		Haiti	Slovenia
Andorra		Honduras	Somalia
Antigua		Hungary	SriLanka
Argentina*	Afghanistan	Indonesia	Sudan
Australia	Albania	Iran	Syria
Austria	Algeria	Iraq	Taiwan
Bahamas	Angola	Jordan	Tajikistan
Barbados	Armenia	Kazakhstan	Tanzania
Belgium	Azerbaijan	Kenya	Thailand
Belize	Bahrain	Kuwait	Togo
Botswana	Bangladesh	Kyrgyzstan	Tunisia
Canada	Belarus	Laos	Turkey
Colombia	Benin	Latvia	Turkmenistan
Costa Rica	Bhutan	Lebanon	United Arab
Cyprus	Bolivia	Liberia	Emirates
Denmark	Bosnia	Libya	Uganda
Dominica	Brazil	Lithuania	Ukraine
Dominican Rep.*	Brunei	Macedonia	Uruguay
Fiji	Bulgaria	Madagascar	Uzbekistan
Finland	Burkina Faso	Malawi	Viet Nam
France	Burundi	Malaysia	Yemen
Greece	Central African	Mali	Zambia
Iceland	Rep	Mauritania	Zimbabwe
India	Cambodia	Mexico	
Ireland	Cameron	Moldova	
Israel	Cape Verde	Mongolia	
Italy	Chad	Morocco	
Jamaica	Chile	Mozambique	
Japan	China	Myanmar	
Luxemburg	Comoros	North Korea	
Malta	Congo	Namibia	
Netherlands	Congo, Dem Rep.	Nepal	
New Zealand	Cote d'Ivoire	Nicaragua	
Norway	Croatia	Niger	
Papua New Guinea	Cuba	Nigeria	
Portugal	Czech Rep.	Oman	
Spain	Djibouti	Pakistan	
Sweden	Ecuador	Panama	
Switzerland	Egypt	Paraguay	
Trinidad & Tobago	El Salvador	Peru	
United Kingdom	Equatorial Guinea	Philippines	
United States	Eritrea	Poland	
Venezuela	Estonia	Qatar	
	Ethiopia	Romania	
	French Guiana	Russia	
	Gabon	Rwanda	
	Gambia	South Africa	
	Georgia	South Korea	
	Germany#	Saudi Arabia	
	Ghana	Senegal	
	Guatemala	Sierra Leone	
	Guinea	Singapore	
	Guyana	Slovakia	

* Not democratic based on Polity score of 6+

Appendix 3: Summary Statistics for Regression Variables

	Obs	Mean	SD	Min	Max
Enviornmental Improvments (Performance 2)	157	3.82	1.93	1	7
Income per capita 1990	149	5.198	7.77	0.122	33.43
Real Economic Expansion (1990-2000)	149	34.2	49.5	-65.7	438.7
Democracy Score*	167	8.6	3.6	2	14
Political Liberalization	167	-1.57	2.95	-10.1	4.1
Econmic Freedom (1980-2000)	121	6.36	1.05	3.4	8.6
Economic Liberalization	121	0.792	0.725	-1	2.8
Trade Openness	166	87	51.1	2	378
ln(Population)	175	8.8	1.98	2.77	14.1