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Austin Baird
Rachel Bodily
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Beyond Democracy: The Effects of the Electoral System on Environmental Performance

Austin Baird, Rachel Bodily, and Angela Merriam

There have been many attempts to explain why some countries exhibit environmentally friendly attitudes and pass environmentally protective policies while others neglect or exploit their natural resources and environmental amenities. Some researchers have explored the link between democracy and the environment, determining that there is only a relationship in certain aspects of environmental protection. Others have linked environmental attitudes to economic growth or gross domestic product (GDP). These studies, however, often fail to explain the variance among countries with similar ideological trends, income levels, or levels of democracy. There are important conclusions to be drawn from further examining democratic governments and variances within these democratic systems and electoral processes. It is instructive not only to recognize that democracies in general create greener policies, but to analyze both the mechanisms and the institutional variance which allow for these policy differences.

Within democracies, we look at electoral systems as a central indicator of environment performance. We examine the differences between first past the post (FPTP) and proportional representation (PR) styles of democracy, and we argue that those countries that utilize PR systems exhibit better environmental attitudes and policies. Using the existing literature, we first explain key differences in the two electoral systems and then highlight several causal mechanisms that may explain why PR systems produce more environmentally friendly policies. We then explain the methodology of the quantitative study and discuss our findings. We spend significant time on the main independent variable of electoral system. While the mere presence of an FPTP or PR system does not explain the variance in environmental performance, we do show that higher district magnitude, a more sophisticated measure of a PR system, yields better environmental performance.

Electoral System

The notion behind PR elections is that each party should be allotted a number of congressional seats commensurate with the percentage of votes received. While, technically, PR systems should precisely transfer the percentage of the votes won to the percentage of seats allotted to a certain party, such a policy could lead to a party’s receiving only half of a seat. Consequently, many systems include some minimum percentage of the vote, a “threshold,” that must be reached in order for a party to gain a seat. The competing electoral system that we examine is FPTP, a plurality system in which the one open seat goes to the candidate that captures the most votes, although not necessarily a majority. This type of system tends to marginalize smaller parties, as the likelihood of a small party winning one available seat is low. PR systems, on the other hand, will encourage multiparty politics due to the inclusion of small parties. For example, if a “green” party wins 10 percent of the vote in a PR system, it will receive about 10 percent of the seats in the legislature, whereas a plurality system would deny any representation. This fragmentation of the vote in PR systems also places a greater focus on a coalition approach to politics, as can be seen in Europe and Latin America, where it is most popular. Plurality eschews this approach, as evidenced by the dominance of two major parties in the U.S. and Great Britain.

Of particular importance to understanding electoral systems, and specifically the way we measure them in this paper, is the definition of district magnitude. This
term refers to the average number of candidates elected in each given district. In a plurality system, each district elects only one representative in what is appropriately called a single-member district. PR systems, however, allow voters to elect multiple candidates per district, ranging from two to as many as 150 in Slovakia and the Netherlands. As John Carey points out, district magnitude determines the proportionality of a system, or the ratio of seats to votes. We hypothesize that, to an extent, higher district magnitude will lead to more equal proportionality and increase the number of parties gaining at least some level of participation.

Environmental Performance and FPTP Systems

Given these characteristics of the two main electoral systems, there are two reasons to expect that environmental performance would be worse in countries with a plurality system. First, plurality systems require that candidates appeal to a broad constituency for whom the environment may not be a common concern. Second, the structure of plurality systems tend to marginalize smaller, single-issue parties that may favor the environment.

As previously addressed, FPTP systems require a party to win more of the vote than the competing parties; therefore, FPTP systems create a significant barrier to entry unparalleled in PR systems. In order to obtain such large percentages, parties must focus their campaigning efforts on issues that will attract large numbers of voters. Allan Meltzer and Marc Vellrath suggest that voters give the most consideration to the question: “Which party will keep the country prosperous in the years ahead?” In addition to the focus on economic performance that this question prompts, Michelle Slone argues that recently within the U.S., the increased amount of media coverage dedicated to terrorist threats and attacks has made national security a determining factor in elections that is just as important as the economy. There are likely other countries with similarly unique issues that directly play into voter decisions and priorities. With pressing issues, such as, security and the economy, at stake in FPTP systems voters are less likely to cast their votes based on a party’s environmental stance. While we acknowledge that there are some voters who make electoral decisions based on environmental issues, they are a small enough minority so as to not affect elections in any major way in a plurality system. When parties consider the relative disinterest with which voters view the environment, they are unlikely to make environmental issues a major plank in their campaign platform, as it does not develop the broad support base that PR systems require. As a respondent notes in Peter Smith’s Democracy in Latin America, “The single-member district does not guarantee the proportional representation of parties, but in exchange it is the best at allowing the representation of the interests that really stir society.”

Regardless of which party wins the election in a plurality system, environmental policies will not usually be at the forefront of the agenda and the lack of protective policy implementation will yield worse environmental performance in the country involved.

Concomitant with this idea of broad appeal is the parties’ need to appeal to “swing” voters. In FPTP systems, each party tends to contain a core group of committed voters who will vote for the party irrespective of which candidate is fielded. Therefore, the most pressing issue for most parties is their ability to woo undecided or “swing” voters. David Gopoian and Sisse Hadjianlambous show that these swing voters, defined as those who make their decision in the last two weeks, are not generally motivated by typical political or ideological issues. Instead, the majority of these voters make their selections seemingly at random, and display a tendency to vote for “the person who saw them last on Election Day.”

Holding this hypothesis true, and assuming political parties’ ability to intuit this, electioneering tactics involving the promise of environmentally friendly issues are unlikely to be effective, thereby making them unlikely to be offered and certainly not implemented.

The second reason to expect that FPTP systems would have worse environmental records is the marginalization of small and single-interest parties. The role played by large parties in FPTP systems is apparent enough that the practically negligible role filled by special interests should be self-evident. Even so, it is still helpful to mention the relationship. The nature of FPTP systems tends to marginalize the effect that single issues can have in directly affecting policy. Instead, they encourage lobbying groups who certainly wield considerable clout in the form of financial contributions but do not take an active role in the writing of or voting on policy. The difference we wish to emphasize is that, in PR systems, special interest groups are able to directly enter the political arena due to the lower barriers of entry. They are able to form coalitions and write and vote on legislation. This ability does not exist in FPTP systems relegating special interest groups to mere lobbyist status. Therefore, almost any special interest group with significant power will, of necessity, be a group with substantial financial backing. These groups are likely to represent business interests because by definition businesses have a larger pool of funding to work with, as any money spent on lobbying can be seen as a financial “investment.” Environmental groups on the other hand mainly rely on individual philanthropists and other donors which are relatively parsimonious. The following section will discuss the merits of a PR system due to its more equitable incorporation of small parties and single issues.

It is also likely that policies in FPTP systems are less stable than those elected through PR. FPTP parties must polarize themselves from other parties in an effort to
attract voters, and they are not as likely to build coalitions and compromise with other parties while they are in office. Thus, they will vacillate among varying environmental policies, which is ultimately harmful for the environment because any positive gains during one term will most likely be negated in the next term when another party is in power. Because PR allows for more variance, it should allow for more stable environmental policies and, therefore, higher environmental performance.

Environmental Performance and PR Systems

It is unlikely that a single-issue group would be able to enter the political arena in a FPTP system under the guise of a viable party. Their influence is mostly limited to lobbying and public-awareness campaigns, and their effectiveness tends to be limited by their lack of resources. It is much easier, however, for single-issue groups to effect political changes in a PR system. In a PR system they have a chance of gaining real political representation and power rather than negotiating legislation as a lobbying consortium. The makeup of a PR system, only a small percentage of the total vote is necessary in order to gain a seat or two, facilitates the entry and participation of parties with more specialized interests. Even though the heightened ease with which these groups may gain legislative seats is obvious, it might be tempting to question the efficacy with which such a seemingly insignificant group could pursue its agenda. The answer lies in a (PR elected) government’s need for consensus and coalition in order to avoid potential conflicts and the ensuing impasses of gridlock. This quality of PR systems, the almost invariant requirement for various parties to compromise and form a functional government, is what allows special-interest parties (in this case environmentally-minded parties) to wield more influence than they would in other electoral systems. This creates an atmosphere of give-and-take in which environmental policies are likely to be passed in return for support on an unrelated matter.

A second issue when considering the effect of the electorate on environmental policies is the expectations that voters are likely to have of their fellow voters. Meltzer and Vellrath note that the economy is the most important determining factor when individuals decide on a candidate, and most voters no doubt realize this as well. Therefore, in a PR system, a voter who feels particular concern for the environment will vote for a “green” party without fearing that security or the economy will be sacrificed, because the majority of the other voters will determine their choice based on these issues. Our voter will be secure in the knowledge that the majority of his neighbors will not share his preoccupation with the environment, thus facilitating the decision to vote for a single-issue group and allow his neighbors to vote on larger issues. Therefore, relatively more people may vote for single-issue “green” parties without fear of their actually taking control of the legislature.

Some may argue that the type of electoral system as related to environmental performance is in fact a spurious correlation resulting from some sort of norms diffusion. This result is unlikely, however, as there is no reason that environmental norms and standards should have any relation to the electoral system adopted. We need only look at areas where we might expect ideology to have been imparted or spread in order to realize that this is improbable. For instance, all of Latin America was land colonized by the Spanish and the Portuguese. Yet, when we analyze the executive branches of the various governments, we find that they have borrowed from the U.S model much more heavily than from the European model. There are certain things that can reasonably be expected to be passed on from one country to another; English is the lingua franca of India; besides the U.S., Japan and Cuba are the only countries in the world that really care about baseball; and France’s former colonies still make up a cultural and linguistic bloc. However, Australia, Canada, and the U.S., all former British colonies, have widely disparate environmental attitudes, despite their common heritage. As tempting and facile as it would be to ascribe environmental performance to regional ideologies, and to propose that electoral systems are just indicators of those ideologies, doing so would be inaccurate. In this case, we see clear evidence for the rational choice, institutionalist argument. We assert that it is specifically the electoral process which not only causes more people to vote for greener parties but also encourages politicians to legislate for better environmental protection.

Hypotheses

In an attempt to empirically test these causal relationships, we estimate two models using different measures of PR versus FPTP. The variable of interest in the first model is a dummy variable for PR. In this model we predict that PR will have a positive effect on the Environmental Performance Index (EPI), and transparency will also have a positive, although nonlinear, relationship to the EPI. We predict that there may be decreasing returns to transparency, which will be shown by a negative coefficient on the transparency-squared term. In other words:

- Hypothesis 1: PR will be positively correlated and statistically significant to the EPI.
- Hypothesis 2: Transparency will be positively and significantly related to the EPI.
- Hypothesis 3: Transparency-squared will be negatively related to the EPI, showing decreasing returns to transparency’s effect on environmental protection.

The second model will involve a measure of district magnitude, which will more precisely estimate the effect of PR. We expect this model to give us a result similar to the coefficient on PR, that is:
Hypothesis 4: District magnitude will be positively and significantly related to the EPI.

Subsequent sections of this paper explain our methods and evaluate the measures of each variable and present the results.

Data

We aim to explore the causal relationship between environmental performance and the type of electoral system through a quantitative analysis. While qualitative studies are sometimes useful, a quantitative study allows us to expand our number of cases and test our hypotheses cross-nationally. This allows for the development of more generalized and applicable results. As the necessary data is available for a fairly large selection of countries, we can test the effects of electoral systems on a wide array of countries.

In combination with the theoretical framework, the quantitative elements of our study build a convincing case for causation. We control for any variables that may indicate correlation rather than causation, such as, per capita wealth, democracy, education, corruption, attitudes, etc. Any relation we predict through the type of electoral system is unlikely to be so highly correlated with another variable that the results, instead, demonstrate the effects of an alternate explanation. It is also highly unlikely that there will be any problems with endogeneity, which is most likely one of the causes of some kind of spurious causal relationship as the coefficient on the explanatory variable would be highly correlated with the error term. There is no theoretical reason apparent to us that could account for the level of environmental performance influencing the type of political system. While it may be possible that the type of electoral system reflects the influence on an alternate electoral variable, such as, open or closed list or the number of effective parties, the theoretical reasoning behind the importance of electoral system provides fairly strong evidence that this is unlikely to be the case. Still, there is no definitive way to test for causality versus correlation; thus, many empiricists assert that while numerical analysis certainly provides evidence of correlation, causation can be slightly more elusive. Despite this, the case for causality is strong, although mere correlation does not seriously undermine our conclusions or policy implications. The text that follows will outline the model selection, methodology, and regression results. In combination with the theoretical framework, these elements build a compelling case for the importance of the electoral system in determining the level of environmental performance.

Environmental Performance Index

As our dependent variable measuring environmental performance, we use a very recently developed comprehensive dataset called the EPI. Developed in 2006, it involves a composite ranking theoretically between zero and one hundred. The ranking quantifies the level of environmental performance with respect to the following two overarching policy objectives: first, the environment as it relates to human health, and second, ecosystem vitality and natural resource management. These indicators are purposefully linked to government environmental policy rather than natural endowments, thus the indicators measure the effectiveness of preserving what endowments already exist rather than measuring the state of the environment at a given time. This measurement is more germane to our study, as it evaluates the political factors and the human impact on the environment rather than a more intangible measurement of sustainability.

The first core area of the EPI measures the environmental impact on health by looking at the influences of environmental factors on morbidity and mortality rates. This aspect of the measurement represents a fairly anthropocentric measure that is probably the least controversial measure of environmental standards. It includes no assumption of the inherent value of the environment; the indicators simply reflect natural human preferences against disease and death. The indicators used, such as, water supply, sanitation, and child mortality, are all incorporated by the Millennium Development Goals as part of environmental objectives that are, for the most part, universally recognized. Two measures of air quality—urban particulates and indoor air pollution—also factor into the equation, as they have significant health implications.

Using slightly more complex and varied indicators of environmental performance, the second core area of the EPI measures ecosystem vitality and natural resource management. Within this measurement is air quality, estimated by the level of urban particulates and ground-level ozone. A value for water resources was quantified through measures of water consumption rates and pollutants discharged into water bodies.

Government policy also receives attention in the measurement of this second core area. Government policies involving the maintenance of productive natural resources are measured with a focus on how these policies seek to protect natural resources versus exploiting them for economic gain. In regard to biodiversity and habitat, the indicators examine not only the percentage of land designated as protected wilderness, but also the evenness in the amount of protection accorded to various biomes. The latter is important because the internationally recognized goal of protecting at least 10 percent of a country's territory may still result in grave ecological damage if the spread of protection covers only a homogenous area. Finally, this second core area uses a measurement of sustainable energy created from data on energy consumption, the percentage of total energy from a renewable energy source, and carbon dioxide emissions per unit of GDP. This measurement of environmental performance is one of the most
comprehensive to date and is well tailored to the objective of our study. The relevance of these measurements is that they focus on government policies toward the environment, not necessarily on their outcomes, which can reflect the influence of numerous other factors.

Electoral System

For our main independent variable analyzing the affect of the electoral system, we run regressions with two different measures. We first use the World Bank’s Political Institutions dataset; it includes a dichotomous variable for the use of proportional representation in the legislative elections. A value of one indicates the presence of PR; however, a value of one may also indicate a mixed system in which voters determine a certain percentage of the legislature through PR and the remainder through plurality. This measure will tell us if the presence of PR, whether the sole vote transfer mechanism or part of a mixed system, has a significant effect on environmental performance.

We use district magnitude as the second measure of electoral system, taken from Joel Johnson and Jessica Wallack’s Electoral Institutions and the Personal Vote dataset. They code district magnitude for both the average district and the average legislator. The authors point out the precision of the latter measure, as it controls for exceptionally small or large districts. However, we choose to use the measurement of the average district due to greater availability of data. If a country has a district magnitude of one, then it uses a FPTP system, whereas numbers greater than one indicate the use of a PR system. This measurement allows us to better nuance our argument and separate electoral system effects, which helps determine the incentives that politicians face. Due to the vote-to-seat ratio, a country with an average district magnitude of two or three will be much more similar to a FPTP system than a country with an average district magnitude of fifteen. There are a few outlying cases, and we exclude all cases where district magnitude is greater than twenty-five. It is standard practice to exclude any extreme variables, as they have a tendency to skew results. With these qualifications in place, the district magnitude measurement thus enhances our ability to test the causal logic that PR systems allow smaller parties that focus on a single issue, such as, the environment, to have some representation in the legislature. Districts that elect a higher number of representatives, thus having a high district magnitude, provide more chances for small parties to gain representation; whereas, districts that elect a lower number of representatives, thus having a low district magnitude, encourage parties and candidates that appeal to a broad constituency and may discourage politicians and parties from taking a strong stand on the environment.

Control Variables

Several factors combine to explain environmental performance, and we attempt to control for these factors in order to accurately identify the effect of the main explanatory variable: PR. The environmental Kuznets curve (EKC) is a popular, if controversial, explanation of the level of environmental protection. The EKC is meant to predict the relationship between environmental degradation and economic development as measured by GDP. As a country begins to develop, the level of environmental degradation increases until it reaches a certain point of development, at which point environmental performance then begins to improve; this relationship graphically forms an inverted U-shape. According to Esty, the EKC can be broken down into three effects: technique effects, composition effects, and scale effects. Technique effects arise when greener technologies are developed; composition effects are defined by a shift in consumption preferences toward greener goods; and scale effects refer to higher degradation due to increased economic activity and wealth. The EKC defines the relative relationship among these three factors, with decreasing environmental degradation as a consequence of composition and technique effects outweighing scale effects. The relative effects of these factors indicate at which point of the EKC each country is located and determines the environmental effects of growth. This relationship necessitates that we account for the effects of economic development. Thus, we include a measurement of wealth in our model. We measure wealth as the per capita GDP of a country, adjusted for purchasing power parity. We take the log of GDP in order to reduce the right skew of the data and normalize it. The log of GDP lets us look at percent change rather than dollar differences in GDP among countries, which will allow for more meaningful comparison.

Contrary to the theory set forth in the EKC, our data actually estimates a linear relationship with respect to GDP and environmental performance as measured by the EPI. On account of the measurement of the EPI being somewhat nonstandard and more related to the political mechanisms for protecting the environment, a linear relationship seems more plausible. While the theoretical backing on the EKC is interesting and sometimes does explain certain cases, several authors have challenged the EKC’s assumptions on the distribution of income and the effects of trade, and its empirical validity.

While education levels, as reflected by literacy rates, may be strongly correlated to GDP, this variable addresses development in a broader sense than simply an increase in GDP. While the EKC generally addresses only the relationship between GDP and environmental degradation, the relationship may go beyond mere measurements of wealth to include the level of development as the definitive variable. Further, literacy will better address the changes in a country that are more specifically related to development. This variable could also measure any changes in attitude that are not accounted for in the post-
Beyond Materiality

While this index will estimate much of the change in attitudes due to economic development, it will not necessarily account for changes in attitude that relate to greater exposure to environmental issues. The use of the literacy rate as our education measurement accounts for the level of education throughout the entire population, which helps to eliminate the bias of social class and gender. Literacy also accounts for the effects of various types of education (e.g., informal, trade schools, etc.) increasing the overall level of education, which formal enrollment rates have difficulty capturing. Literacy skills will open up the channels of communication and knowledge, where even the ability to read a local newspaper could change environmental attitudes at a more basic level. This measurement then accounts for differences stemming from development and changes in environmental attitudes due to increased exposure.

Manus Midlarsky demonstrates the positive effect of democracy on environmental performance. Scholars have also shown that environmental degradation has a disproportionate effect on certain segments of the population, particularly the poor. Theoretically, democracies should allow these disadvantaged sectors to better convey their opinions and to better affect environmental outcomes. The incentive for politicians to gain support, and thus votes, should also impact the responsiveness of policy and performance in democracies. Autocrats who do not rely on a broad constituency to derive power and authority are less likely to care about conditions that do not directly affect them, such as, environmental degradation. With a strong theoretical backing and favourable empirical analysis, it is imperative to include democracy as a control variable. We measure it using the Polity IV dataset. This measurement scores countries from zero to ten, with ten being the most democratic. The rating is determined based upon four categories: competitiveness of political participation, competitiveness of executive recruitment, openness of executive recruitment, and constraints on the chief executive.

We have also included a transparency variable to determine the level of corruption in a country. First, corruption will affect the way the political system operates. High levels of corruption may impede the voters' check on their politicians, as voters may be prone to support a candidate due to bribery and favours rather than platforms and promised policies. Voters may not even cast their own votes, or votes may not all be legitimately counted. The absence of voters who are able to legitimately influence policy undermines the causal logic that we have put forth, in which PR systems are better able to incorporate small, single-issue parties into the government. If corruption obstructs the channels of democracy, then party platforms and issues may not have a significant affect on voters' choices.

The concerns regarding corruption are particularly salient in the consideration of environmental issues. As previously addressed, business interest groups and labor unions have significant resources available to them. In addition, big business may constitute one of the last groups to embrace restrictions meant to protect the environment, as such restrictions often lead to more expensive production costs and chip away at profits. In order to prevent the implementation of protective environmental policies, labor groups may draw on their deep pockets to convince politicians to pursue a different policy. While "bargaining" may never disappear from the political arena, this type of bribery will be less likely in a country with high levels of transparency; therefore, transparency should be positively related to the EPI.

We use the measurement of Transparency International to measure the degree of transparency in a country. Transparency International measures corruption on a scale of zero to ten, with ten being the most transparent. Transparency International defines corruption as "the abuse of public office for private gain," and uses surveys to determine perceptions of corruption in a given country. While Daniel Treisman points out that this does not account for the experiences of the average citizen with corruption, this study aims to understand corruption more generally across the country and to compare levels cross-nationally. Treisman also points out that the Transparency International ratings correlate strongly with other cross-national measures of corruption; this correlation allows for meaningful comparisons. It is important to mention that we have also included a squared-term for transparency. A look at the data reveals a curvilinear relationship between transparency and the EPI. The regression results when a squared term was not included indicated the need to account for this nonlinear relationship. Statistical significance improves with the addition of a squared term, allowing us to better predict the level of environmental performance.

The causal logic that we put forth also necessitates the inclusion of environmental attitude in our model. If electoral systems are to have any affect on environmental performance it is through the means by which they encourage politicians to appeal to their constituencies and the way in which they capture voters' attitudes. Whether citizens of a country generally support environmental protection, are indifferent to it, or do not place it as a high priority that will affect the attention given to the environment in the political arena. If voters do not care about the environment, then even the emergence of a party that focuses on environmental issues may be unlikely, not to mention the likelihood of the party's rise to power.

In any study, one finds great difficulty in accounting for and predicting attitudes. Attitude discernment is complex even with well crafted surveys and the high
level of variance among populations makes it challenging to obtain an accurate sample. The World Values Survey\textsuperscript{32} no doubt faces these constraints, but still assembles the most complete compilation of values and attitudes in many countries. The World Values Survey asks a series of five questions about the environment, but none seemed to capture the overall value placed on environmentalism and the level of environmental protection in the country. In addition to this, the World Values Survey included fewer measures of environmental attitudes than our final measurement did; this reduced our total observations and detracted from the significance of the analysis.

We turned instead to the two questions on the World Values Survey that ascertain the presence of post-materialism, and subscribed to Ronald Inglehart’s\textsuperscript{35} assertion that as material needs are met, people then turn their focus to non-material concerns. Several scholars\textsuperscript{34} have shown that environmentalism should be included as a post-materialist value, and the degree of materialist values in a country indicate or are at least strongly correlated with environmental attitudes. The post-materialist values indicator combines answers from two questions (see Appendix), the composite of which determines if a country is materialist (a score of one), post-materialist (three), or a mix (two). Thus, we expect to see a positive coefficient on this variable, as a higher value reflects the presence of post-materialist values. Again, while the inclusion of this variable reduces the number of cases by about half, the theoretical arguments for its inclusion are compelling.

**Methods**

We will test our hypotheses using an Ordinary Least Squares (OLS) regression. Our analysis includes fifty-five countries. The limited availability of data on environmental attitudes creates the main limitation on the number of cases we have included. However, we cannot ignore the strong theoretical reasons to include environmental attitudes in our analysis, and so we proceed with a limited number of cases. Our case selection also runs the possibility of bias due to the fact that there were disproportionately more developed countries in our survey than there were less developed countries than a random sample would generate; twenty-eight out of the fifty-five countries sampled are members of the OECD. This is most likely because the World Values Survey is biased toward countries that are more developed, possibly as a result of lower survey costs due to existing infrastructure, less restrictive governments, or communication barriers. In any case, the variables for attitudes decreased our survey from ninety-eight observations to fifty-two observations, leaving out many developing countries and keeping in all members of the G-8 and all but one of the OECD countries (Luxembourg). If there is some inherent difference between these developed and less developed countries this could bias our results. This bias could be due to higher education that basic literacy is unable to control for, some kind of nonlinearity with GDP, or cultural differences that attitudes are unable to pick up. Therefore, we attempt to control for this relationship between development (a broader definition of development than income provides) and environmental performance using a binary variable for OECD membership. The summary statistics are included in Table 1 (page 54):

The data section discusses some of the challenges encountered in this analysis. The reliance on the data collection of others always poses some concern, particularly due to the risk of miscoded information. While most of the data that we have used comes from fairly standard sources, such as the World Bank and the Polity database, the survey data from Transparency International and the World Values Survey may potentially be susceptible to these problems. Survey research poses a problem in any field. Problems can occur in the creation of the survey (certain questions may produce biased answers), the execution of the survey (communication problems, self-reporting, disinterested respondents), and the coding of the information obtained through the survey. While both Transparency International and the World Values Survey are well executed surveys and reputable sources, these challenges remain a legitimate concern. Furthermore, extracting the attitudes of an entire country on a polarizing issue like the environment always constitutes a formidable challenge.

**Results**

**Dummy PR Variable**

In order to accentuate the importance of our main model and the findings on the significance of the district magnitude, we have included the original model using a dummy variable for PR. The variable is coded one, if any type of PR system is in place, and zero, if not. Based on the literature, we first predicted that PR would have a significant and positive effect on the EPI. Using this variable as a general measure of the many theoretically positive effects of PR on the environment (\textit{i.e.}, both the consistency argument and the special interest group argument), this measure shows how the identification of a country’s political system affects its environmental protection. This measure does not account for the possibility of varying degrees of representation, or differentiate between any theoretical causal mechanism. Thus, we began our estimation using a binary for PR, and the results are shown in Table 2.

At first, these results seemed to do a good job of explaining the differences in environmental performance among different countries. The \( R^2 \) at 0.82 is high, meaning that the model explains approximately 82 percent of the variation in the EPI. The remaining 18 percent may be explained by variables that are not controlled for by the model, or more likely may represent inherent vari-
Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Median</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Performance Index (EPI)</td>
<td>41.1 88</td>
<td>75.55</td>
<td>71.52</td>
<td>11.93</td>
</tr>
<tr>
<td>Literacy</td>
<td>41.1 99</td>
<td>97.75</td>
<td>91.47</td>
<td>13.54</td>
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<tr>
<td>GDP per capita</td>
<td>723 42,364</td>
<td>11,489</td>
<td>15,962.42</td>
<td>12,434.89</td>
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<tr>
<td>Log GDP</td>
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<td>9.35</td>
<td>9.27</td>
<td>1.03</td>
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<td>Democracy</td>
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<td>9</td>
<td>7.42</td>
<td>3.42</td>
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<tr>
<td>Transparency</td>
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<td>3.95</td>
<td>4.88</td>
<td>2.57</td>
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<tr>
<td>Transparency Squared</td>
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<td>15.61</td>
<td>30.28</td>
<td>29.03</td>
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<tr>
<td>District Magnitude</td>
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<td>6.46</td>
<td>19.59</td>
<td>37.90</td>
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<tr>
<td>Post-Materialist Values</td>
<td>1 3</td>
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<td>1.48</td>
<td>0.57</td>
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</table>

Table 2: Regression Estimates for Model Using Binary PR

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<tr>
<th>Variables</th>
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<th>Std. Error</th>
<th>T-statistic</th>
<th>P-value</th>
<th>R² = 0.82</th>
<th>Adj R² = 0.78</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-10.03</td>
<td>14.12</td>
<td>-0.71</td>
<td>0.481</td>
<td>0.82</td>
<td>0.78</td>
</tr>
<tr>
<td>Literacy_2005</td>
<td>0.28</td>
<td>0.08</td>
<td>3.76</td>
<td>0.001</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Log GDP</td>
<td>4.86</td>
<td>2.06</td>
<td>2.36</td>
<td>0.023</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Democracy</td>
<td>-0.59</td>
<td>0.39</td>
<td>-1.53</td>
<td>0.132</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Transparency</td>
<td>3.13</td>
<td>2.47</td>
<td>1.26</td>
<td>0.213</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Transparency²</td>
<td>-0.20</td>
<td>0.19</td>
<td>-1.06</td>
<td>0.293</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Binary PR</td>
<td>1.36</td>
<td>2.15</td>
<td>0.63</td>
<td>0.530</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Attitudes</td>
<td>3.01</td>
<td>1.70</td>
<td>1.77</td>
<td>0.084</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>OECD</td>
<td>1.52</td>
<td>2.68</td>
<td>0.57</td>
<td>0.572</td>
<td>0.28</td>
<td>0.28</td>
</tr>
</tbody>
</table>

ability. Overall, this is compelling evidence that the independent variables are well chosen and that the model is valid.

These results correspond well to those estimated in the second model, but there are some unexpected findings. The variables for literacy, GDP, and democracy all have fairly consistent estimates, and the significance does not change between models. Literacy works well as a control variable, as it is strongly correlated with environmental protection, and GDP has a similarly predictable result, as it is also significant and positive. Surprisingly, GDP and literacy are the only statistically significant variables at the .05 confidence level, yet the model overall holds strong predictive power, which may indicate some degree of multicollinearity.

Another similar red flag for multicollinearity is the negative, statistically insignificant coefficient on democratic openness. This result would imply that greater democratic openness and transparency leads to less environmental protection, yet the opposite result has been empirically proven previously. Multicollinearity is often exhibited in strong overall estimation with few individually significant variables, and if multicollinearity is present it can also predict the wrong signs for some coefficients. Multicollinearity is likely the culprit behind this surprising prediction on democratic openness.

Democratic openness has proven to be highly correlated with education levels and GDP and is apt to be correlated with favorable attitudes toward the environment. Citizens in a country that is more open to democracy, oftentimes, have greater opportunities for education beyond basic literacy—these effects are not picked up by our literacy variable. Also, as democratic openness increases, knowledge regarding global environmental problems may be disseminated more quickly to the general public, as reflected by a freer press. These two effects could theoretically lead to some sort of correlation between democratic openness and attitudes. Strong empirical support validates a correlation between these variables.

The predictive power of democracy and attitudes together is significant with an F-stat for democracy and attitudes together as 2.58, yet neither coefficient is sig-
significant on its own at this high level. While the estimation on democratic openness is unexpected, our model is still valid and this estimate does not bias our main explanatory variable in any way. While this model as a whole has good explanatory power and lends legitimacy to our variable selection, the statistical insignificance of some of the results reduces its validity.

This model estimates the level of transparency as statistically insignificant. We expected transparency to increase the level of environmental performance at a decreasing rate, so the model exhibits the expected signs; however, the P-values are very high which really limits the model's credibility. The estimation on attitudes also presents a variable with the expected sign, but the results are not significant. Surprisingly this significance changes when a more precise specification of PR is used in the next model. We will explore the potential reasons for this change in significance, but first let us review our main explanatory variable and its effect in this model.

Initially, we predicted that the binary PR variable may not be significant simply due to multicollinearity; therefore, we tested the correlation between democracy and PR, as it seemed to have the most intuitive connection. The correlation matrix is as shown in Table 3.

Because the PR and democracy variables exhibit some degree of multicollinearity, we assumed that perhaps the low and insignificant effect of PR was simply consumed in the coefficient on democracy. However, looking at the correlation matrix, we can see that democracy and PR are not very highly correlated. Also, the F-stat on this variable is only 1.24, showing that both variables together do not significantly predict the EPI. After analyzing the data through these and other tests we determined that the binary PR value simply did not have the significant effect that we had predicted. While at first disheartening, this makes the results for the second model using district magnitude all the more interesting.

**District Magnitude**

In the second model, we estimated the effect of PR using a different measurement, and found that it significantly affected the EPI. In the second and most important model (Table 5) the only modified variable is that representing PR, changing from a binary to the number elected to the legislature from each district. This model more accurately estimates the degree of proportional representation because as this district magnitude increases it reflects the variance of the voters' preferences with more precision. A higher number of seats also increases the likelihood of smaller interest groups obtaining seats in the legislature; this occurrence directly relates to one of the theoretical reasons why PR matters. We hypothesized earlier that a larger role for small interest groups facilitates more “green” policies; hence, the number of members in a district should lead to a significant, positive effect on environmental protection. The estimates for this second model are shown in Table 4.

We are correct in our hypothesis that the number of members in the legislature elected from each district is a more accurate predictor for the environment. Our $R^2$ increases by almost 5 percent while the number of variables stays the same, showing that the overall explanatory power increases. In terms of the control variables, literacy and GDP still have a significant, positive

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**Table 3: Correlation Matrix for Democracy and PR**

<table>
<thead>
<tr>
<th></th>
<th>Democ</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Democ</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td>0.397</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Table 4: Regression Estimates for Model Using Number of Members in a District**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>T-statistic</th>
<th>P-value</th>
<th>$R^2 = 0.839$</th>
<th>Adj $R^2 = 0.81$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-16.6</td>
<td>12.13</td>
<td>-1.37</td>
<td>0.178</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literacy_2005</td>
<td>0.23</td>
<td>0.07</td>
<td>3.18</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log GDP</td>
<td>5.63</td>
<td>1.80</td>
<td>3.12</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Democracy</td>
<td>-0.45</td>
<td>0.33</td>
<td>-1.38</td>
<td>0.173</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparency</td>
<td>4.42</td>
<td>2.41</td>
<td>1.83</td>
<td>0.073</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparency'</td>
<td>-0.33</td>
<td>0.19</td>
<td>-1.69</td>
<td>0.097</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Member dist.</td>
<td>0.32</td>
<td>0.148</td>
<td>2.14</td>
<td>0.038</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>3.11</td>
<td>1.70</td>
<td>1.83</td>
<td>0.075</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OECD</td>
<td>0.01</td>
<td>2.62</td>
<td>0.00</td>
<td>0.997</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
effect on environmental performance, which confirms previous research on the subject. The only real issue with this model is the consistently unexpected sign of the coefficient on democracy. The only thing that this could mean is potential multicollinearity, but this does not pose any problems with the rest of our estimates, as discussed earlier. This model does, however, solve all of the other difficulties in estimation with the previous model.

We can see that the magnitude and significance of political attitudes increases with this model because we have a more precise estimation of the role of special interests. This is consistent with the belief that a greater diversity of interests is represented with an effective PR system, and thus, environmental attitudes matter more in terms of policy. Environmental attitudes are better represented in a PR system, and this can be seen through more environmentally sound policies. Other control variables also prove to be more significant in this model.

The coefficients on the transparency terms increase in significance to the point that they are significant at the 0.10 level. As Torsten Persson and Guido Tabellini have shown, PR actually has a slightly positive effect on transparency and similarly, with a more precise measure for PR, corruption matters more in our model. We hypothesized that an increase in transparency would actually create better environmental performance. Environmental amenities and natural resources are important public goods that depend on the right incentives for governments— incentives that are skewed by corruption. Therefore, controlling for this nonlinear relationship is important in proper estimation.

The coefficients on the transparency and the transparency-squared variables show the direction in which transparency effects the environment, and then the rate at which this effect is taking place (as it is nonlinear it will not affect environmental performance at a constant rate). The positive coefficient shows that at the mean, as transparency increases by one, the EPI is improved by 4.42, and the estimate on transparency-squared shows that as transparency increases, the rate at which it affects the EPI is mitigated. Conceptually, this could result from the transparency variable scale being nonlinear in some way (that is, a change from zero to one is larger than a change from four to five), or because a relationship exhibiting decreasing returns exists between transparency and environmental performance, or a combination of both these effects occurring simultaneously. The initial reductions in corruption could matter a lot to environmental performance as the conditions of anarchy and disorder (dumping environmental waste, bribing officials to bypass emissions standards, etc.) are mitigated. Yet, after a certain point, reductions in corruption are less dramatically related to the environment (these increases in transparency would create better electoral processes, etc.). Most likely, decreasing marginal returns to transparency account for at least a portion of this effect and, in addition to our main explanatory variable, could have interesting practical implications.

Our dummy variable control for OECD countries picks up an interesting and previously undisussed effect in both models. We included this variable to limit any selection bias because there are disproportionately more OECD countries than a random sample would include. This dummy variable controls for any inherent differences in environmental protection with respect to membership in the OECD versus non-membership, which might pick up any shifts in environmental protection that our control variables do not address. Our estimate is actually surprising because it shows no statistically significant difference between these two groups. The only estimates that change when we include the OECD dummy variable are those for literacy and GDP. This means that the OECD estimate is most likely picking up wealth and education effects. Estimating the model with a control for G-8 membership rather than OECD membership actually predicts the opposite effect, G-8 countries have worse environmental performance. However, this result is likely biased by the U.S. and Russia, who are notorious for relatively low environmental standards compared to other parts of the developed world. Thus, we can be assured that our model represents a robust predictor of environmental performance that guarantees the validity of the results on our main explanatory variable.

Our main predictor is significant when measured according to district magnitude, where the binary variable for PR versus FPTP is not significant. The measurement on district magnitude more precisely estimates the likelihood of a special interest group or party obtaining one or more seats in the legislature. Where a one-member district is a FPTP system and presents opportunities only for large and established parties, single-interest parties are increasingly likely to obtain seats in the legislature with a greater district magnitude. The coefficient shows that when one more member of the legislature is added from each electoral district, the EPI increases by .32; this information confirms our hypotheses that PR matters because of increased opportunities to special interest groups.

While the coefficient on district magnitude may seem insufficiently large to represent real, tangible change in environmental performance, it is important to again look at the measure of the EPI. The EPI measures environmental health, air quality, water resources, biodiversity and habitat, productive natural resources, and sustainable energy. While governments have a substantial influence on environmental performance, there are nevertheless constraints on both the policymaker's realm of influence and natural factors. In addition to the control variables accounted for in this model, variability in the EPI can also be explained by colonial heritage, pollution from external sources where effects are distributed interspatially, deg-
radation where effects are distributed intertemporally, international standards, or environmental shocks, specific to each country. Hence, while the effect of district magnitude may initially seem insignificant, due to the variety of complex determinants of environmental performance, any political influence should be given due credit.

Conclusion

As our results show, the mere presence of a PR system does not significantly influence a country's environmental attitudes; rather, the district magnitude in PR systems is the determining factor. These results are important for two principal reasons. First, we are able to access the inner workings of democracies as they interact with policies and constituents. In this instance, the results themselves are not as important as the fact that there are results and that they show a noticeable difference in the performances of democracies.

But why is this significant? The advantages of democracies over non-democracies are so obvious and so multitudinous that it becomes tempting to ignore the differences among democracies for the facile contrast between democratic systems and other systems. Too often, dysfunctional democratic states are lionized for the sheer fact that they are democratic instead of being offered comparisons and suggestions from more functional states. Along this same vein, non-democratic states are merely urged to "democratize" without being offered specific examples or methods to do so.

This research will help with states' attempts to improve their environmental records. This research shows the importance of incorporating smaller groups into the political arena and the effects that this will have on environmental policy. The implications of our study do not limit themselves to improving environmental attitudes or the study of electoral systems. This disparity among democratic electoral systems and their environmental performance should be considered indicative of larger trends within the study of democracies.

Following these results, research should be done to determine what aspects of democracies affect such vital issues as women's rights, education, economic growth, or even human rights, all issues whose representation in democracies is hardly equal. When this research is done, states will be able to analyze the results and compare them against the specific aspects of their governing systems. Thus, states participating in human rights abuses will see what influences respect for human rights in other democracies, or states that need to give more equal opportunities to women will see what specific aspects of democracy have the most positive correlation to women's rights. Furthermore, when currently non-democratic states do decide to democratize, they can look at the problems unique to their country, the corpus of research devoted to those certain problems, and, then, choose to implement democratic systems designed specifically to target those problems.

The second significant part of our research is the proven desirability of the integration of interest groups into the political arena in a way that is not driven entirely by money. The obvious differences between systems with low district magnitude, or FPTP systems, and PR systems with high district magnitude highlight the role that special interest groups play in the political system, specifically, the role that they are allowed to play and the effects they are allowed to have as determined by the limiting factors of the electoral system. The positive effects of an increased participation by special interest groups could easily translate to other areas of public policy or social needs. In addition to the increased role of special interest groups, the interaction between financial contributions from these groups and favorable legislation passed for them might be drastically reduced. As money gradually becomes less significant, confidence in the government is likely to grow and democratic institutions are likely to be strengthened.

NOTES

13. Cox.
15. Melzer and Vellrath.
23. Esty.
26. Midlarsky.
35. Midlarsky.

REFERENCES