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Political and Social Foundations for Environmental Sustainability

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This article quantitatively investigates several possible foundations for environmental sustainability, as measured across countries with varying geography, development patterns, social customs, and political arrangements. Two central hypotheses about the roles of democracy and federalism, as well as other hypotheses about economic development, religion, and demographics, are tested. The study provides moderate evidence that sustainability levels depend on democratization, but little evidence that it depends on the presence of federalism. In addition, it is found that the effects of environmental interests, development paths, and religious orientations vary across different measures of sustainability.

Keywords: *sustainability; environmental policy; democracy; federalism*

Numerous recent studies have offered solutions to the problem of achieving environmental sustainability—the long-term preservation of our environment for the future. Scholars have offered any number of principles for development (e.g., Dresner 2002), design approaches (e.g., Birkland 2002), leadership lessons (e.g., Fullan 2004), measurement strategies (e.g., Bell and Morse 2003), production ethics (e.g., McDonough and Braungart 2002), and change strategies (e.g., Doppelt 2003; Edwards and Orr 2005) to guide societies away from older forms of engagement with the environment to new (and presumably better) ways of doing things. Many policy analysts see technological change and development as spurring the search for growth patterns that balance the economy and quality of life while maintaining the environment. Of course, it is difficult to find a conclusive combination of factors that describe a country's level of sustainability. Moreover, there is no clear understanding of what factors underpin sustainability. Which political systems and social arrangements lead to greater sustainability?

The purpose of this article is to quantitatively investigate several possible foundations for environmental sustainability, as measured across countries with varying geography, development patterns, social customs, and political arrangements. We are primarily concerned with testing two central hypotheses about political institutions. First, does democratization increase sustainability? While numerous recent studies argue that democracy causes nation-states to shift their patterns of social benefit preservation, no study has assessed how democracy contributes to the protection of the environment at the levels this article addresses (see York, Rosa, and Dietz 2003; Jorgenson 2006; Shandra et al. 2004). Second, does federalism reduce environmental sustainability? Studies argue that environmental protection is lower when states within a given country compete for capital in-flows by reducing regulation. Our study asks whether federations experience lower levels of sustainability. We test these hypotheses in a setting where we account for other potential causes of environmental sustainability. We also assess the roles of groups representing different kinds of environmental interests, development paths, and religious orientations. We discuss specific hypotheses about these other potential causes below.

Environmental sustainability is value based, and because values change over time there is no one measure of environmental sustainability. We compare the effect of democratization and federalism in different contexts. First, we compare their effects for several dependent variables from the 2002 Environmental Sustainability Index (ESI) that measure aspects of sustainability (ESI 2002). The ESI approach quantifies whether countries safeguard their resources effectively, using sixty-eight data sets to construct a global index of sustainability and five

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components of the index; we first use the global index and three components—environmental systems, reducing environmental stresses, and reducing human vulnerability. This comparison allows us to disentangle the effects of two components that are included in the global index: the fourth (societal and institutional capacity) and fifth (global stewardship) measures include attributes of countries that are potentially causally connected to the first three (York, Rosa, and Dietz 2003; Jorgenson 2006). While some criticize the ESI because of data gaps, methodology, and weighting methods (Esty 2001; Jha and Murthy 2006), the ESI data are accepted as the most comprehensive approach to measuring sustainability (e.g., Green and growing 2001); their use—especially at the policy-making level—gives reason to investigate their causation. The ESI data used in our analyses are adjusted to account for these methodological criticisms (Gelman, Abayomi, and Levy 2005). In addition, we address the effects of democratization and federalism in the context of five subcomponents that measure specific aspects of national-level environmental quality: air quality, water quantity, reducing air pollution, reducing water stress, and environmental health.

We offer a series of models of these attributes that allows for hypothesis testing while accounting for other potential relationships in the data. When modeling the three components, we use seemingly unrelated regression (Zellner 1962), which allows us to test for the effects of democratization and federalism across multiple dependent variables. We find moderate evidence for the effect of democratization, although the effects vary across the measures of sustainability. We find little support for federalism as associated with any of the measures of sustainability. We find that the effects of economic development (both current and historical), different environmental interests (business environmental practices and international environmental organizations), and religious affiliations vary with our measurement of sustainability. Together, these findings portray a complex and varied set of foundations for environmental sustainability.

The next section discusses the factors our model assesses as potential causes of sustainability. After that, we discuss our measurement strategies and estimation approach. In the fourth section, we review the results of the models. Finally, we discuss our theory, data, test, and the implications of our results for our understanding of environmental sustainability.

Foundations

Much theorizing about environmental sustainability centers on the roles of political institutions in framing and representing latent social interests (like environmentalism), political systems that increase the power of capital and reduce regulation, beliefs that support use of the environment for human goals, the power of social forces to attain environmental goals, or the development paths of countries. We first review two central political institutional arrangements, democracy and federalism, and then review two theories about political forces for environmentalism. Finally, we review additional hypotheses about development paths and religious orientations.

First, we offer the hypothesis that a country's level of democratization is positively associated with a country's commitment and ability to attain environmental sustainability. Studies have asked whether democracies are more environmentally committed (Congleton 1992; Midlarsky 1998; Barrett and Grady 2000; Gaston and Fredriksson 2000; Gleditsch and Sverdrup 2002; Neumayer 2002; Grafton and Knowles 2004; Jorgenson 2006; York, Rosa, and Dietz 2003). These mostly argue that the free speech and press rights associated with democracies make citizens more informed about the importance of the environment and ways to alleviate environmental stresses. Armed with this knowledge, citizens of democracies will place greater pressure on their government for positive environmental policy. However, the same individual liberties that lead to greater environmental commitment can also lead to greater environmental stress. Whether democracies are better able to commit to environmental sustainability depends on balancing the desires of citizens and the desires of businesses in a democracy. Some studies have assessed this but often only at the cost of selecting cases from only industrialized democracies (e.g., Scruggs 1999, 2003). Most studies find a positive effect, but many are limited to policy outputs like accession to specific treaties (e.g., for the protection of the ozone layer or endangered species. Others find varied support for improved outcomes, usually for air and water pollution.

While much of the debate has occurred over the measurement of democracy, little attention has been paid to democracy's effects on aggregate outcomes. Consideration of particular policies is a useful route of inquiry, as is gaining knowledge of democracy's effect on specific policy outcomes. Yet, aggregate information is at the core of considerations of environmental sustainability. Is democracy a prerequisite? Are inferences about the role of democracy policy-specific? To answer these questions, we offer the hypothesis: when democracy is more prevalent (and thus countries are less autocratic), a country's environmental policies are more sustainable.

A foundation for sustainability is the constitutional choice to have a federal system. Studies have asked

whether federalism is associated with lower environmental quality (Lowry 1992; Scruggs 1999; Eser 2002; Helland and Whitford 2003; Rabe 2004, 2005). The answer appears to depend on context. Within countries, it is clear that states can make policy choices that lead to lower levels of environmental protection. The vertical delineation of tasks often makes it difficult to coordinate and execute environmental policy. Environmental damage does not respect boundaries, so national implementation might be more effective. The core hypothesis is usually that aggregate environmental protection suffers from a "race to the bottom" when more active states push through stringent environmental laws, but other states (catering to capital and business interests) loosen their environmental regulations in response to perceived flight risk. We note, of course, that the increased power of capital may not be a byproduct but instead an intentional outcome for federal systems that are intended to be "market-preserving" (Weingast 1995). While there is evidence that states vary in terms of environmental commitment, other analyses show limited differences (but those studies have rarely addressed federal systems in less developed areas). We assess this claim in a set of countries with varied social, economic, and political features by offering this hypothesis: federal systems have lower aggregate sustainability.

We contrast these two hypotheses centering on the role of political institutions with two additional hypotheses regarding the presence of environmental interests. Why would outcomes depend on interests? At a minimum, complex societies include many interests and political forces, so the relative presence of interests increases the chance of increased state activity with regard to the environment. Of course, how interests are translated into state action will depend on a country's political system. In the United States and Western Europe, the process of rule development (in administrative procedures or encapsulated in corporatism) allows for the formal participation of interests (e.g., Mazmanian and Nienaber 1979; Taylor 1984; Scruggs 1999). Alternatively, in a coproduction relationship, the groups themselves may take voluntary actions that produce positive environmental outcomes (Mol, Lauber, and Liefferink 2000). We assess the influence of two broad types of environmental interests: the presence of international environmental pressure organizations, and degree to which firms in the country engage in environmental self-regulation.

First, we assess whether the presence of international environmental organizations (IEOs) and nongovernmental organizations (NGOs) has a significant influence on sustainability. Put broadly, a greater number of IEOs and NGOs may reflect enhanced citizen attitudes toward preserving the environment; those citizens can pressure the government for enhanced sustainability (Jasanoff 1997). Shandra et al. (2004) show that countries with more international environmental organizations have much lower levels of carbon dioxide emissions. Evidence for this causation has certainly been found in Western Europe (Carter 2001). Can it be generalized to broader measures of environmental sustainability, or to nonindustrialized nations? Our hypothesis is: increased presence of IEOs will be associated with higher levels of environmental sustainability. Second, we assess the role of firms' voluntary compliance with environmental management system (EMS) regimes that may support sustainability. In essence, compliance with ISO 14001 makes firms' processes more adaptable by facilitating technology information exchange and helping social and market images, and it may produce environmental benefits (Clapp 1998; Markowitz and Rosner, 2002; Potoski and Prakash 2005). Ultimately, firms engage in regulatory self-compliance to help themselves; does it also contribute to better environmental outcomes, especially when accounting for levels of development across nations? Our hypothesis for this mechanism is: increased adoption of an EMS (specifically, ISO 14001) is associated with higher levels of environmental sustainability. Because of the nature of our test, we must guard against potential reverse causation: that lower levels of sustainability spur the creation of environmental organizations, or that lower levels of sustainability spur the adoption of an EMS like ISO 14001.

We also argue that other factors may contribute to a country's sustainability, including a country's development path and its mix of religions. In the Porter hypothesis, environmental progress can be achieved without sacrificing competitiveness; yet sustainability is not directly caused by increased GDP (Porter and van der Linde 1995). Esty and Porter (2001) show that strong environmental performance is positively correlated with competitiveness and national income, they also show that there are dramatic differences in environmental performance among different countries at similar economic levels. Related is the question of an inverted U-shaped relationship between national income and pollution (Grossman and Krueger 1995), although evidence is limited in large samples and to very specific policy-outcome measures (Stern 2004). We assess a compound hypothesis: as national income increases, environmental sustainability falls, but that sustainability increases at

higher levels of national income. We test this relationship by including a quadratic term. We note that Grossman and Krueger provide evidence when their dependent variables are pollution levels, whereas our evidence would occur when the dependent variable is sustainability (which moves inversely with pollution). This explains why our predicted effects are oppositely signed from the typical inverse-Kuznets argument (see also Shandra et al. 2004). We also recognize, though, that evidence for the inverse Kuznets explanation of sustainability is sparse and often only present when measured at the local level (e.g., York, Rosa, and Dietz 2003, 287).

In addition, we assess whether historical development paths affect environmental outcomes. We do this first by asking whether being a common law country and the support of property rights are negatively correlated with environmental sustainability. Property rights allow for security of contract and capital, but property rights also lead to rapid economic growth and decreased environmental sustainability (Acemoglu, Johnson, and Robinson 2000; La Porta et al. 1999). Our hypothesis is: English origins are associated with lower levels of environmental sustainability. English origins are likely a cause of national income and economic growth; however, the mechanism that underpins that relationship is a particular treatment of private property in the common law regime—and that treatment has important implications for the protection of common property resources and thus environmental sustainability. We also recognize that the presence or absence of certain natural resources is likely associated with environmental sustainability. We offer the hypothesis that countries with larger petroleum reserves will experience lower environmental sustainability. The mechanism here is straightforward—that petroleum extraction reduces environmental quality (e.g., Kaufmann 1995).

We note that we omit from our model a traditional measure that is included in other models that explain policy outcomes: the level of "state environmentalism," often measured as an index of environmental treaty ratification (Dietz and Kalof 1992; Roberts, Parks, and Vasquez 2004; Jorgenson 2006). One reason is that empirical studies often show that state environmentalism as measured by the adoption of institutions does not necessarily translate into improved conditions (Buttel 2000; Fisher and Freudenberg 2004; York, Rosa, and Dietz 2003; but also see Jorgenson 2006).

We also assess an additional mechanism in religiosity. Religion acts as a major driving force in many people's lives, and different religions dictate differently on the environment. There are multiple threads to our reasoning here. Historically, the debate has centered on the relative roles in Judeo-Christian religious systems of the "dominion" belief versus the "stewardship" belief (e.g., Tarakeshwar et al. 2001; White 1967; Woodrum and Hoban 1994). On one hand, recent advances in "eco-theology" suggest that there can be a religious foundation for advances in environmental sustainability (Haught and Holmberg 1996). Some Catholic theologians have expressed the sentiment that the earth is God's gift to be properly respected (Ven 1994). Yet, the Protestant work ethic also served to justify capitalism as an economic system, with effects on the environment in North America and Europe (Ezzy 2004); moreover, more literal Judeo-Christian beliefs have been shown in multiple countries to result in overall lower concern about the environment and a relative emphasis on anthropocentric versus eco-centric concerns (Schultz, Zelezny, and Dalrymple 2000). In the United States, the evidence for a direct effect of religious tradition and commitment on pro-environmental beliefs is sparse, although conservative eschatology does predict perspectives (Guth et al. 1995). In a cross-national analysis, Catholics have been shown to have less support for economic policies to protect the environment than liberal Protestants, although the evidence is limited to only a few countries that have English origins (Hayes and Marangudakis 2000).

Most of the studies of religiosity and pro-environmental beliefs and action have taken place in the developed world, a situation that has lead to calls for more work on datasets that include developing countries (Stern 2000; Rice 2006). One consequence is that we have little knowledge of the relationship between Islam and environmental outcomes. Interestingly, Islam has substantial theological, philosophical, and ethical overlap with aspects of environmentalism (Dien 2000), which can be interpreted in stewardship terms (Foltz, Denny, and Baharuddin 2003). However, this encoding has not always translated into environmental policy, with environmental issues often secondary to economic development (Ouis 2003). Islamic religious teachings and religiosity are correlated with pro-environmental behavior, "thus lending support to the presence of an Islamic environmental ethic" (Rice 2006, 373). Of course, even if a religion espouses a given moral responsibility toward the environment, that encoding does not always translate to environmental sustainability (e.g., Berry 2003). We offer three hypotheses: that a greater presence of Protestants (or Catholics) is associated with

lower levels of environmental sustainability, and that a greater presence of Muslims is associated with higher levels of environmental sustainability. For Judeo-Christian beliefs, "dominion" and "stewardship" are competing hypotheses.

Finally, we control for two additional demographic effects. The first helps identify the relative contribution of religiosity in our three measures of religious affiliation by accounting for the diversity of cultural beliefs and affiliations within the country. Scholars have identified ethnolinguistic fractionalization (ELF) as an important barrier to achieving political and economic stability (e.g., Annet 2001; Easterly and Levine 1997). Essentially, high levels of ELF record when there are many minority groups. Also, population pressure is a well-known explanation for cross-national variation in environmental impact (e.g., York, Rosa, and Dietz 2003).

Model Specification

We next describe the variables collected for the countries included in this study. In this study, we looked at variables that could affect (directly or indirectly) the environmental sustainability of a country. Our data include evidence from eighty countries representing a wide variety of social and development attributes (see the appendix). Our choice is dictated by data availability to insure the causal sequencing of dependent and independent variables.

Our first dependent variable, the Environmental Sustainability Index, was built in 2002 under the auspices of the Global Leaders of Tomorrow Environment Task Force of the World Economic Forum by Yale University's Center for Environmental Law and Policy and Columbia University's Center for International Earth Science Information Network. The ESI measures progress toward reaching the overall goal of environmental sustainability for a broad array of countries by accumulating evidence on sustainability from twenty indicators that each combine from two to eight variables. There are sixty-eight datasets that are combined to measure the relative success of countries for five components: Environmental Systems, Reducing Stress, Reducing Human Vulnerability, Social and Institutional Capacity, and Global Stewardship (ESI 2002). Our first variable is the complete single (unidimensional) ESI Index, which ranges from 23.9 to 73.9 in our data. The three lowest scores on the ESI measure in our data are Kuwait, Saudi Arabia, and Haiti; the three highest scores are Finland, Norway, and Sweden.

We then move our focus to three components of the total ESI given our concern that the last two components, Social and Institutional Capacity and Global Stewardship, are likely causally related to the first three components. Our second variable, Environmental Systems, describes the current state of the natural environmental and the physical and biological interactions that go on within it; its purpose is to describe a country's current environment maintenance level and where that country's environmental systems are heading. The 2002 ESI uses air quality, water quality, biodiversity, and anthropogenic land impact as indices of environmental system quality. Air quality is measured by the concentration of NO_2, SO_2, and total suspended particulates and indoor air pollution from solid fuel use. Biodiversity includes the percentage of a country's territory in threatened eco-regions and the presence of different indigenous species within each country. For water quality, measures include oxygen, suspended solids, and phosphorus concentrations, electrical conductivity, and the availability of freshwater and groundwater per capita. The score ranges from 18.1 to 90.4. The three lowest scores on this measure are Haiti, Kuwait, and the Philippines; the highest are Canada, Finland, and Norway.

The third dependent variable is Reducing Environmental Stress, which includes anything that can damage and drain our natural environment (e.g., human stress such as pollution and overconsumption of natural resources, natural stresses such as storms or droughts). Naturally, every country experiences environmental stress; this measure relates relative differences. The measure represents a collection of indices for air pollution, ecosystem stress, population pressure, waste and consumption pressures, water stress, and the management of natural resources. Among included measures are: the amount of NO_X, SO_2, volatile organic compound emissions, coal consumption, and vehicles in use per populated land area; average forest change rate and acidification from anthropogenic sulfur deposition; the change in projected population and the total fertility rate;[1] biological oxygen demand emissions per available freshwater; fertilizer and pesticide consumption and the presence of severe water stress; waste and consumption pressures like waste recycling rates and the generation of hazardous wastes; and fishing productivity, agricultural subsidies, salinized area as a percentage of arable land, and the degree to which forest area is certified for sustainable management. Our third variable ranges from 9.4 to 69.6 in our data. The three

lowest scores on the Reducing Stress measure in our data are Belgium, Kuwait, and the United Kingdom; the three highest scores are Cuba, Armenia, and Mozambique.

Our fourth dependent variable is Reducing Human Vulnerability to Environmental Stresses; this variable measures society's capacity to withstand these environmental stresses. By lowering their vulnerability, societies are better prepared to withstand environmental alterations and possible national environmental policy changes. The ESI vulnerability measure addresses environmental health, basic human sustenance, and exposure to natural disasters. Included measures are death rates from intestinal infectious diseases, the child death rate from respiratory diseases, and the mortality rate for children under five; the percentage of undernourished and the percentage of population with access to improved drinking water sources; and the average number of deaths per million inhabitants from natural disasters and the country's environmental hazard exposure index score. Our fourth dependent variable ranges from 5.4 to 85.1 in our data used in our models. The three lowest scores on this measure in our data are Mozambique, Burundi, and Malawi; the three highest scores are the Netherlands, Austria, and Sweden.

For each dependent variable, a higher score on each scale is interpreted as representing an outcome that is more environmentally sustainable. More importantly, as other studies have noted, one issue for the ESI data is that not all variables are available for all countries, leading to potential bias in the construction of the system, stress, and vulnerability scales. We limit this problem in our data by using the Gelman, Abayomi, and Levy (2005) measures for each scale. Gelman et al. used multiple imputation to construct robust measures by imputing missing values for the underlying variables. Essentially, multivariate imputation is a linked set of regression models that allows for constructing imputed values for each of the underlying measures used to construct the Environmental Stress, Environmental System, and Human Vulnerability scales. For each measure, the imputations for both variables were corrected based on residuals identified from observed data. Multiple imputation is usually used when data are missing at random (MAR). Gelman et al. used a Sequential Regression Multivariate Imputation (SRMI) approach in which generalized linear models are used iteratively to estimate missing values in the data, which allows for the construction of complete scales for all countries in the sample. Specifically, the question of MAR is whether "the parameters governing the missingness process (i.e., patterns of missing data) are independent of the parameters of the complete data model," so that "the missing data mechanism is called ignorable" (ESI 2002, 52). SRMI is less restrictive, although it is more restrictive than other simulation methods. Gelman et al. show that the estimated latent indices for the ESI are virtually the same using either the SRMI or Markov chain Monte Carlo (MCMC) approaches, and so they opt for the simpler technique.

Our measure of democracy is the Polity IV scale constructed by Gurr and Jaggers (1996).[2] This is a score assigned to each country based on the level of democracy versus autocracy within its political system based on the general "openness" or "closedness" of political institutions. They examined numerous indicators such as the constraints on the chief executive, the regulation and competitiveness of participation, and the openness of executive recruitment. Scores are generated by subtracting "autocracy" from "democracy" and rescaled to create a scale of 0 to 20; countries with higher scores are more democratic. The three lowest scores on the democracy measure in our data are Saudi Arabia, Bhutan, and Oman; the three highest scores are Denmark, Belgium, and the United States. We note that other studies reviewed above that have examined the effects of democratic institutions have used other measurement schemes (notably from Freedom House).

Our measure of federalism describes whether the state or provincial governments are locally elected. It records a 0 if neither the local executive nor the local legislature is directly elected by the population they govern; it is coded as a 1, however, if either is directly elected and the other is indirectly elected; a score of 2 for this variable signifies that both local executive and legislature are directly elected. Where multiple tiers of subnational government exist, the highest level is considered to be the state/provincial level (Beck et al. 2001). The score ranges from 0 to 2. Three countries without federal systems are Portugal, Nicaragua, and Nepal; three countries with a score of 2 are Switzerland, Papua New Guinea, and Colombia.

Our first measure of interest group pressure is a count of international environmental organizations in a nation from the Yearbook of International Organizations. Our measure does not include the membership numbers or the power exerted by each organization, but we assume that nations with many international environmental organizations face greater pressure than those with few organizations.

We divide this by the logged population to measure the incidence of environmental organizations. This measure ranges from 0.26 to 3.18. The three lowest scores are Bhutan, Armenia, and Guinea; the three highest are France, the Netherlands, and Norway. Our second measure is the incidence of ISO 14001 in a national economy measured by the number of certified sites at the International Standards Organisation as of November 2001; we calculated a zero-skewness log transformation. We also divide this raw number by the log of the population of the country to produce a measure of the relative incidence of voluntary environmental self-regulation. This score ranges from –0.69 to 0.85. The three lowest scores in our data are Gambia, Bhutan, and Mongolia; the three highest scores are Sweden, Denmark, and Japan.

Our first measure of a country's development path is the natural log of each country's per capita GDP. GDP per capita is in 2000 dollars and is adjusted for purchasing power parity.[3] This ranges from 6.98 to 10.46. The three lowest scores are Burundi, Tanzania, and Madagascar; the highest are the United States, Norway, and Switzerland. In the models we will also account for nonlinear relationships between each of our dependent variables and GDP by including a quadratic term.[4] We address questions of multicollinearity below. Our second measure is a dummy variable for the origin of a country's legal system. English origin dummies are generated to reflect legal attributes such as judicial vs. legislative precedent, rights to private property, and the general rights of the individual relative to the state. In general, English legal systems are coded as 1 for former colonies and all others are coded as 0 (La Porta et al. 1999). Three example countries without English systems are Peru, Argentina, and Cuba; three examples with those origins are Australia, Malaysia, and Thailand. Our third measure of economic development is the size (in billions of barrels) of a country's proved oil reserves as measured in 2000; we calculate the zero-skewness log transformation of the size of reserves.[5] This measure of economic development ranges from –13.94 to 5.57 in our data used in the models below. The three lowest scores on this measure in our data are Honduras, Armenia, and Belgium; the three highest scores are the Saudi Arabia, Kuwait, and Venezuela.

We account for three aspects of religiosity in the cultures of the countries we are studying: the proportion of the country's population that is Protestant, the proportion that is Catholic, and the proportion that is Muslim (La Porta et al. 1999). Each is computed with a log transformation of the underlying proportion. The measure of Protestant religiosity ranges from –1.84 to 4.58 in our data used in the models below. The three lowest scores on the measure in our data are Nepal, Tunisia, and Bhutan; the three highest scores are the Norway, Denmark, and Finland. The measure of Catholic religiosity ranges from 1.33 to 4.61 in our data used in the models below. The three lowest scores in our data are Bhutan, Albania, and Mongolia; the three highest scores are Spain, Colombia, and Dominican Republic. The measure of Muslim religiosity ranges from –4.87 to 4.60 in our data used in the models below. The three lowest scores on the measure are Nicaragua, Guatemala, and Japan; the highest are Morocco, Tunisia, and Algeria.

Finally, we also include two controls for demographic aspects of the countries. First, our measure of ELF is an average of three indices created by Philip Roeder.[6] One index calculates scores using subgroup data when they are available. A second excludes racial distinctions among groups of people that do not dramatically alter linguistic/cultural patterns (e.g., black and white Americans). A third classifies racially distinct subgroups as independent of one another regardless of their linguistic similarity. The scores generated are a fraction and represent the chance that two random draws will produce individuals from different ethnolinguistic groups. Second, our measure of population is from the Penn World Tables (Version 6.2).[7] We calculate a zero-skewness log transformation of this measure as well. Descriptive statistics are located in Table A1 in the appendix. The list of included countries is in Table A2.

Estimation and Results

We offer a series of models to estimate the effects of federalism and democratization on environmental sustainability. We first estimate a model that tests for the effects of federalism and democratization on the broad ESI. The model, which is estimated by Ordinary Least Squares with robust standard errors, is in Table 1. In addition to our two main independent variables, we also estimate the effects of international environmental organizations, the penetration of ISO 14001, the three measures of economic development (including for an inverse Kuznets relationship), the three measures of religious affiliation, and the effects of ELF and population. The first column of Table 1 shows the model that also includes the inverse Kuznets relationship (the quadratic term for GDP); the second column omits this relationship.

In total, the explanatory power of the model as a whole is reasonable (R^2 = 0.52). Table 1 shows a

Table 1
A Simple Model of Environmental Sustainability, With and Without Nonlinear GDP Effect

	With		Without	
Variable	Estimate	Standard Error	Estimate	Standard Error
Federalism	–0.046	0.993	–0.245	0.999
Democracy	0.423	0.164***	0.423	0.165***
IEOs per capita	1.995	2.339	1.170	1.976
Ln ISO per capita	7.104	3.059***	8.091	2.731***
Ln GDP per capita	–2.321	1.995	–2.263	2.013
Ln GDP squared	–1.218	1.259		
English origins	0.354	2.062	–0.213	1.956
Ln oil reserves	–0.098	0.163	–0.055	0.156
Religion: Protestant	1.049	0.588**	0.882	0.547*
Religion: Catholic	–1.407	0.815**	–1.417	0.824**
Religion: Muslim	–0.523	0.336*	–0.634	0.319**
ELF	–1.699	4.662	–1.250	4.623
Ln population	–2.053	0.767***	–2.082	0.735***
Constant	150.577	26.870***	86.277	18.264***
N	80		80	
RMSE	6.82		6.85	
F	10.69***		11.17***	
R^2	0.52		0.51	

Note: Ln = Natural log. SE = Standard Error. RMSE = Root Mean Squared Error. Est. = Estimate. ISO: International Organization for Standardization. This is ISO from the name in French. In this table, ISO indicates the number of ISO certified sites.
Note: IEOs = international environmental organizations; ELF = ethnolinguistic fractionalization.
$*p < 0.10$. $**p < 0.05$. $***p < 0.01$ (all one-tailed tests).

statistically significant and positive effect for democratization on environmental sustainability. The magnitude of the effect indicates almost a half-point increase in sustainability, which is measured on a 0 to 100 scale, for each point increase in democratization. The average effect would create an increase of almost ten points in sustainability for moving from autocracy to democracy, which is equivalent to a one-standard deviation shift in the dependent variable. Whether the effect is substantively important depends on its comparison with other effects. In contrast, a one-point increase in log population translates into (on average) a little over a two point reduction in the sustainability index. In this model, we find no impact of federalism on sustainability, which provides a degree of evidence against the "race to the bottom" hypothesis.

The only other significant variables in the first column of Table 1 are related to ISO 14001 penetration and religious affiliation. We find strong evidence of a positive relationship between Protestantism and sustainability, moderate evidence of a negative relationship between Catholicism and sustainability, and weak evidence of a negative relationship between Islam and sustainability. The evidence, though, does not reveal much impact. Specifically, a one-standard deviation shift in Protestantism produces a 2.1 point increase in sustainability; the same for Catholicism produces a drop in sustainability of less than 2.1 points, and for Islam the reduction in sustainability is less than 0.7 points. We note that the raw correlation for the data for Islam and the ESI index is –0.47, so the partial correlations are smaller than those found in exploratory analysis. The raw correlation for Protestantism is 0.45 and for Catholicism it is 0.20. Our theories indicated that the coefficient for Catholicism should be negative. Protestantism could have either a positive or negative coefficient based on the relative importance of stewardship and dominion. The positive coefficient supports the stewardship mechanism. Islam was predicted to have a positive sign, and while we find a negative sign, the significance level is quite low.

There is no evidence for an inverse Kuznets effect. One possibility is that collinearity is obscuring our inferences about any of these proposed effects. One source could be including a quadratic term for GDP; a second source could be in including all three measures of religiosity. English origins or religiosity could be confounded with economic development. We address collinearity calculating variance inflation factors (VIFs); using the usual threshold of ten, the VIFs indicate that the quadratic term is not a major source of collinearity and that none of the other

measures indicate collinearity concerns (all VIFs are below six; the mean is 2.61).

We assess for changes in the model based on the omission of the quadratic GDP term in column two of Table 1; this shows the basic model without the test for the Kuznets relationship. The results show a robust finding for democratization and almost the same findings for the other results. The evidence for a positive impact of ISO 14001 penetration is robust. This model's fit is roughly the same as the model that includes the quadratic term. We also estimated a model that omitted the three religiosity measures, and found that both democratization and proven oil reserves retained the same sign and significance; no other measures were significantly related to sustainability. In that model, the fit was marginally lower ($R^2 = 0.45$), although reasonable ($F = 8.54$). However, while including the quadratic term is a potential source of collinearity, omitting it also could introduce omitted-variable bias given the findings of Grossman and Krueger (1995). In the models presented here, we err on the side of including the quadratic term.

Systems, Stress, and Vulnerability

As noted, one issue with the total ESI measure data is that it includes items that are also potential causes of sustainability. A second is the potential overlap (or correlation) between the system, stress, and vulnerability scales. We account for this in a multivariate model by estimating by the method of seemingly unrelated regression (SUR) (Zellner 1962). This involves joint estimates from several regression models, each with its own error term. It allows the contemporaneous errors associated with each of the three dependent variables to be correlated. After estimation, we assess the independence of the equations by testing for correlation among the errors. The model is estimated by feasible generalized least squares (FGLS). We note that the estimates are virtually the same as would be observed in three separate OLS estimators since the covariates are identical in the models, although in the SUR we are also able to jointly test for significance of a covariate across the three models in addition to being able to test for correlations among the three sets of residuals. Gains in estimation also result when the covariates are disjoint.

Table 2 shows the results from our SUR estimation of the three regression equations, one each for the dependent variables of Systems, Reducing Stress, and Reducing Vulnerability. The fit statistics indicate the second and third models fit quite well. However, the F statistic for the Systems equation shows that we reject only at the 0.05 significance level. The R^2 statistic imperfectly describes of the percent of variance explained by the predictors because the model is estimated by FGLS. In this case, the Stress and Vulnerability equations represent significant total predictive power, but the Systems equation has limited predictive power. We also note that the remaining variation not explained by the three models, which is located in the error terms, is correlated across equations; the Breusch-Pagan test suggests that the null hypothesis of independent errors can be rejected at better than 0.01 level ($\chi^2 = 15.93$). By taking into account the variation that is common to the pairs of dependent variables but is not accounted for in the individual equations, we identify the parts of the three dependent variables are specific to the causal processes we outlined above. The importance of this will be shown explicitly when we assess how a specific covariate's effects vary across the three dependent variables.

First, federalism is not a significant predictor of levels of environmental sustainability measured three ways. The coefficient for federalism is not significant at conventional levels in the three equations (joint $F = 0.70$). In contrast, we find evidence for a positive impact of democratization on sustainability in the Systems model. The studies recounted above have found varying levels of association between democracy and environmental protection measures, and we found an effect for democratization in the case of the ESI. Yet we find in our analysis, using three more specific measures of sustainability and a robust measure of democracy, association only in the case of Systems (joint $F = 1.75$, $p = 0.16$, one-tailed test). The evidence for Systems is moderate and bounded by our concern about the overall model fit. While studies find varying associations between federalism and environmental protection, we find for these measures of sustainability no connection for federalism and only contingent evidence for democratization. Simple reasons for this are likely that scholars have concentrated on single country studies, studies of only industrialized countries, or studies of very specific environmental outcomes. In this sense, other studies are bound in their findings by sampling choices, either for units of analysis or for choice of dependent variables. Our findings about federalism indicate no clear support for a direct role for this form of political system on levels of environmental sustainability. Democratization, though, depends on the interpretation of environmental sustainability—with clearer evidence in the case of an eco-centric measure of sustainability, and no

Table 2
Seemingly Unrelated Regression (SUR) Model of Three Components of Environmental Sustainability

	Systems		Stress		Vulnerability	
Variable	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Federalism	–1.598	2.162	–1.071	1.460	1.711	1.556
Democracy	0.784	0.348**	0.289	0.235	–0.051	0.250
IEOs per capita	2.244	4.067	–1.450	2.746	2.773	2.928
Ln ISO per capita	1.053	6.670	4.138	4.503	21.433	4.801***
Ln GDP per capita	–3.240	3.315	–10.462	2.238***	10.453	2.286***
Ln GDP squared	–1.749	1.960	–5.418	1.323***	–2.676	1.411***
English origins	3.485	4.008	–2.491	2.706	2.137	2.885
Ln oil reserves	0.529	0.311**	–0.097	0.210	0.171	0.224
Religion: Protestant	1.524	1.014*	0.988	0.684*	–2.354	0.730***
Religion: Catholic	–0.795	1.554	–1.997	1.049**	–0.086	1.118
Religion: Muslim	–0.315	0.675	–0.811	0.456**	–0.386	0.486
ELF	–1.656	6.688	0.777	4.515	–8.609	4.814
Ln population	–4.127	1.570***	0.109	1.060	–2.446	1.130**
Constant	110.448	37.878***	150.577	25.571***	–10.215	27.264
N	80		80		80	
RMSE	14.35		9.69		10.33	
F	2.13**		8.88***		38.37***	
R^2	0.26		0.59		0.86	

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$ (all one-tailed tests).

evidence in the case of our biocentric measure (Reducing Human Vulnerability).

We also find a contingent pattern of relationships between environmental interests and levels of environmental sustainability. We find no relationship between the presence of international environmental organizations and sustainability levels (joint $F = 0.67$). Yet, we observe that having firms with ISO 14001 EMS systems is associated with higher levels of environmentally sustainable outcomes in the Reducing Human Vulnerability; while there is no association for the eco-centric measure, the F test suggests strong evidence for this factor as a cause of sustainability (6.79). The Reducing Vulnerability equation suggests that sustainability is greater where the incidence of EMS is high. The Porter hypothesis has partial support elsewhere and is consistent with this second interpretation. We are concerned about reverse causation, but our belief is that reverse causation is less likely in the case of the Vulnerability equation.

We also find an interesting mix of relationships between our development indicators and environmental sustainability. For current development levels, we find that national income per capita is negatively related to sustainability in the cases of the Stress equation, which indicates that higher levels of economic development translate into less sustainable outcomes. Yet, in that equation, while the coefficient for the quadratic term is significant, the sign is opposite that in the inverse Kuznets hypothesis—a finding consistent with that in York, Rosa, and Dietz (2003); this indicates acceleration in the effect on sustainability over increasing levels of GDP. In the case of Reducing Human Vulnerability, the signs of the coefficients are exactly opposite those in the inverse Kuznets relationship (Grossman and Krueger 1995). Specifically, the coefficient for the base GDP effect is positive and the quadratic coefficient is negative—which means that countries are better able to reduce human vulnerability as GDP increases, but that there are decreasing returns in the payoff of increasing development. Overall, we find a significant role for GDP across all three models (joint $F = 15.22$) and the quadratic term (joint $F = 6.79$). As noted above, the evidence for the inverse Kuznets hypothesis in other studies is decidedly mixed. In none of the three models do we find evidence for historical development paths, measured as English origins (joint $F = 1.17$). In only the Systems equation do we find evidence that countries with greater oil reserves experience higher levels of sustainability, a finding opposite to that hypothesized above. The joint F test for oil reserves provides weak evidence of a global role (joint $F = 1.78$, $p = 0.15$).

Our last major set is a mixture of results about religiosity. In the case of the full index, we found a positive relationship between Protestantism and sustainability, and negative effects for Catholicism and Islam. In the SUR model we found a result for the proportion of the country that adheres to Islam and sustainability outcomes only in the case of Reducing Environmental Stress; the sign of the coefficient is negative, indicating a reduction in sustainability in those countries, yet the size of the impact is quite small. The coefficients for Percentage Muslim are not significant in either of the other two equations (joint $F = 1.24$). We note that the effects for Islam are significant even when we control for the size of a country's proven oil reserves, which aids in clarifying the role of Islam in countries such as Saudi Arabia, Kuwait, Malaysia, and Indonesia.[8]

In contrast, the proportion of the country that adheres to Protestantism has mixed effects: increasing sustainability (when measured by the Systems scale and the Reducing Stress scale) and decreasing sustainability (when measured by the Reducing Vulnerability scale) (joint F = 4.74). This indicates variation in the way that religious encoding translates into environmental outcomes, one that is particularly interesting based on the construction of the dependent variables.[9] We note that the coefficient for the measure of Catholicism, like that for Islam, is negative in the case of Reducing Stress, but not significant in either of the other equations (joint $F = 1.25$).[10] An area for additional research is the role of religious encoding and protection of public health outcomes. We also note that population decreases sustainability in the case of Systems and Reducing Human Vulnerability (joint $F = 4.52$). We find no evidence of a role for ELF (joint $F = 1.14$). Finally, correlations between the errors suggest that there is greater correspondence between the Systems and the Reducing Stress components ($\rho = 0.44$), and virtually none between those components and Reducing Vulnerability ($\rho = 0.04$ and $\rho = 0.07$).

Inside Systems, Stress, and Vulnerability

We now extend our analysis of these three components of the ESI by moving inside each component to examine five different subcomponents. The sixty-eight measures inside the ESI are aggregated in pieces, so the window of investigation can be applied at one of three levels. We move inside Systems, Stress, and Vulnerability to examine five subcomponents: Air Quality and Water Quantity, which are subcomponents of the Environmental Systems component; Reducing Air Pollution and Reducing Water Stress, which are subcomponents of the Reducing Environmental Stress component, and Environmental Health, which is a subcomponent of the Reducing Human Vulnerability component. We selected these five because either the coverage within the ESI is considered very good or excellent or because their relevance was very high (ESI 2002, 27). For example, in the case of Air Quality, the coverage was considered poor but its relevance to the goal of measuring environmental sustainability is very high; this subcomponent is itself composed of three indicators (urban concentrations of SO_2, NO_2, and total suspended particulates). The others are composed of the following numbers of indicators: Water Quantity (2), Reducing Air Pollution (5), Reducing Water Stress (4), and Environmental Health (4). The purpose of this section is to address the possibility that the main causal variables under study here actually vary in their effects across finer measurements of the concept of environmental sustainability. Again, we estimate the effects by a SUR model; the Breusch-Pagan test suggests that the null hypothesis of independent errors can be rejected at better than 0.001 level ($\chi^2 = 33.6293$).

Table 3 shows that the effects of democratization are positive and significantly different from zero in the case of Water Quantity and Reducing Water Stress; in contrast, there is no evidence of a direct effect of democratization on environmental sustainability in any of the other three measures (joint $F = 1.67$, $p = 0.14$). For environmental interests, there is no evidence that any measure is higher when there are more environmental interest groups per capita (joint $F = 1.41$). For ISO 14001, there are positive effects in the case of Reducing Air Pollution and Environmental Health, and no effects for other measures (joint $F = 2.71$, $p = 0.02$). This variety of effects is consistent with the findings reported in the SUR model in Table 2.

The economic development indicators suggest a role for GDP, with the base term's effect being significant in every equation, although oppositely signed in the cases of Air Quality and Environmental health (joint $F = 8.20$). The coefficient for the quadratic term for GDP is significantly different from zero in really only one equation (joint $F = 1.06$), and the sign is inconsistent with the inverse Kuznets hypothesis. In addition, the coefficient for English origins is positive and significant in the case of Air Quality and Environmental Health, opposite to that hypothesized above (joint $F = 2.20$, $p = 0.05$). While the effect of natural resources measured as proven oil reserves varies (negative in the case of Air Quality and

Table 3
Seemingly Unrelated Regression (SUR) Model of Five Subcomponents of Environmental Sustainability

	Air Quality		Water Quantity		Reducing Air Stress		Reducing Water Stress		Environmental Health	
Variable	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Federalism	–0.077	0.079	–0.023	0.101	–0.176	0.110*	0.000	0.081	0.058	0.055
Democracy	0.012	0.013	0.033	0.016**	0.001	0.018	0.026	0.013**	–0.006	0.009
IEOs per capita	0.318	0.148	0.025	0.191	–0.234	0.206	–0.072	0.152	0.051	0.104
Ln ISO per capita	0.010	0.243	0.225	0.313	0.335	0.339*	–0.301	0.249	0.492	0.171***
Ln GDP per capita	0.293	0.121***	–0.400	0.156***	–0.512	0.168***	–0.401	0.123***	0.402	0.085***
Ln GDP squared	–0.093	0.071*	–0.038	0.092	–0.145	0.099*	–0.017	0.073	–0.086	0.050**
English origins	0.430	0.146***	0.099	0.188	–0.130	0.203	–0.078	0.149	0.132	0.103*
Ln oil reserves	–0.014	0.011	0.044	0.015***	0.006	0.016	0.006	0.012	0.006	0.008
Religion: Protestant	0.003	0.037	0.037	0.048	0.056	0.051	0.144	0.038***	–0.093	0.026***
Religion: Catholic	–0.034	0.057	0.006	0.073	0.014	0.079	–0.061	0.058	0.006	0.040
Religion: Muslim	–0.023	0.025	–0.070	0.032**	–0.018	0.034	–0.033	0.025*	–0.035	0.017**
ELF	–0.091	0.244	0.459	0.314*	0.147	0.339	–0.129	0.249	–0.320	0.171**
Ln population	–0.055	0.057	–0.206	0.074***	–0.142	0.080**	0.060	0.059	–0.100	0.040***
Constant	–2.465	1.380**	4.890	1.778***	6.344	1.923***	2.895	1.411**	–2.220	0.969**
N	80		80		80		80		80	
RMSE	0.52		0.67		0.73		0.53		0.37	
F	7.72***		3.27***		5.19***		6.50***		28.76***	
R^2	0.56		0.35		0.46		0.51		0.82	

*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$ (all one-tailed tests).

positive in the case of Water Quantity), the joint F test suggests that proven oil reserves contributes to the overall explanatory power of the models ($F = 2.57, p = 0.03$). The effect of Protestantism is positive for Reducing Water Stress and negative for Environmental Health (joint $F = 5.70$). The effect of the incidence of Muslims is negative but weak in three models (joint $F = 1.96, p = 0.08$). Last, we note that the coefficients for population are negative and significant in three equations (joint $F = 4.29$). ELF is negative in the case of Environmental Health (joint $F = 1.46$).

Conclusion

This article offers the first quantitative analysis of the political and social foundations of environmental sustainability using broad measures of sustainability in a variety of development and geographic contexts. This analysis fills gaps in the literature, which has largely proceeded along the grounds of examining single countries, industrialized nations, or narrow measures of sustainability. We find varying support for our primary political hypotheses. Democracy receives moderate support; federalism is not directly correlated with any of the measurements of sustainability. We do find varying patterns of relationships between the measurements and our remaining social foundations for sustainability, including the effect of economic development (both current and historical), business practices, the presence of religious affiliations, and demographic factors. Together, these findings portray a complex and varied set of foundations for environmental sustainability, but only limited support for a direct political foundation.

Two themes warrant additional emphasis. First, because of design choices, other studies often overstate the direct role of political systems on sustainability outcomes. Our study finds only moderate evidence for a direct role for democratization, but it remains the case that political systems can broadly impact other, more proximate causes of sustainability—like economic development, international organizations, or ISO adoption. We note that this is particularly the case with regard to the Reducing Human Vulnerability equation, where the impacts for national income and EMS system penetration dwarf all other causes; clearly countries with larger national incomes are better at protecting their populations from environmental health problems. The broader question is how countries with lower development paths can protect their populations from these vulnerabilities? Our results indicate that democracy and federalism have no direct role—unless they work through other proximate causes like national income or EMS adoption.

Second, the social foundations this article discusses are worthy of additional research by policy scholars and political analysts. As case in point, we find little discussion of the role of religious encoding in the political literature on environmental protection policies, yet our study reveals an intriguing pattern of results that are worthwhile for those actually attempting to change a country's development path. Religion changes very slowly and religious encoding changes glacially, in part because of dependence on population shifts. For a policymaker trying to spur national movement toward a sustainability path, our study provides only a few foundations that can be relied on. Moreover, our analysis indicates that what policymakers wish to optimize (e.g., reduced stress, vulnerability) will determine which lever they should try to manipulate. Writ large, there are no simple solutions, although there are clear indications that a few traditional "silver bullets" like democracy probably are not as silver as long thought.

Appendix

This appendix addresses the distribution of the variables and the countries included. Table A1 includes the descriptive statistics. Table A2 shows the countries used in the analysis.

Table A1
Descriptive Statistics

Variable	Mean	Standard Deviation
Environmental Sustainability Index	51.576	9.006
Environmental Systems	50.004	15.215
Reducing Environmental Stress	50.391	13.838
Reducing Human Vulnerability	58.042	24.818
Systems: Air Quality	0.153	0.717
Systems: Water Quantity	–0.084	0.762
Stress: Reducing Air Pollution	–0.081	0.904
Stress: Reducing Water Stress	–0.022	0.701
Vulnerability: Environmental Health	0.223	0.799
Federalism	0.975	0.856
Democracy	14.450	6.433
IEOs per capita	1.553	0.689
Ln ISO per capita	0.159	0.494
Ln GDP per capita	8.827	1.029
Ln GDP squared	78.958	18.126
English origins	0.288	0.455
Ln oil reserves	–5.537	6.947
Religion: Protestant	0.876	2.014
Religion: Catholic	2.999	1.334
Religion: Muslim	–0.196	3.605
ELF	0.428	0.283
Ln population	9.652	1.377

Table A2
Included Countries

Albania	Japan
Algeria	Jordan
Argentina	Kuwait
Armenia	Libya
Australia	Madagascar
Austria	Malawi
Bangladesh	Malaysia
Belgium	Mali
Benin	Mexico
Bhutan	Mongolia
Bolivia	Morocco
Botswana	Mozambique
Brazil	Nepal
Bulgaria	Netherlands
Burundi	New Zealand
Cameroon	Nicaragua
Canada	Norway
China	Oman
Colombia	Panama
Costa Rica	Papua New Guinea
Cuba	Peru
Denmark	Philippines
Dominican Republic	Poland
Egypt	Portugal
El Salvador	Saudi Arabia
Finland	Senegal
France	South Africa
Gambia	Spain
Germany	Sri Lanka
Ghana	Sweden
Guatemala	Switzerland
Guinea	Syria
Haiti	Tanzania
Honduras	Thailand
Hungary	Tunisia
India	United Kingdom
Indonesia	United States
Ireland	Uruguay
Israel	Venezuela
Italy	Zimbabwe

Notes

1. We note that one of our covariates in the models below is the total population of the country; we do not estimate models using fertility and population growth as covariates.

2. See http://www.cidcm.umd.edu/inscr/polity/.

3. Penn World Tables, Version 6.2, 2007, http://pwt.econ.upenn.edu/.

4. We follow convention from other recent articles on the inverse Kuznets relationship (York, Rosa, and Dietz 2003; Shandra et al. 2004) and center the logged GDP measure before squaring it.

5. Energy Information Administration, "World Proved Reserves of Oil and Natural Gas: Most Recent Estimates," 2007, http://www.eia.doe.gov/emeu/international/reserves.html.

6. Roeder, Philip G., "Ethnolinguistic Fractionalization (ELF) Indices, 1961 and 1985," February 16, 2001, http//:weber.ucsd .edu/~proeder/elf.htm.

7. Penn World Tables, Version 6.2, 2007, http://pwt.econ. upenn.edu/.

8. The raw correlations between Percent Muslim and each of the three dependent variables are –0.26, –0.06, and –0.30, respectively.

9. The raw correlations between Percent Protestant and each of the three dependent variables are 0.32, –0.11, and 0.07, respectively.

10. The raw correlations between Percent Catholic and each of the three dependent variables are 0.13, –0.01, and 0.08, respectively.

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