NATIONAL CULTURE AND ENVIRONMENTAL SUSTAINABILITY: A CROSS-NATIONAL ANALYSIS

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Abstract

This paper demonstrates the significance of culture in examining the relationship between income and the environment. Specifically, we examine the relationship among scores on the Environmental Sustainability Index of the World Economic Forum and the four dimensions of national culture proposed and measured by Hofstede (1983). We find that there are significant multidimensional interrelationships among the cultural and environmental sustainability measures. As an important application, we examine the Environmental Kuznets Curve (EKC) phenomenon. Our finding suggests the limited applicability of the EKC notion when cultural variables are included in the model. (JEL O5, Z1, Q2)

Introduction

The emergence of debate on the environment has attracted attention regarding a possible contradiction between promoting free markets and meeting domestic environmental objectives. In particular, there has been a concern for environmental degradation in the process of growth and globalization, since damage to the environment is thought by some to be linked to increased economic activity. Given the interdependent and trans-boundary nature of collective exhaustible and renewable natural resources, environmental issues are more subtle. The popular view among the environmental NGOs based on the *pollution-haven* hypothesis posits that trade liberalization, open markets, increased foreign direct investment and multinational corporations (MNCs, hereafter) will encourage the flow of low-technology and polluting industries to developing countries and trigger a 'race to the bottom' in environmental standards. [See Xing and Kolstad (2002), Goldsmith (1997), Gersh (1999), and Tonelson (2000)]. The other view, the *pollution-halo* hypothesis, suggests that trade liberalization or foreign direct investment encouraged by the MNCs may actually help elevate worldwide environmental standards through the transfer of efficient technology and established management practices. [See Gentry (1998), Blackman and Wu (1998), Dowell et al. (2000), and Eskeland and Harrison (2002)].

Grossman and Krueger (1995) examined a closely related, and perhaps broader, question asking whether economic growth itself harms the environment. They found an inverted U-shaped relationship between income growth and environmental conditions. That is, environmental conditions, such as air pollution and contamination, seem to worsen with increases in income in low-income countries, and appear to benefit from economic growth once some critical level of income has been reached. This result is often called the Environmental Kuznet Curve (EKC, hereafter) phenomenon in the literature. The EKC has been examined by many researchers and found to be far from universal. It appears for some pollutants and not others; for some groups of countries and not others; and for some econometric-technique/data combinations and not others; see for example, Stern and Common (2001) for a summary, critique and extension of the EKC literature on sulfur emissions.

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One potential caveat in these studies is that they fail to account for the effect of culture. It can be reasonably conjectured that the will and ability to protect the environment are influenced by intra-country socio-cultural factors. If people are more culturally conscious of environmental conditions, a higher level of environmental sustainability can be maintained, and if environmental damages occur, they can be restored more quickly. In this scenario, national culture is expected to influence how people utilize their natural resources and environments by shaping their attitudes and perceptions. Herein lays the importance of empirically determining the significance of national culture on environmental conditions. Despite this, however, a majority of the relevant work on this issue in the literature has been anecdotal and descriptive.

The purpose of the present paper is to provide some modest first steps in the search for greater understanding of the statistical relationship between elements of culture and environmental sustainability. To the best of our knowledge, this is the first paper to demonstrate an overall statistical relationship between two sets of environmental and cultural variables. A quantitative analysis of culture and the environment is not an easy task, primarily because culture is itself a complex concept. This paper takes as its base Hofstede's work (1980, 1983, and 1991) and employs four dimensions of national culture. Additionally, we include socio-economic *normalizers*, such as per capita GNP and educational attainment. Then, we explore the relationships between environmental variables and culture. To perform our empirical tests, we utilize the Environmental Sustainability Index (ESI) of the World Economic Forum and its five sub indices. As an important application, we revisit the Environmental Kuznet Curve (EKC). We hypothesize that previous EKC results may be mere artifacts, and find that the income variable turns out to be insignificant when the effect of national culture is included. Specifically, we do not find a significant non-linear pattern between income and pollution, after netting out the effect of culture.

In the next section we provide a brief review of contributions to the (largely non-quantitative) literature on the relations between culture and environmental conditions. We then concentrate on the dimensions of culture, especially the suggestions of Hofstede (1980). Next, the measures of *environmental sustainability*, as suggested by the World Economic Forum's Global Leaders for Tomorrow Environmental Task Force, are set out. In section 3, we motivate and state four hypotheses concerning the relationship among elements of culture and environmental sustainability, and two hypotheses concerning the role of control variables, income and education levels. Results of empirical testing are presented and discussed in Section 4. The final section provides concluding remarks.

Culture and the Environment

Background

The number of studies have discussed and theorized the link between national culture and environmental conditions. We select a few examples to give the flavor of this literature. Cohen and Nelson (1994) propose that the mechanism of a link between culture and the environment must be the impact of culture on normative ethical beliefs regarding what is morally correct behavior. These beliefs are reflected in common business practices, government regulation of business activity, and are widely held perceptions of acceptable business conduct within a given society. This suggests that the perception of environmentally responsible behavior can be significantly different across countries. In a similar vein, Gorham (1997) argued that cultural factors operate at various levels: through the policies of sovereign states, public and private agencies that serve the policies, and the public officials who are directly responsible for how the policies are carried out. This view is consistent with Elgin (1994), who suggested that we may not be able to make any material changes required to achieve environmental sustainability if we fail to reach beneath physical challenges and confront problems at a much deeper level in our culture and consciousness.

Taking a slightly different tack, and using somewhat different language, other researchers have focused on the relationship between culture and environment in the context of the relation between social/human and natural capital. The notion is that *social/human capital*, the social bonds, norms, and values in a society, are important to environmental sustainability because they, in part, determine the nature of the society's relationship to its environment, its *natural capital*. In this regard, researchers have investigated the relationship between connectedness among people and the environmental condition in a society [see Cernea (1993), Narayan and Pritchett (1996), and Ward (1998)]. In particular, Etzioni (1995) found that, in a society demonstrating a high level of social/human capital, members would balance their own rights with collective responsibilities such as managing their natural resources. Kellert (1996) observed that there is significant cross-cultural variability in people's attitudes about nature and its conservation. For example, he argues that the Japanese people lack interest in wild nature and ecological processes and demonstrate limited support for wildlife conservation and protection, while Germans subscribe to more pronounced ecological values and exhibit a greater willingness to maintain pristine nature and protect wild life. More recently, Pretty and Ward (2001) extensively investigated this issue and concluded that social and human capitals (embedded in a culture) are prerequisites for the improvement of natural capital (environment).

Another set of researchers has paid more attention to other elements of culture, in particular levels of trust and spirituality, because they believe these facilitate cooperation and reduce transaction costs. When a society is infested by distrust, cooperative efforts among different types of people, which are necessary in managing public resources such as the environment, are not likely to happen [see Baland and Platteau, 1998]. Kinsley (1995) claimed that there is a profound relationship between religious spirituality and the ecological condition of a society. While these studies provide insights useful in beginning to understand the effect of culture on the environment, little effort has been made to examine the overall relationship between dimensions of culture and environmental sustainability and little of the work has been quantified for empirical testing.

Dimensions of National Culture

This paper begins with the following propositions:

- That institutions, both private and public, are central to national performance in both economic growth and environmental management; but
- That our understanding of why some countries have developed successful institutional structures and some have not is inadequate; and
- That at least a preliminary quantitative understanding of the relationship among the elements of national culture and performance in the environmental management challenge will be a useful step in improving that understanding.

It is hard to quarrel with the proposition that institutions, both public and private, matter for both economic growth and environmental management.[1] One serious obstacle to making practical use of this proposition, to actually encourage growth while maintaining at least some modest level of environmental quality, is that the understanding of how institutions are created, maintained (or not) and adapted (or not) over time is limited.[2] It is easy, though not very helpful, to say that institutions both reflect and shape *culture*. Even the dimensions along which cultures might be compared are matters of continuing debate. Beyond that, theories of how culture influences institutional developments do not necessarily have persuasive predictive power, though such theories do exist.[3]

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[1] A look at a development text book, such as that of Todaro (2000) or Meier and Rauch (2000) makes it clear that development economists accept the proposition that institutions matter; see World Bank (2001) on the environment side.

[2] Examples of efforts at enhanced understanding include Payne and Losada (2000), Tlaiye and Biller (1994), and Straub (2000). Hirschman (1999) presents a discouraging historical review of efforts to alter civil service institutions in line with the current fashion in development theory.

[3] Straub (2000), for example, concludes with a plea for the development of *better theoretical understanding*.

As argued by Smith et al. (1996), identification of reliable dimensions of cultural variation is necessary to creating a framework that is capable both of integrating diverse attitudinal and behavioral empirical phenomena and of providing a basis for hypothesis generation. To this end, researchers have worked diligently to identify major cultural dimensions.[4] Since Max Weber's most famous work, *The Protestant Ethic and the Spirit of Capitalism* (1958), the impact of culture on various socio-economic phenomena has been the subject of much research in the social sciences, and recently there has been a noticeable resurgence of research on the role of culture in economic anthropology [See Halperin (1994), Appadurai (1996), Wilk (1996), Narotzky (1997), Douglas and Ney (1998), and Gudeman (1998)]. Since one of the major purposes of this paper is to examine the statistical relationship between the national culture and environmental sustainability, we examined many previous studies of quantifying culture and looked for reliable measures consistent with the purposes of this paper. Actually, there have been ambitious and pioneering research projects undertaken to identify cultural dimensions of value and to develop indices for the dimensions identified; see Hofstede (1980, 1983, and 1991), Schwartz (1990, 1994), Trompenaars and Hampden-Turner (1994), and House et al. (1999).

As mentioned in the previous section, this paper takes as its base Hofstede's (1980) work. Hofstede defined national culture as the set of collective beliefs and values that distinguish people of one nationality from those of another, and identifies four important dimensions of those beliefs and values:

(1) High versus Low Risk Avoidance (UAI)
(2) Collectivism versus Individualism (IND)
(3) High versus Low Power Distance (PDI)
(4) Masculine versus Feminine (MAS)

These four cultural dimensions have been found effective and are widely accepted in explaining various socio-economic phenomena in cross-cultural settings. [See Hofstede (1983), Hofstede and Bond (1984), Hoppe (1990), Kogut and Singh (1988), Shane (1992), and Nakata and Sivakumar (1996)].[5]

Environmental Sustainability

The World Commission on Environment and Development (1987), also known as the Brundtland Commission, defined *sustainable* development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Since the 1992 Earth Summit, the objective of much work on environmental policy has been to refine and make operational this notion of sustainability. In a particularly ambitious effort in this direction, the Environmental Sustainability Index (ESI) was developed by the joint efforts of World Economic Forum's Global Leaders for Tomorrow (GLT) Environmental Task Force, the Yale Center for Environmental Law and Policy (YCELP), and the Columbia University Center for International Earth Science Information Network (CIESIN) (Global Leaders of Tomorrow, 2001). The index rests on a set of 67 underlying variables. These variables are combined into 22 'indicators'; each indicator reflecting two to six of the variables.[6] These indicators are then divided into five core 'components' of environmental sustainability:

(1) The actual state of the nation's environmental system (ESYSTEM)
(2) The amount of environmental stress (ESTRESS)
(3) Human vulnerability (HUMVUL)
(4) Social and institutional capacity to cope with environmental challenges (SOCINT)

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[4] See, for example, Parsons and Shils (1951), Kluckhohn and Strodtbeck (1961), and McClelland (1950).

[5] We do not wish to imply that Hofstede's approach has been accepted without controversy. Hampden-Turner and Trompenaars (1997) and Tayeb (1994), for example, criticize his questionnaire on which the characterization of countries' cultures rest. And, as the reader will see, the dimensions are more highly correlated than one would like to see. But there are characterizations for 50 countries available, a practical argument of considerable weight.

[6] The 22 indicators are calculated by un-weighted averaging of the values of the underlying variables.

(5) The ability to respond to and join in global stewardship (GLBSTEW).

Finally, the ESI is derived as a composite value based on the above five major components. In Appendix A, we provide details of the elements, indicators, and five components that comprise the ESI.

Hypotheses and Data

Background for the Hypotheses

The dimensions of culture identified by Hofstede can be briefly described as follows:

Risk- Avoidance, varying from high to low, represents the degree to which the people in a society consider themselves threatened by the risks posed by natural and human forces. A high value implies that the society puts greater effort into trying to reduce these risks than does a society low on this dimension.

Individualism vs. Collectivism is an attempt to capture the relative importance that people of a society place on individual as opposed to shared interests. Being on the individualistic end of this scale implies a reduced tendency to form cooperative ventures within the society.

Power Distance, varying from high to low, is designed to measure how equally or unequally power is distributed within a society and how readily inequality is accepted. In high Power-Distance cultures, power is more concentrated and the powerless tend to accept this as a fact of life.

Masculine vs. Feminine represents the social manifestation of the elements of individual personality and behavior frequently associated with human gender. In particular, Hofstede associates the feminine end of the scale with caring for others and for quality of life. He associates the masculine end with assertiveness in the pursuit of material goals.[7]

Managing the environment for sustainability is almost always a collective enterprise. Truly, the task is a collective enterprise in which small benefits accruing to many individuals are implicitly or explicitly found to outweigh the costs to a small number of polluters or exploiters, in which arguments about future uncertain outcomes are often used to justify the acceptance of present sacrifices, and in which the goal is often described as *quality of life*. The outcome is expected to be governed by cultural factors. Thus, we consider the following hypotheses:

1. Higher risk-avoidance cultures will exhibit higher levels of environmental sustainability.
2. Highly collectivist cultures will exhibit higher levels of environmental sustainability.
3. Low power-distance cultures will exhibit higher levels of environmental sustainability.
4. More feminine cultures will exhibit higher levels of environmental sustainability.

Two subsidiary and unsurprising hypotheses are offered concerning the roles of the socio-economic variables per capita income, and educational attainment. The former is measured as per capita gross national product (GNP), the latter by the percentage of the population aged 20-24 that is enrolled in post-secondary schools and universities. The hypotheses are:

5. Higher income, with cultural variation controlled for, will be associated with higher levels of environmental sustainability.[8]

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[7] It is tempting to think that masculine and individualistic are close to the same in meaning and similarly for feminine and collective. As will be seen in the next section, however, the correlation of scores on these dimensions across countries is not significantly different from zero.

[8] The literature on the Environmental Kuznets Curve (EKC) might seem to suggest a quadratic, rather than monotonic hypothesis here e.g., Stern (1998). There are two arguments for anticipating a simpler relation. The most important is that the EKC results are generally found to apply to narrow, regional pollution or exploitation measures such as SO_2 concentrations or extent of deforestation. Broader measures tend to be monotonically related to income, and it is hard to imagine a broader measure than the ESI. The second reason is that the standard EKC research does not involve controlling for cultural descriptors, and these are likely to be related in complex ways to the process generating both income and environmental outcomes. In these circumstances a simple hypothesis seems safer.

6. Higher education levels, with cultural variation controlled for, will be associated with higher levels of environmental sustainability.

Data Sources

In the previous sub-sections, we discussed the dimensions of culture and the environment. The total number of countries is 43. A brief summary of data sources seems necessary:[9]

The ESI and its 5 "component" sub indices are taken from the Global Leaders for Tomorrow Environmental Task Force report by the World Economic Forum (2001).

National Culture dimension data are drawn from the work of Hofstede (1983). We note that national culture is generally seen as an enduring phenomenon, unlikely to change significantly on a decadal time scale.

Education and Per Capita Income data come from the World Development Indicators reported in World Bank, 2001.

Descriptive Statistics

A summary of descriptive statistics describing the data is provided in Table 1. The panel reports descriptive statistics of the data for all countries based on their level of income and region.

One interesting observation from the descriptive statistics is what appears to be a significant difference in the mean value of IND based on the level of income and region. First of all, the mean value of IND for high income countries is by far greater than that of low income countries. Note that we use the overall mean of all countries as a cut-off point for high versus low income countries. However, this finding is not really surprising because a strong positive relationship between IND and National Income (GNP) was already signaled by Hofstede's previous research (1983). Furthermore, since the majority of OECD member countries (the most industrialized) are located in Europe and North American, it is quite conceivable that the mean value of IND of those countries is higher than in that of other regions.

Another significant difference is observed in the mean value of PDI between these two groups of countries. Even if the mean value of PDI for the high income countries is significantly lower than that of low income countries, it also coincides with our expectations given the negative relationship between PDI and IND noted in Franke et al. (1991).

[9] We have provided the data in Appendix B.

Table 1: Descriptive Statistics of the Data

Variables	Mean	Std. Dev	Min	Max
[Total Countries]				
ESI	57.97	11.4	35.7	80.5
Esystem	55.08	16.8	22.0	91.2
Rstress	45.98	14.3	10.0	67.5
Rhumvul	68.20	17.6	26.3	83.0
Socintcap	63.90	18.6	32.8	92.3
Glbstew	57.69	12.3	34.1	80.5
GNP	14.73	12.9	0.4	43.6
EDU	38.65	20.7	4.0	90.0
UAI	67.51	24.4	8.0	112.0
IND	45.70	26.8	6.0	91.0
PDI	55.28	23.4	11.0	104.0
MAS	49.00	19.4	5.0	95.0
[High Income Countries]				
ESI	65.54	10.4	44.1	80.5
GNP	26.77	8.3	14.9	43.6
EDU	54.75	15.5	34.0	90.0
UAI	55.35	23.2	8.0	94.0
IND	69.40	16.5	20.0	91.0
PDI	37.75	17.2	11.0	74.0
MAS	50.40	24.8	5.0	95.0
[Low Income Countries]				
ESI	51.38	7.7	35.7	64.6
GNP	4.26	3.8	0.4	14.6
EDU	24.65	13.1	4.0	53.0
UAI	78.09	20.5	36.0	112.0
IND	25.09	13.3	6.0	51.0
PDI	70.52	16.3	35.0	104.0
MAS	47.78	13.5	21.0	73.0
[Region 1: Europe and North America]				
ESI	65.02	10.1	44.1	80.5
GNP	24.47	9.0	11.0	43.6
EDU	53.05	14.4	34.0	90.0
UAI	63.63	25.6	23.0	112.0
IND	66.63	16.4	27.0	91.0
PDI	39.42	17.0	11.0	68.0
MAS	46.11	23.2	5.0	79.0
[Region 2: Other Regions]				
ESI	52.38	9.3	35.7	71.3
GNP	7.02	10.1	0.4	38.2
EDU	27.25	17.7	4.0	80.0
UAI	70.58	23.5	8.0	101.0
IND	29.13	21.2	6.0	90.0
PDI	67.83	20.0	22.0	104.0
MAS	51.29	15.9	21.0	95.0

Notes: UAI: Uncertainty Avoidance Index; IND: Individualism-Collectivism Index; PDI: Power Distance Index; MAS: Masculine-Feminine Index; GNP: GNP per capita; EDU: % of Tertiary Education. The details of the description of these variables are provided in Appendix A. The classification for high or low income countries is given as a code in the last column in Appendix B (Income Group: 1 = high, 2 = low). The classification for Regions 1 and 2 is provided as a code in Appendix B (Region Code: 1 = Europe and North America, 2 = Other Regions).

Data Analysis and Discussion

By way of a first cut, we consider the Pearson product-moment coefficients of correlation reported for the ESI, the cultural dimensions, income, and education in Table 2. Eight of fifteen correlation coefficients among the independent variables are statistically significant at the 1% level or better. Six of these involve cultural dimensions and either income or education. Two are for relationships between the cultural dimensions themselves (IND/UAI and IND/PDI). Looking at the correlation coefficients between the ESI and each of six other variables, we find that the bilateral relationship generally supports the hypotheses described in the previous section. The signs are mostly as expected. The exception is that the sign of the correlation coefficient between ESI and UAI is unexpectedly negative, although this relationship is not statistically significant at the 5% level. This bilateral analysis is limited in the sense that we do not control for the effects of other variables. However, this preliminary analysis provides evidence that a multicollinearity problem may not be present.[10]

Table 2: Pearson Product Moment Coefficient Correlation

	ESI	UAI	IND	PDI	MAS	GNP	EDU
ESI	1.000						
	.						
UAI	-.218	1.000					
	(.080)	.					
IND	.650	-.395	1.000				
	(.000)	(.004)	.				
PDI	-.692	.245	-.687	1.000			
	(.000)	(.057)	(.000)	.			
MAS	-.216	.080	.035	.107	1.000		
	(.082)	(.305)	(.411)	(.248)	.		
GNP	.646	-.361	.715	-.616	.007	1.000	
	(.000)	(.009)	(.000)	(.000)	(.483)	.	
EDU	.719	-.226	.784	-.618	-.029	.653	1.000
	(.000)	(.072)	(.000)	(.000)	(.427)	(.000)	.

Notes: UAI: Uncertainty Avoidance Index; IND: Individualism-Collectivism Index ; PDI: Power Distance Index; MAS: Masculine-Feminine Index ; GNP: GNP per capita, EDU: % of Tertiary Education. The numbers in parentheses indicate p-values of the t-test on the hypothesis that the correlation coefficient is zero.

We now examine the overall relationships among the five components of the ESI and the four cultural dimensions, plus income and education measures. To do this, we use canonical correlation analysis, which is appropriate in examining the overall relationship among two sets of variables. Concisely, the canonical correlation coefficient is the overall correlation coefficient between two sets of variables. Table 3 reports values for the canonical correlation coefficients and the canonical roots. Given two sets of variables, we can have five canonical functions. The first canonical correlation coefficient, which is the most important figure, has the value of 0.950. The corresponding canonical root (the square of the coefficient) is 0.903. The coefficient is significant at the 1% level (p-value < 0.001). This is clear evidence that the two sets of variables are highly inter-related. The same results are found from the multivariate tests of significance of the canonical correlations. We report four different test statistics: Wilk's lambda, Pillai's criterion, Hotelling's trace, and Roy's greatest characteristic root (GCR). They show that the canonical

[10] We also examined the variance inflation factor (VIF) to check for multicollinearity among the explanatory variables. No significant evidence of multicollinearity was found.

correlations, taken collectively, are statistically significant at the 1% level (all p-values < 0.001). These results provide convincing statistical evidence that these two sets of environmental and socio-cultural variables are highly associated.

Table 3: Measures of Overall Model Fit for Canonical Correlation Analysis

Canonical Function	Canonical Correlation	Canonical Roots	F-statistics	p value
1	.950	.903	4.65	< .001
2	.487	.237	1.16	.320
3	.394	.155	1.13	.348
4	.341	.117	1.27	.284
5	.290	.084	1.61	.214

Multivariate Significance Test

Statistics	Value	F-statistics	p-value
Wilk's lambda	.051	4.65	<.001
Pillai's Trace	1.496	2.49	0.001
Hotelling-Lawley Trace	9.997	9.94	<.001
Roy's GCR	9.229	54.13	<.001

Notes: The canonical correlation is defined as the square roots of the eigen-values of the matrix, $S_{yy}^{-1}S_{yx}S_{xx}^{-1}S_{xy}$, where S_{ij} is the covariance matrix between two sets of variables, i and j, for i,j = x, y; and where $\mathbf{x} = (x_1, ..,x_p)'$, $\mathbf{y} = (y_1, ..,y_q)'$. There are s = min(p,q) numbers of canonical correlations. Canonical roots are the squares of the canonical correlation. The F-statistics gives the measure for the significance of succeeding canonical correlations after the preceding canonical correlations. The F-statistics for each of the multivariate significance tests are given for the hypothesis of no relationship between two sets of variables (the y's and the x's). They test for the overall significance of the canonical correlations.

Next, we employ multiple regression analysis to investigate the relationship between each of socio-cultural variables and the overall ESI. The hypotheses previously proposed are tested. The results are reported in Table 4 in the form of standardized coefficients, corresponding t-statistics.[11] The results show that PDI (power distance index) and MAS (masculine-feminine index), and EDU (Tertiary Education) are significant at the 10% level or lower. In particular, PDI and EDU are significant at the 5% level, and their signs are as expected. The significant and negative coefficient on PDI implies that our hypothesis #3 is supported by the data. That is, low-power-distance cultures tend to have a higher level of environmental sustainability than high-power-distance cultures. In high power distance cultures, social justice or environmental justice for non-power holders can be often ignored for the benefits of the power holder, or in the name of efficiency. In cross-national settings, power holders in certain countries such as dictators and military regimes earn personal gains by taking the environmental toxins of other countries at the sacrifice of their own general public. Power holding government elites in many countries have used their positions to seek rent by deliberately mitigating the environmental policy and implementation Lopez and Mitra (2000). These kinds of practices that lower environmental conditions can be committed with less social resistance in high power distance cultures than low power distance cultures, since non-power holders as well as power holders tend to accept such environmental inequalities as an inevitable condition necessary to maintain social order.

[11] We also test for possible heteroskedasticity of an unknown form using White's LM test (1980). The LM statistic is given as 1.384 (p-value = 0.258) when the cross-terms of independent variables are used, and it is 0.925 (p-value = 0.535) when no cross-terms are used. These results indicate that a heteroskedasticity problem does not exist in the regression model in Table 4.

Table 4: Regression Result (I)

Dependent variable: Environmental Sustainability Index (ESI)

	Standardized Coefficients	t-statistics	p-value
UAI	0.037	0.341	0.735
IDV	-0.006	-0.030	0.977
PDI	0.308	-2.187**	0.035
MAS	-0.176	-1.765*	0.086
GNP	0.218	1.478	0.148
EDU	0.394	2.400**	0.022
$R^2 = 0.663$			

Notes: UAI: Uncertainty Avoidance Index; IND: Individualism-Collectivism Index; PDI: Power Distance Index; MAS: Masculine-Feminine Index; GNP: GNP per capita; EDU: % of Tertiary Education. * significant at the 10% level; ** significant at the 5% level.

Another aspect of high power distance culture that can contribute to a negative relationship with the level of ESI is the fact that the illegal use of power is rarely challenged by the non-power holder. Any challenges initiated by subordinates against their boss in high power distance culture can be viewed as disloyal, or a challenge to the authority of the boss. Only vertical-downward communication or instruction is considered appropriate; power distribution between power holders and non-power holders discourages subordinates from questioning authority (Cohen and Nelson, 1994). More often than not, catastrophic environmental accidents are the result of pathological deprivation of morality in the society. Particularly, in high power distance cultures, instructions from those in charge to cut corners to save money or to improve "efficiency" are accepted and implemented at the lower level with less resistance or challenges. This type of culture tends to become more propitious for so called "crimes of obedience," as described by Kelman and Hamilton (1989). People seem to assume that superior orders override the moral considerations that might apply in other situations, freeing them of responsibility for their actions. Unquestioning obedience to authoritative orders shown by people will be more prominent in high power distance cultures than lower power distance cultures, and thereby seriously jeopardize environmental justice and contribute to an increase in unsafe environmental practices.

The other significant culture variable is MAS. Its coefficient is also negative, which implies that our hypothesis #4 is also supported. Thus, the overall level of the ESI in a feminine culture is predicted to be higher than in a masculine culture, for equivalent income, education, etc. As Hofstede (1980) indicates, since feminine cultures emphasizes such values as being more attentive to the needs of others and pursuing the quality of life, it can be more conducive to a high level of environmental consciousness and sensitivity, which can eventually lead to higher levels of ESI. When people in masculine cultures reach the crossroads of a decision, their mental programming provides pressure to favor achieving goals or obtaining material gains, even at the sacrifice of others well being. This goal oriented masculine culture tends to ignore the environmental risks and judge them as less problematic. This increases their tendency to negotiate environmental concerns for more swift achievement of their goals by bypassing the law or cutting corners. Even if we have to exercise every caution not to confuse this cultural dimension with the characteristics of the gender, since the profile of feminine culture seems to encompass values that are more typical of women than of men, eco-feminism can lend us some insight as to how a feminine culture can be more inclined to be pro-environmental than a masculine culture. *Eco-feminism* basically claims that women are closer to nature than men because both eco and feminism sustain life, and both are colonized and exploited within the male-dominant society. Thus, women can develop more of a sense of solidarity with nature Jackson (1993). Since people in feminine cultures emphasize values

as typical female members do, such as caring for others, interdependence and quality of life, as compared to goal achievement, they tend to care more about public goods including the environment, which is so vital to the well-being of other members in the society. This kind of cultural orientation will be undoubtedly more conducive to enhance environmental sensitivities and help people maintain a higher level of ESI.

The significant positive coefficient on EDU supports our hypothesis #6. The positive relation between the level of education and the degree of natural environmental consciousness has been already corroborated by previous research [see Cotgrove and Duff (1980), Morrison and Dunlap (1986), Kriesi (1989), and Eckersley (1989)]. This result seems quite sensible because people who have a higher level of education are more likely to be aware of the complex relationships between mankind and environment, and understand the long term consequences of environmental actions. This intellectual capability acquired through education, can lead to a higher level of environmental sensitivity.

As briefly mentioned before, the coefficients of UAI and IDV are insignificant at the 10% level [see Table 4]. Further, their signs are different from those in the canonical correlation analysis. Thus, results in Table 4 indicate that neither hypothesis #1 or #2 is supported by our data. One further interesting finding is that the coefficient on per capita GNP is insignificant. As noted above, the notion of looking for a simple linear relationship between per capita income and ESI may be wrong headed; either (or both) because an Environmental Kuznet Curve (EKC) result applies rather than a monotonic relation, or because controlling for cultural variation in effect already controls for income. To test these possibilities, several auxiliary regressions were run, with the results reported in Table 5.

As a baseline model, we repeat the regression results from Table 4, but this time with un-standardized coefficients. This is denoted as Model A. To begin with, in Model B, we consider the regression model that excludes the two significant culture variables, PDI and MAS. Interestingly, the coefficient of per capita GNP now becomes significant (at the 10% level). Clearly, there is an interaction effect between income and cultural variables. This may suggest that the significant income effect of the EKC results reported for cross sections of countries may be mere artifacts, which appear when significant culture variables are absent. They may exhibit the generally negative influence of authoritarian regimes that are reflected in income and education levels and the environment. In Model C, we obtain a similar result; only when we drop two significant variables: one cultural variable (PDI) and the social variable (EDU), the coefficient of per capita GNP becomes significant.[12]

Perhaps, the relationship between income and ESI is non-linear, as the EKC literature suggests. We investigate this possibility by adding the squared term of per capita GNP to Model A. Results are reported as Model D, and show that the coefficients of both per capita GNP and its squared term are insignificant, negating the non-linear relationship between income and environmental conditions. Clearly, the EKC results are not supported, and this finding makes a sharp contrast from that of Grossman and Krueger (1995).[13] In Model E, we drop two highly significant variables, PDI and EDU (as in Model B), but keep the square of GNP. The coefficients of income and its square term remain insignificant. This result is not changed when two cultural variables, PDI and MAS, are dropped, though we do not report this regression. Overall, our findings show that the popular EKC phenomenon can be seen as mere artifacts that may be shown when the effect of cultural variables is not taken into account. This illustrates the importance of the role of cultural variables.

[12] The common model selection procedures using the adjusted R-square or the Akaike information criterion lead us to select Model A over Model B or C. The usual F and LR tests (not reported) also indicate that Model A is preferred.

[13] However, some caution is warranted because the nature of the data for this research is somewhat different from that typically used for EKC studies. ESI is a more general data than specific pollutants such as SO_2, and the evidence in the literature is that the broader the measure the more likely that the relation to income will be monotonic.

Table 5: Regression Results (II)

	Dependent Variable: ESI				
Variables	Model A[a]	Model B	Model C	Model D	Model E
UAI	0.017	0.012	0.051	0.024	0.042
	(0.34)	(.223)	(0.91)	(0.45)	(0.71)
IDV	-0.002	0.037	0.184	0.021	0.144
	(-0.03)	(0.44)	(2.71)**	(0.24)	(1.59)
PDI	-0.151			-0.156	
	(-2.18)*			(-2.23)**	
MAS	-0.103		-0.143	-0.104	-0.140
	(-1.77)*		(-2.22)**	(-1.76)*	(-2.15)**
GNP	0.193	0.254	0.336	-0.199	0.677
	(1.48)	(1.83)*	(2.43)**	(-0.37)	(1.30)
GNP*GNP				0.009	-0.008
				(0.74)	(-0.68)
EDU	.217	0.259		0.253	
	(2.40)**	(2.64)**		(2.45)**	
Constant	59.08	41.39	48.19	58.95	48.45
Adj R^2	0.607	0.529	0.506	0.602	0.499
AIC	6.926	7.069	7.115	6.957	7.149
R^2	0.663	0.573	0.553	0.668	0.559
F-stat	11.81	12.77	11.77	10.07	9.373
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log-lik	-141.91	-146.98	-147.97	-141.58	-147.71

Notes: t-statistics are given in the parentheses. * Significant at the 10% level and ** Significant at the 5% level.
[a] Model A corresponds to the model in Table 4, but the coefficients are not standardized here, where the coefficients reported in Table 4 are standardized.

Concluding Remarks

It may not be difficult to admit that the private and public institutions of a country will reflect its culture and that the culture/institutions nexus makes a difference in both economic activities and the level of environmental sustainability of the nation state. Nonetheless, the significance of cultural variables has not been seriously considered in the literature. Cultures are not surface garments to be discarded when they seem to be of questionable usefulness in relation to widely desired ends. In this regard, in this present paper, we have explored the statistical link of cultural factors with the environmental performance.

Our exploration has uncovered a clear statistical link, at least for the sample of 43 countries, between two dimensions of national culture and environmental sustainability measured at the

national level by the ESI. Specifically, we find that both power distance and masculinity are significantly negatively related to the ESI, while education is positively related. As an illustration of the important role of cultural variables, we demonstrated that the popular Environmental Kuznets Curve (EKC) phenomenon can be seen as a mere artifact which can occur in the absence of cultural variables: there is no significant relationship between per capita income and the ESI when the significant culture variables are included, though there is a positive relation when they are excluded. Our findings also imply that the environmental performance of a country depends on various economic activities such as international trade and foreign direct investment, but it also depends on socio-cultural traits of the nation sate. Particularly, the inter-relationship may be inferred from the perspective of the restorative capability for the degraded environment and their ability to respond to environmental challenges.

References

Appadurai, A, 1996. *Modernity at Large: Cultural Dimensions of Globalization.* Minneapolis, MN, University of Minnesota Press.

Baland, J. M. and J. P. Platteau, 1998. "Division of the Commons: A Partial Assessment of the New Institutional Economics of Land Rights." *American Journal of Agricultural Economics* 80: 644-650.

Blackman, A. and X. Wu. 1998. "Foreign Direct Investment in China's Power Sector: Trends, Benefits, and Barriers." Discussion paper 98-50, Washington, D.C., Resources for the Future.

Cernea, M. M. 1993. "The Sociologist's Approach to Sustainable Development." *Finance and Development* 30: 11-13.

Cohen, D. V. and K. Nelson. 1994. "Multinational Ethics Programs: Cases in Corporate Practice." *Emerging Global Business Ethics*, edited by Hoffman, W.M., Kamm, J. W., Frederick, R.E. and Petry, Jr., E. S., Westport, CT: Quorum Books.

Cotgrove, S. and A. Duff. 1980. "Environmentalism, Middle-Class Radicalism and Politics." *The Sociological Review* 2: 333-351.

Douglas, M. and S. Ney, 1998. *Missing Persons: A Critique of Personhood in the Social Sciences.* Berkeley, CA: University of California Press.

Dowell, G., S. Hart, and B. Yeung. 2000. "Do Corporate Global Environmental Standards Create or Destroy Market Value?" *Management Science* 46: 1059-1074.

Eckersley, R. 1989. "Green Politics and the New Class: Selfishness or Virtue?" *Political Studies* 2: 205-223.

Elgin, D. 1994. "Building a Sustainable Species-Civilization. A Challenge of Culture and Consciousness." *Futures* 26: 234-245.

Eskenland, G. and A. Harrison. 2002. "Moving to Greener Pastures? Multinational and the Pollution Haven Hypothesis." Cambridge, MA: National Bureau for Economic Research. NBER Working paper 8888.

Etzioni, A, 1995. *The Spirit of Community: Rights Responsibilities and the Communitarian Agenda.* London, UK: Fontana Press.

Franke, R. H., G. Hofstede, and M. H. Bond. 1992. "Cultural Roots of Economic Performance: A Research Note." *Strategic Management Journal* 12: 165-173.

Gentry, B, 1998. *Private Capital Flows and the Environment: Lessons from Latin America.* Cheltenham, UK: Edward Elgar Press.

Gersh, J. 1999. "Seeds of Chaos: Effects of Globalization on the Environment." *The Amicus Journal* 21: 36-40

Goldsmith, E. 1997. "Can the Environment Survive the Global Economy?" *The Ecologist* 27: 242-248.

Gorham, E. 1997. "Human Impacts on Ecosystems and Landscapes." in *Placing Nature: Culture and Landscape Ecology*, edited by Joan Iverson Nassauer. Washington D.C.: Island Press.

Grossman, G. M and A. B. Krueger. 1995. "Economic Growth and the Environment." *Quarterly Journal of Economics* 112: 353-377.

Gudeman, S. 1998. *Economic Anthropology*. Cheltenham, UK: Edward Elgar Publishing Co.

Halperin, R. 1994. *Cultural Economies Past and Present*. Austin, TX: University of Texas Press.

Hampden-Turner, C. and F. Trompenaars. 1997. "Response to Geert Hofstede." *International Journal of Intercultural Relations* 21: 149-159.

Hirschmann, D., 1999. "Development Management Versus Third World Bureaucracies: A Brief History of Conflicting Interests." *Development and Change* 30: 287-305.

Hofstede, G. H. 1980. *Culture's Consequences, International Differences in Work-Related Values*. Beverly Hills, CA: Sage Publications.

Hofstede, G. H. 1983. "National Cultures in Four Dimensions." *International Studies of Management and Organization* 13: 46-74.

Hofstede, G. H. 1991. *Cultures and Organizations: Software of The Mind*. London, UK: McGraw-Hill.

Hofstede, G. and M. Bond, 1984. "Hofstede's Cultural Dimensions: An Independent Validation Using Rokeah's Value Survey." *Journal of Cross-Cultural Psychology* 15: 417-433.

Hoppe, M, 1990. "A Replication of Hofstede's Measures." Unpublished doctoral dissertation, University of North Carolina at Chapel Hill.

House, R., M. W. Dickson, P. J. Hanges, and S. A. Ruiz-Quintanilla. 1999. "Cultural Influences on Leadership and Organization Globe Project." *Advances in Global Leadership*, Vol. 1, JAI Series.

Jackson, C.. 1993. "Women/Nature or Gender/History? A Critique of Ecofeminist 'Development'." *Journal of Peasant Studies* April 20: 389-419.

Kellert, S. R. 1996. *The Value of Life*. Washington, D.C.: Island Press.

Kelman, H. and V. L. Hamilton. 1989. *Crimes of Obedience: Toward a Social Psychology of Authority and Responsibility*, New Haven, CT: Yale University Press.

Kinsley, D. R. 1995. *Ecology and Religion*. Englewood Cliffs, NJ: Prentice Hall.

Kluckhohn, F. and F.L. Strodtbeck, 1961. *Variations in Value Orientations*. Evanston, IL: Row, Peterson.

Kogut, B. and H. Singh. 1988. "The Effect of National Culture on the Choice of Entry Mode." *Journal of International Business Studies* 19: 411-432.

Kriesi, H. 1989. "New Social Movements and the New Class in the Netherlands." *American Journal of Sociology* 94: 1078-1116.

Lopez, R. and S. Mitra. 2000. "Corruption, Pollution, and the Kuznets Environmental Curve," *Journal of Environmental Economics and Management* 40: 137-150.

McClelland, D., 1950. *The Achieving Society*, New York, NY: Van Nostrand.

Meier, G. M. and J. E. Rauch, 2000. *Leading Issues in Economic Development*. (7th Edition), New York, NY: Oxford University Press.

Morrison, D. E. and R. E. Dunlap. 1986. "Environmentalism and Elitism: A Conceptual and Empirical Analysis." *Environmental Management* 10: 581-589.

Nakata, C and K. Sivakumar. 1996. "National Culture and New Product Development: An Integrative Review." *Journal of Marketing* 60: 61-72.

Narayan, D. and L. Pritchett. 1996. *Cents and Sociability: Household Income and Social Capital in Rural Tanzania*. Washington D.C.: The World Bank.

Narotzky, Susana, 1997. *New Directions in Economic Anthropology*. London, UK: Pluto Press.

Parsons, T and E. A. Shils. (eds), 1951. *Toward a General Theory of Action*. Cambridge, MA: Harvard University Press.

Payne, M. and C. Losada. 2000. *Institutions and Development in Latin America: An Approach Toward Quantitatively Describing Institutional Capacity in the Region*, Technical Study. Washington, D.C.: Inter-American Development Bank.

Pretty, J. and H. Ward. 2001. "Social Capital and the Environment." *World Development* 29: 209-227.

Ronen, S.. 1986. *Comparative and Multinational Management.* New York, NY: John Wiley and Sons.

Schwartz, S. H., 1990. "Individualism-Collectivism: Critique and Proposed Refinements." *Journal of Cross-Cultural Psychology* 21: 139-157.

Schwartz, S. H. 1994. "Cultural Dimensions of Values: Toward An Understanding Of National Differences." In U. Kim, H.C. Triandis, C. Kagitcibasi, S.C. Choi, and G. Yoon (eds.), *Individualism and Collectivism: Theoretical and Methodological Issues* (pp. 85-119), Thousand Oaks, CA: Sage Publications.

Shane, S. 1992. "Why Do Some Societies Invent More Than Others?" *Journal of Business Venturing* 7: 29-46.

Singh, P. J.. 1990. "Managerial Culture and Work-related Values in India." *Organizational Studies* 11: 75-101

Smith, P. B., S. Dugan and F. Trompenaars. 1996. "National Culture and the Values of Organizational Employees. A Dimensional Analysis across 43 Nations." *Journal of Cross-Cultural Psychology* 27: 231-264.

Stern, D. I., 1998. "Progress on the Environmental Kuznets Curve?" *Environment and Development Economics* 3: 173-196.

Stern, D. I., and M. S. Common. 2001. "Is There an Environmental Kuznets Curve for Sulfur?" *Journal of Environmental Economics and Management* 41: 162 – 178.

Straub, S. 2000. "Empirical Determinants of Good Institutions: Do We Know Anything?" Working Paper #423, Research Department, Washington, D.C.: Inter-American Development Bank.

Tayeb, M. 1994. "Organizations and National Culture: Methodology Considered." *Organizational Studies* 15: 429-446.

Tlaiye, L and D. Biller. 1994. "Successful Environmental Institutions: Lessons from Columbia and Curitiba, Brazil." Washington, D.C.: World Bank.

Todaro, M. P. 2000. *Economic Development.* Reading, MA: Addison-Wesley.

Tonelson, A. 2000. *The Race to the Bottom.* Boulder, CO: Westview Press.

Trompenaars, F. and C. Hampden-Turner. 1994. *Riding the Waves of Culture: Understanding Diversity in Global Business.* Burr Ridge, IL: Irwin Professional Publisher.

Ward, H. 1998. "State, Association, and Community in a Sustainable Democratic Polity: Towards A Green Associationalism." in F. Coenen, D. Huitema, and L.J. O'Toole (eds.) *Participation and the Quality of Environmental Decision Making.* Dordrecht, Netherlands: Kluwer Academic Publishers.

Weber, M. 1958. *The Protestant Ethic and the Spirit of Capitalism.* translated by Talcott Parsons, Reprint, New York, NY: Charles Scribner's Sons.

White, H.. 1980. "A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity." *Econometrica* 48: 817-838.

Wilk, R. R. 1996. *Economics and Cultures: Foundations of Economic Anthropology.* Boulder, CO: Westview Press.

World Bank. 2001. *The World Development Indicators.* Washington, D.C.: World Bank.

World Commission on Environment and Development. 1987. *Our Common Future.* Oxford, New York, NY: Oxford University Press.

World Economic Forum. 2001. *Global Leaders for Tomorrow, Environmental Sustainability Index.* Genova, Switzerland.

Xing, Y. and C. Kolstad. 2002. "Do Lax Environmental Regulations Attract Foreign Investment?" *Environmental and Resource Economics* 21: 1-22.

Appendix A. Environmental Sustainability Index Building Blocks

Components	Indicators	Underlying Variables
Environmental	Air quality	SO2, NO2, TSP concentration
Systems	Water Quality	Internal renewable water/cap, water inflow/cap
(ESYSTEM)	Water quantity	Dissolved oxygen, phosphorus concentration, suspended solids, electrical conductivity
	Biodiversity	% of mammals threatened, % of breeding bird threatened
	Terrestrial	Severity of human induced soil degradation
	Systems	% of land area affected by human activities
Stresses	Air	NOx emissions/ populated land area; SO2 emissions/populated
(ESTRESS)	Pollution	land area; VOCs emissions/populated land area; Coal consumption/populated land area; Vehicles/populated land area
	Water Stresses	Fertilizer consumption/ hectare of arable land; Pesticide use/ hectare of crop land; Industrial organic pollutants/ available fresh water
		% of country's territory under severe water stress
	Eco-system Stress	% change in forest cover 1990-1995
		% of country's territory in acidification exceedence
	Waste Consumption	Consumption pressure/cap
	Pressure	Radioactive waste
	Population	Total fertility rate
	Pressure	% change in projected population between 2000 and 2050
Human	Basic Population	Daily per capita calorie supply as a % of total requirements
Vulnerability		% of population with access to improved drinking-water supply
(HUMVUL)	Environmental	Child death rate from respiratory diseases
	Health	Death rate from intestinal infectious diseases
		Under-5 mortality rate
Social and	Science/Technology	R&D scientists and engineers per million population
Institutional		Expenditure for R&D as a percentage of GNP
Capacity		Scientific and technical article per million population
(SOCINT)	Capacity for	IUCN member organizations per million population
	Debate	Civil and political liberties
	Regulation and	Stringency and consistency of environmental regulations
	Management	Degree to which environmental regulations promote innovation
		Percentage of land area under protected status
		Number of sectoral EIA guidelines
	Private Sector	No. of ISO 14001 certified companies per million dollars GDP; Dow
	Responsiveness	Jones Sustainability Group Index membership; Average Innovest
		EcoValue'21 rating of firms; World Business Council for Sustainable
		Development members; Levels of environmental competitiveness
	Environmental	Availability of sustainable development info. at the national level
	Information	Environmental strategies and action plans
		Number of ESI variables missing from selected data sets
	Eco-Efficiency	Energy efficiency (total energy consumption per unit GDP)
		Renewable energy prod. as a % of total energy consumption
	Public Choice	Price of premium gasoline
	Distortions	Subsidies for energy or materials usage & Corruption
Global	International	No. of memberships in environmental intergovernmental orgs.
Stewardship	Commitment	Percentage of CITIES reporting requirements met
(GLBSTEW)		Levels of participation in the Vienna Convention/Montreal Prot.
		Compliance with the environmental agreements
	Global-Scale	Montreal Protocol Multilateral Fund participation
	Funding/Participation	Global Environmental Facility participation
	Protecting	FSC accredited forest area as a % of total forest area
	International	Ecological footprint "deficit"
	Commons	CO2 emissions (total times per capita); Historic cumulative CO2
		Emissions; CFC consumption (total times per capita)

Appendix B. Data on ESI, Culture, GNP/Cap and Education for Sample of 43 Countries

Country	ESI	Esystem	Rstress	Rhumvul	Socintcap	Glbstew	UAI	IDV	PDI	MAS	GNP	TERTEDU	Income Group	Region Code
Argentina	62.5	71.2	67.5	66.3	56.2	50.1	86	46	49	56	8.87	42	2	2
Australia	70.7	65.7	50.4	81.3	82.8	69.5	51	90	36	61	20.14	80	1	2
Austria	67.8	65.8	37.1	80.5	83.2	67.6	70	55	11	79	28.18	48	1	1
Belgium	44.1	25.5	10.0	81.2	68.2	67.4	94	75	65	54	27.24	57	1	1
Brazil	57.4	58.0	62.6	61.1	53.1	55.2	76	38	69	49	4.78	15	2	2
Canada	78.1	91.2	51.2	82.6	82.5	72.1	48	80	39	52	19.83	90	1	1
Chile	56.6	53.3	58.6	65.2	60.6	43.2	86	23	63	28	4.70	31	2	2
Colombia	54.8	70.5	60.4	63.3	41.0	44.1	80	13	67	64	2.18	17	2	2
Costa Rica	58.8	51.2	34.5	77.2	68.8	72.7	86	15	35	21	3.10	33	2	2
Denmark	67.0	57.0	30.6	82.9	87.4	68.4	23	74	18	16	36.86	45	1	1
Ecuador	51.8	62.6	54.2	43.1	45.8	49.5	67	8	78	63	1.57	26	2	2
El Salvador	43.7	51.0	43.3	33.6	44.5	37.4	94	19	66	40	1.78	18	2	2
Finland	80.5	85.3	58.0	78.5	91.2	69.9	59	63	33	26	25.48	74	1	1
France	65.8	58.8	40.9	82.8	80.7	63.7	86	71	68	43	26.13	51	1	1
Germany	64.2	n.a.	35.2	82.8	82.5	66.0	65	67	35	66	28.30	47	1	1
Greece	53.1	44.2	55.3	81.5	46.6	57.6	112	35	60	57	11.13	47	2	1
Guatemala	47.3	50.7	42.8	45.0	45.1	55.9	101	6	95	37	1.51	8	2	2
India	40.9	24.0	57.0	32.7	43.7	44.3	40	48	77	56	0.37	7	2	2
Indonesia	42.6	33.5	57.8	52.7	34.3	46.4	48	14	78	46	1.11	11	2	2
Ireland	64.0	69.7	44.2	82.4	72.5	49.8	35	70	28	68	16.28	41	1	1
Israel	49.5	46.1	17.8	81.7	72.9	34.1	81	54	13	47	15.73	44	1	1
Italy	54.3	36.8	40.7	82.6	66.7	54.8	75	76	50	70	20.01	47	1	1
Japan	60.6	50.3	25.4	83.0	82.8	58.3	92	46	54	95	38.19	43	1	2
Malaysia	49.7	52.9	31.9	70.7	47.1	66.3	36	26	104	50	4.46	11	2	2
Mexico	45.3	25.0	57.2	62.7	44.6	52.2	82	30	81	69	3.71	16	2	2
Netherlands	66.0	58.0	23.7	79.4	87.1	75.6	53	80	38	14	25.19	47	1	1
New Zealand	71.3	57.6	56.3	82.3	83.3	74.9	49	79	22	58	14.88	63	1	2

Appendix B continued

Country	ESI	Esystem	Rstress	Rhumvul	Socintcap	Glbstew	UAI	IDV	PDI	MAS	GNP	TERTEDU	Income	Region
Norway	78.2	87.4	52.3	82.4	85.3	73.9	50	69	31	8	39.75	62	1	1
Pakistan	43.6	43.4	47.9	26.3	42.1	52.5	70	14	55	50	0.50	4	2	2
Panama	55.9	50.8	60.1	50.0	53.7	66.0	86	11	95	44	2.80	32	2	2
Peru	54.3	66.1	64.5	32.3	43.7	56.3	87	16	64	42	2.65	26	2	2
Philippines	35.7	22.0	36.8	49.5	37.8	45.6	44	32	94	64	1.19	35	2	2
Portugal	61.4	58.8	52.2	81.0	66.5	52.9	104	27	63	31	10.95	38	2	1
Singapore	46.8	44.6	16.8	82.1	65.2	39.0	8	20	74	48	33.93	39	2	2
Spain	59.5	46.8	52.6	82.3	66.9	55.9	86	51	57	42	14.61	53	2	1
Sweden	77.1	79.3	53.9	77.6	86.3	80.5	29	71	31	5	25.77	50	1	1
Switzerland	74.6	60.3	44.8	82.9	92.3	75.3	58	68	34	70	43.60	34	1	1
Thailand	45.2	36.3	50.8	48.5	47.6	43.3	64	20	64	34	2.72	21	2	2
Turkey	46.3	38.1	58.1	62.4	42.4	39.2	85	37	66	45	3.11	21	2	2
UK	64.1	58.1	23.7	82.3	86.6	61.8	35	89	35	66	20.87	52	1	1
Uruguay	64.6	69.7	62.0	65.6	59.9	69.8	100	36	61	38	6.67	30	2	2
USA	66.1	63.1	37.0	82.3	83.4	56.4	46	91	40	62	29.04	81	1	1
Venezuela	50.8	72.6	58.9	45.9	32.8	45.2	76	12	81	73	3.45	25	2	2

Notes: ESI (Environmental Sustainability Index) is a composite value based on the five major components described in Appendix A. The definitions of the other variables are given in Appendix A. Income Group: 1 = High Income countries, 2 = Low income countries. Region Code: 1 = Europe and North America, 2 = Other Regions (Asia, Australia, Latin America and Africa)