Contribution of Descriptive Characteristics to the Level of Environmental Impact Among Nations with Low Debt-to-Asset Ratios

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Abstract

This study examines the relationship between countries with low debt-to-asset ratios ecological balance, as measured by the difference between a countries' biocapacity and ecological footprint of consumption and several descriptive factors. The independent variables within this model are specifically focused on the governmental propensity to respect the environment, employment makeup within the country, and citizen welfare as it relates to resources available for environmental efforts. In contrast to other studies, countries used were those who arguably have the monetary means to invest in environmental policy and the model was multifaceted, including many levels. Using multiple linear regression analysis of empirical data from 101 countries, results were that the factors of life expectancy at birth, literacy rate, percent employment in agriculture, and CO_2 emissions per capita significantly correlated with the ecological footprint while governmental environmental agency, percent of unemployment, life expectancy at birth, percent employment in industry, and proportion of seats held by women in national parliament did not appear to have a significant correlation with the ecological footprint. Based on these findings, the United Nations and other such governing bodies should look at developing policies that consider these internal factors if they wish to have successful policy outcomes and adherence with respect to the environment.

Keywords: ecological footprint, environmental impact, international environmental law

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The most recent Global Environment Outlook report published by the United Nations Environmental Programme (2007) highlights that current environmental trends are compromising human welfare: "in some cases climate change is having severe effects on human health, food production, security and resource availability," "both indoor and outdoor pollution [are] still causing many premature deaths," "land degradation is decreasing agricultural productivity, resulting in lower incomes and reduced security," (p. 6), species extinction rates are increasing at a rate 100 times that shown in fossil records (p. 162), and "contaminated water remains the greatest single cause of human sickness and death on a global scale" (p. 151). There is not a more truly international crisis occurring today which calls for action and investigation than the health of the world and resources which we all share.

The current study explores which empirical factors are important in influencing the environmental impact a country and is measured by the ecological footprint, stated as either the deficit or surplus, a country consumes as compared to the resources it has available (Global Footprint Network, 2010). This is the dependent variable. Environmental impact is operationally defined as a country which draws heavily on its available resources and in the context of the ecological footprint, has a deficit.

In consideration of the independent variables to be used, the United Nations Environmental Programme (2009) focuses on six main areas in its environmental examination: climate change, resource efficiency, disasters and conflicts ("minimize threat to human well-being from the environmental causes and consequences of existing and potential natural and man-made disasters"), environmental governance, harmful substances and hazardous waste, and ecosystem management (p.2). The scope of this study includes independent variables similar to those which the United

Nations Environmental Programme focuses on: governmental propensity to respect the environment; employment as it influences its likelihood to be less environmentally impactful; and citizen welfare as it relays how much need a country has to invest its resources in improving the countries overall health as opposed to environmental efforts.

In order to select the countries used in the study, countries with a low debt-to-asset ratio are used – logically those who have relatively more resources to invest on improving their environmental state and at a level seen by the European Union in its guidelines for adopting the Euro (European Union, 2006). Ultimately 101 countries (see Table 1) were selected.

This study is done primarily to modestly aid in how international institutions should approach structuring laws and with factors to consider when creating and modifying environmental standards to be supremely effective. Though including such variables requires great breath – "The development of modern international environmental law…has been one of the most remarkable exercises in international lawmaking, comparable to the law of human rights and international trade law in the scale and form it has taken" (Birnie, Boyle, & Redgwell, 2009, p. 1). Consequently, in an effort to refine our understanding of environmental impact, it is essential in this and future studies that the approach to examining environmental impact be multifaceted and thorough, considering many significant key actions involved within a nation such as implementing environmental laws, structuring government to support such desires, and assessing methods for enforcement.

The paper begins with a presentation of previous literature and the theories and discussion presented posits a need to examine a multifaceted empirically based model for determining environmental impact. Next, the variables used in the model are rationalized, examined, and finally conclusions are stated along with the implications for future research.

Literature Review

Environmental concerns have unquestionably been a hot topic internationally on many fronts – within economics, science, and sociology, for example. The word sustainable, used in many contexts, has been noted to be a common buzzword used with "remarkable regularity" among government officials, policy-makers, and scientist alike (Bell, 2008, p. 3). The many benefits and fruits the environment produces are being highlighted as well: promoting economic growth, as a contributor to unique cultures, and enabling enjoyable, free, and often survival supporting benefits (United Nations Environmental Programme, 2007, p. 13). All too often, these resources are being recognized as they slowly begin to disappear. The conversation and action throughout the world have caused many multilateral environmental agreements (MEAs) to become adapted (United Nations Environmental Programme, 2007, p. 9) recognizing the formal importance of the environment and fashioning an international push to reverse the damage done.

However, these agreements have been only moderately successful. So why are some countries proposing and adhering to "environmental appreciation" more frequently and consistently than others? Research over the last two decades has explored various elements such as income distribution and wealth effects (Holland, Peterson, & Gonzalez, 2009; Hamilton & Turton, 2002), urbanization (York, Rosa, & Dietz, 2003), and levels of international trade (Widemann, Lenzen, Turner, Barret, 2007). Most often gross domestic product (GDP) and population are attributed to environmental impact (Özler & Öbach, 2009, p.82). The inverse relationship has also been examined. Less developed, less populous countries become better off economically as a product of their environmentalism (Schofer & Granados, 2006, p. 965). This relationship indicates a strong, established relationship between a country's environmental impact and economic well-being, as measured by GDP, regardless of a country's state of development.

Also explored within the field of environmental law enforcement have been the disparate environmental impact levels between more-developed and developing countries. The ecologically unequal exchange theory "posits that the vertical flow of exports is a structural mechanism allowing for more-developed countries to partially externalize their consumption-based environmental impacts to lesser-developed countries" (Jorgenson, Austin, & Dick, 2009, p. 263) and also suggests that more-developed countries have greater access to resources externally (p. 265). From another perspective, the environmental Kuznets curve (EKC) says that "in the early stages of economic growth degradation and pollution increase, but beyond some level of income per capita, which will vary for different indicators, the trend reverses, so that at high income levels economic growth leads to environmental improvement" (Stern, 2004, p. 1419). The ecologically unequal exchange theory, in combination with the EKC presents a very grim outlook for developing countries both in having their resources depleted by outside sources as well as their own country's lack of economic growth causing them to face a pinnacle that cannot be achieved to reduce their environmental impact.

Another applicable theory, the "treadmill of production," helps to explain how the cycle of struggling to increase production and increase GDP often leads to corners being cut and more waste being produced therefore increasing the environmental impact (Gould, Weinberg, & Schnaiberg, 1993, p. 221). This cycle is often cited as very influential in the environmental impact of countries and helps to explain and encourage research such as this which examines the disparities between ecological footprints of countries with low debt-to-asset ratios. Therefore, if a country has successfully amassed assets, mainly strong gross domestic product (GDP), that country is more likely to have faced what the treadmill of production asserts is a lesser likelihood to be more environmentally impactful, countering the EKC.

Previous environmental research has examined most or all countries including developing countries and those with high debt to asset ratios in their analysis. Despite the opposing views on

whether high GDP countries are more or less environmentally impacting, this study will use countries with low debt-to-asset ratios so as to eliminate countries with overwhelming barriers to environmental success on the front of resource availability. Additionally, GDP as a significant predictor of countries with low debt-to-asset ratios would indicate that the treadmill production theory could be likely if such a correlation was negative.

Specific overarching theories and models have seldom been presented to predict or determine a country's involvement environmentally. Dernbach's (2003) research presents many significant themes by arguing that the core of attaining sustainable development globally is to analyze integrated decision-making because it "ensure[s] that environmental considerations and goals are integrated or incorporated into the decisionmaking [sic] process for development, and are not treated separately or independently…" along with being the "most easily translated into law and policy tools" (p. 248). He argues that this focus responds well to governments who have been fragmented in their commitment to such policies by acting as the glue which holds sustainability policies together (2003, pp. 257-258). Contributing to this argument, the United Nations Environmental Programme (2007) observed that decision making has become increasingly hands-on and is often spurred by the interaction of various stakeholders and groups "building on national consensus…[and by] encourag[ing] local authorities to engage in dialogue with their citizens" (p. 10). Other research has examined one factor, multiple measure models within the empirical realm such as governmental structure (York, Rosa, and Dietz, 2003; Schofer & Hironaka, 2005) and economics (Özler & Öbach, 2009, p. 98; Jorgenson, Austin, & Dick, 2009).

The literature indicates a gap in studying a consistent group of countries using a multifaceted empirical model due to the newness of this topic. As the goals of this study mirror the outcomes seen within the decision-making model (Dernbach, 2003) and in light of the previous research presented, the following variables are examined:

1. Government as it illustrates inclination to environmental issues and enactment of environmental law (e.g. Dernbach, 2003);
2. Employment structure as it examine links between sectors of employment and their effect on environmental impact (e.g. Rice, 2007; Enrhardt-Martinez, Crenshaw, & Jenkins, 2002);
3. Individual citizen welfare, as a measure of ability to engage in positively contributing to reducing the environmental impact (e.g. Jorgenson, 2003; Heil & Seldon, 2001).

The research question at hand is: what factors most directly affect the degree of environmental impact among countries with low debt-to-asset ratios? The research hypothesis states that there is a significant direct relationship between environmental impact and descriptive characteristics involving governmental attention, employment structure, and citizen welfare. Therefore the null hypothesis is that there is no direct relationship between environmental impact and descriptive characteristics involving governmental attention, employment structure, and citizen welfare. This study is testing the theoretical orientation associated with the Ecological Kuznet's Curve (Stern, 2004, p. 1419) in the sense that the lesser the debt of a country, the more likely they will be or become less environmentally impactful.

Method of Analysis

The basis of this study is to find which indicator variables predict environmental impact – an idea that has been popular "with many governments and agencies devoting substantial resources to indicator development and testing" (Bell, 2008, pp.3-5). There is a challenge to conceptualize the definition of environmental impact (Dernbach, 2003, p. 247). The term 'environmental impact' is used in this study to describe the degree to which a country impacts the earth. Hence, being an environmentally impactful country denotes that a country uses a large portion of the resources available, does not make many efforts to lessen this impact, and engages in environmental

degradation. On the opposite end, countries that are not very environmentally impacting are those which are much more sustainable in their practices such as setting standards when building or producing to lessen the impact as well underutilizing the resources available by investing financially or through other means to enable greater resources efficiency.

The independent variables are governmental propensity to respect the environment, as measured by the proportion of women in the national parliaments, military expenditures, and the presence of a governmental environmental agency; employment structure of the country as it influences its likelihood to be less environmentally impactful, as measured by GDP per capita, percent of employment in agriculture and industry, and unemployment level; and citizen welfare as it relays how much need a country has to invest its resources in improving the countries overall health as opposed to environmental efforts and overcoming large existing environmental hurdles, as measured by life expectancy at birth, literacy rate, and current carbon emissions per capita.

Countries used in this study are those with low debt-to-asset ratios. The logic behind this selection is that the lower the debt-to-asset ratio is the more money a country would arguably be able to spend on discretionary spending such as environmental measures, for instance by decreasing their ecological footprint or increasing biocapacity and increasing their ecological reserve. Ultimately 101 countries, as shown in Table 1, were selected whom had debt-to-asset ratios below .6 which was calculated as external debt divided by GDP (World Bank, 2010). To justify the .6 level considered was that among the Euro convergence criteria was a requirement that the ratio of government debt to GDP was not to exceed 60% (European Union, 2006) therefore indicating that a ratio below .6 is considered economically sound in at least one large international institution's viewpoint and would assumedly equate to the ability to be environmental conscious as well. When the European Commission conducts assessments the .6 debt-to-asset ratio is used to take into account: potential growth; "prevailing cyclical conditions; and "developments in the medium-term budgetary position, particularly fiscal

consolidation efforts in "good times,"' among others (European Union, 2007) all factors which are important in evaluating the propensity of countries to be environmentally aware.

In using this criteria for country selection it is likely that they face the threats of both the treadmill of production theory and possibly threat of the EKC and ecological unequal exchange theory because of their successful accrual of a high GDP comparable to their external debt and possibly because of their stage of development, which the majority of them are ranked relatively low on the World Development Index (United Nations Development Programme, 2010) as shown in Table 1. Additionally, this process left out a large majority of countries which are high on development, such as the United States and many European countries due to their large debt-to-asset ratios.

Dependent Variable

The Global Footprint Network was established in 2003 in order to detail how proportionally people and nations were using resources as they were available. For this study the environmental impact of the country is determined by the ecological balance calculated by the biocapacity of the country minus the ecological footprint of consumption for the country, as made available from Global Footprint Network (2010) data. Each of these measured is reported as global hectares per capita. Biocapacity of the country is the global hectares per capita of cropland, grazing land, forest, fishing ground, and built land. Ecological footprint of consumption is the global hectares per capita of each of these elements consumed. The entirety of this data set is shown in Table 4. In 2007 data made available in 2010, the United Arab Emirates had the largest deficit of 8.9, Kuwait followed with a deficit of 7.4, and Qatar had the third largest deficit of 5.8. Bolivia had the largest reserve of 16.9, Congo had a reserve of 12.2 and Canada had the third largest reserve of 11.3.

Arguably the ecological footprint reflects poorly on countries who have little biocapacity. However, all three of the countries who had the largest reserve also have the largest biocapacities. The United Arab Emirates and Qatar each fell around the average biocapacity of 1.7. As a point of

reference, the United States had the 19th most biocapacity and the 6th largest deficit. This measure is seen as relatively fair and balanced in its approach to measuring the ecological reserve or deficit of a country because it takes into account the existence and use of environmental resources available as well as the land mass and population of the countries by virtue of measuring the resources available and used in hectares per capita of resources available and used (Global Footprint Network, 2010). Its use has been growing and has appeared in numerous other studies as a measure of environmental impact (e.g. Özler & Öbach, 2009; Jorgenson, 2003; Rice, 2007; York, Rosa, Dietz, 2003) and has been called the most comprehensive measure of environmental impact to date.

Independent Variables

Analysis within the categories of government, employment, and citizen welfare is limited to variables which can increase empirical knowledge about the factors influencing the environmental impact rather than aiming to assess the overall well-being of the countries directly, outside of their low debt-to-asset ratio.

Government. There is a large network of organizations ranging from the governments themselves to inter-governmental organizations to the scientific community that have aimed to have an impact on environmental practices and outcomes (Schofer & Hironaka, 2005, p. 25). It is ultimately the governments and citizens themselves who enact the laws and execute environmental practices which influence the overall state of the environment internationally making the characteristics of the government and its people of primal importance to better understand why the large variations of environmental impact exist. However, York, Rosa, and Dietz's (2003) study suggests that form of government has no part in explaining the variations in environmental impact (p. 279). Therefore, form of government is not included within this study. Also within the literature is the positive correlation of military expenditures (Jorgenson, Clark, & Kentor, 2010, p. 8) with environmental impact – the more a country spends on its military the less environmentally conscious it is. Especially among countries

who have managed their debt successfully, military expenditures correlation with environmental impact is of great interest. A variable that has little research in the field of international environmentalism is be included in the model as well – proportion of women in national parliaments. It would be easy to reason that women would be more likely to demand equal resource distribution and care in laws and regulations. Additionally included is a variable for the presence of a governmental environmental agency. Many factors such as money and time investments suggest that this would be a very strong predictor of environmental impact.

Employment. A previous study that used the ecological footprint as its measure already has established that "in almost every respect, the free market, left unchecked by state action, yields greater ecological degradation" (Özler & Öbach, 2009, p. 98) and therefore this study does not aim to examine economic freedom within a country but instead mainly the employment structure of the country. These measures are used: GDP per capita, in order to examine effects as presented by the previously mentioned environmental Kuznets curve, as well as to confirm a previous finding that "low- and lower middle-income countries…exhibit lower environmental consumption" (Rice, 2007, p. 1369); percent of employment in industry and agriculture, to examine the effect of the structure of domestic production, as has been suggested (Enrhardt-Martinez, Crenshaw, & Jenkins, 2002); and percent of the population which is unemployed, in order to reflect the economic and overall health of the country in another manner.

Citizen welfare. Another study which also uses the ecological footprint as measured by Jorgenson (2003) takes a global-approach to find why countries' have a great environmental impact and finds that more powerful countries indeed consume significantly higher (p. 375). Jorgenson (2003) also discovers that "domestic income inequality and literacy rates all prove to be significant predictors of per capita ecological footprint" (p. 375). Literacy rates are used in this study as well as life expectancy at birth to more accurately and comprehensively measure how the welfare of

individual citizens ability and willingness to participate, also mirroring the decision-making model (Dernbach, 2003).

Additionally included is a measure is CO_2 emissions per capita in order to measure the current state of environmental degradation as it affects citizen welfare within a country. Previous research suggests that countries with high incomes contribute the majority of CO_2 emissions (Heil & Seldon, 2001) which closely mirrors the treadmill of production theory.

Analysis

The PASW statistical package was used to determine the strength of the model proposed given the factors chosen in their relation to environmental impact. The empirical data from each of the variables was analyzed using collinear and multiple linear regression analysis. Data used for the analysis is displayed in its entirety in Tables 5, 6, and 7.

Case presentation and discussion

A multiple linear regression was calculated to predict a nation's environmental impact based on their governmental, employment, and citizen welfare variables. The model was significant, R^2 = .410, F (9, 32)=4.167, p< .001, n=41, as shown in Table 2. Life expectancy at birth, literacy rate, percent employment in agriculture, and CO_2 emissions per capita were the most significant predictors. The life expectancy at birth, percent employment in agriculture, and CO_2 emissions per capita were negatively correlated with environmental impact. The literacy rate was positively correlated with environmental impact.

The null hypothesis was accepted with a few exceptions. The null hypothesis stated that there was not a significant direct relationship between environmental impact and descriptive characteristics involving governmental attention, employment structure, and citizen welfare. Indeed, some of the factors did have a direct relationship with environmental impact. However, variables such as governmental environmental agency, which conceptually seems closely related, did not have any

direct significance. And while there was no previous research supporting this, proportion of seats held by women in national parliaments was not significant and actually had a negative effect.

Some of the previous research was not supported by this study either. For instance, the variable of military expenditures (Jorgenson, Clark, & Kentor, 2010, p. 8) was most nearly significant as seen in Table 3, Model 3 which includes GDP per capita and not CO_2 emissions per capita. This result suggests that national defense expenditures likely vary a great deal in their effect on the environment.

Each of the significant findings positively contributes to the theories posed. According to the environmental Kuznets curve (EKC), countries moving through development will be negatively affected by variables such as low life expectancy at birth and literacy rate which is what these results illustrated holds true even in countries with greater resources to surpass such obstacles. The variable of CO_2 emissions per capita agrees with ecologically unequal exchange theory because countries with higher CO_2 emissions per capita, which could be due to more-developed countries externalizing their consumption, indeed are more environmentally impactful which contributes to the hurdles faced by the EKC.

The treadmill theory of production is not supported by this research because GDP was only found to be significant when the independent variables of "CO_2 emissions per capita" and "governmental environmental agency" are removed as illustrated in Table 3, Model 2. In terms of the ecological footprint, these variables are very influential within the model. With both of these variables included, GDP becomes insignificant as seen in Table 3, Model 1. Interestingly, however, when CO_2 emissions per capita are not included GDP per capita becomes incredibly significant as seen in Table 3, Model 3.

The limitations of this research are primarily access to consistent and recent data. While the lag in data was compensated by mostly using the same year – 2008 – missing data had a large effect on

results ability to be generalizable. Collinearity was analyzed as well and the model seen in Table 2 is the model that has minimal overlap (VIF $\leq$ 3.735) providing strength to the results.

Environmental law implications for this study are numerous. If a consistent predictor such as life expectancy at birth or literacy rate were to be used to set standards for reducing environmental impact (e.g. countries with literacy rates above 80 are required to reduce their ecological footprint by 1 global hectare per capita per year whereas countries with literacy rates below 80 are only required to reduce their ecological footprint by .5 global hectare per capita per year), there could be a greater hope for achieving application that provides a change in the environmental state. Additional impacts could be seen in the formulation of such laws targeting countries with high existing carbon emissions more than those with lower existing carbon emissions. If the environmental governance focuses primarily on a consistent predictor it is logical that better outcomes could be possible and more greatly received.

Further research is needed using a complete data set for every country in the world to determine if this limitation of choosing only countries with debt-to-asset ratios lower than .6 is influencing the strong correlations seen in the significant variables. The research should aim to determine how much these variables actually influence the policy and decision making processes related to environmental decisions.

Conclusion

The existence of a World Environmental Organization has been proposed extensively as a solution to improving global environmental governance and was suggested by US foreign policy strategist George F. Kennan in the 1960s who is often accredited as the person "who started the debate on organizational aspects of what later evolved into today's global environmental governance discourse…[in his] call for 'an organizational personality' in international environmental politics (Biermann & Bauer, 2005). Research such as this however, suggests that countries are continuously relying not on their own capabilities and resource availability to become less environmentally

impactful, but instead acting according to their internal states – mainly life expectancy, literacy rate, percent employment in agriculture, and CO_2 emissions per capita. Therefore, the dilemmas often suggested to global governance organizations – "address[ing] questions of transparency, accountability, and democracy" (Moravcsik, 2002, p. 213) cannot be overcome unless we realistically consider the individual differentials in social power (p. 222) and include empirical analysis as well (p. 238).

While this model is significant on paper, the examination of whether these factors are actively or passively affecting environmental impact requires future research to greater solidify more extensive research being done. Still, any effort to consistently gain adherence and form more equal standards to decrease environmental impact on a global scale must keep in mind the empirical differences, specifically within employment and citizen wellbeing indicators, among countries if it hopes to be successful in creating a better future for the health of our world.

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Appendix:

Table 1

Countries with debt-to-asset ratios below .60 [a], alphabetical

Afghanistan	Georgia !	Nigeria
Algeria !	Ghana	Oman
Angola	Greenland	Pakistan
Argentina !	Guatemala	Panama !
Armenia !	Guyana	Papua New Guinea
Aruba	Haiti	Paraguay
Azerbaijan !	Honduras	Peru !
Bahrain *	India	Philippines
Bangladesh	Indonesia	Poland *
Belarus !	Iran !	Romania !
Belgium *	Israel *	Russia !
Bolivia	Italy *	Saudi Arabia !
Bosnia and Herzegovina !	Japan *	Senegal
Botswana	Jordan !	Singapore *
Brazil !	Kenya	South Africa
Burkina Faso	Korea, South *	Sri Lanka
Cambodia	Kuwait !	Swaziland
Cameroon	Laos	Syria
Central African Republic	Lesotho	Tajikistan
Chile !	Libya !	Tanzania
China	Madagascar	Thailand
Colombia !	Malawi	Trinidad and Tobago !
Congo, Dem.	Malaysia !	Tunisia !
Costa Rica !	Maldives	Turkey !
Cote d'Ivoire	Malta *	Turkmenistan
Cuba	Marshall Islands	Uganda
Czech Republic *	Mauritius	United Arab Emirates *
Dominican Republic	Mexico !	Uruguay !
Ecuador !	Mongolia	Uzbekistan
Egypt	Morocco	Venezuela !
El Salvador	Mozambique	Vietnam
Equatorial Guinea	Namibia	Yemen
Ethiopia	Nepal	Zambia
Gabon	New Zealand *	

[a] Calculated using World Bank data (2010): GDP(ex. exchange rate)/external debt (exchange rate basis)

* Very high human development (12); ! High human development (28) (from Human Development Index (2010), pp. 139-142)

Table 2
Coefficients for independent variables

Independent variables	**Beta** **t**	**Sig.**
Military expenditures as % of GDP	-.070 -.374	.711
Proportion of seats held by women in parliament	-.198 -1.331	.192
Percent of unemployment	-.273 -1.411	.168
Life expectancy at birth	-.555 -2.488	.018*
Literacy rate	.469 2.948	.006**
Percent employment in agriculture [a]	-.430 -1.857	.073
Percent employment in industry [a]	-.159 -.798	.431
CO_2 emission per capita	-.677 -3.322	.002**
Governmental environmental agency	.051 .373	.712

Note: Data is 2008 World Bank (2010) development indicator data except where noted.

[a] Data from 2006 and 2007 were used as most recently available from the World bank ($r = .874$, $p < 0.01$ (1-tailed)). Conceptually it makes sense that this same correlation would be found among percent employment in industry.

** $p < .01$

* $p < .05$

Table 3
Coefficients for independent variables based on three models

Independent variables	**Beta** **t**	**Sig.**
Model 1: Coefficients for independent variables (with IV GDP per capita included)		
Military expenditures as % of GDP	-.111 -.584	.563
Proportion of seats held by women in parliament	-.185 -1.238	.225
Percent of unemployment	-.257 -1.327	.194
GDP per capita	-.279 -.994	.328
Life expectancy at birth	-.445 -1.787	.084
Literacy rate	.433 2.661	.012*
Percent employment in agriculture [a]	-.442 -1.905	.066
Percent employment in industry [a]	-.208 -1.014	.319
CO_2 emission per capita	-.414 -1.240	.224
Governmental environmental agency	0.42 .308	.760
Model 2: Coefficients for independent variables (not including CO2 emission per capita or governmental environmental agency and including GDP per capita)		
Military expenditures as % of GDP	-.374 -1.582	.711
Proportion of seats held by women in parliament	-.202 -1.364	.182
Percent of unemployment	-.213 -1.262	.216
GDP per capita	-.559 -3.281	.002**
Life expectancy at birth	-.295 -1.395	.172
Literacy rate	.363 2.384	.023*
Percent employment in agriculture [a]	-.442 -2.001	.054
Percent employment in industry [a]	-.329 -1.828	.077

Note: Data is 2008 World Bank (2010) development indicator data except where noted
[a] Data from 2006 and 2007 were used as most recently available from the World bank ($r = .874$, $p < 0.01$ (1-tailed)). Conceptually it makes sense that this same correlation would be found among percent employment in industry.
** $p < .01$
* $p < .05$

Table 3 (cont.)
Coefficients for independent variables based on three models

Independent variables	**Beta** **t**	**Sig.**
Model 3: Coefficients for independent variables (with GDP per capita present and not including CO_2 emissions per capita)		
Military expenditures as % of GDP	-.248 -1.582	.123
Proportion of seats held by women in parliament	-.201 -1.337	.191
Percent of unemployment	-.192 -1.020	.216
GDP per capita	-.556 -3.201	.003**
Life expectancy at birth	-.287 -1.331	.193
Literacy rate	.366 2.364	.024*
Percent employment in agriculture [a]	-.425 -1.818	.078
Percent employment in industry [a]	-.318 -1.699	.099
Governmental environmental agency	.037 .268	.791

Note: Data is 2008 World Bank (2010) development indicator data except where noted
[a] Data from 2006 and 2007 were used as most recently available from the World bank ($r = .874$, $p < 0.01$ (1-tailed)). Conceptually it makes sense that this same correlation would be found among percent employment in industry.
** $p < .01$
* $p < .05$

Table 4

Ecological footprint data for all available countries (all values in global hectares per capita)

Country	Ecological Footprint of Consumption	Total Biocapacity	Ecological Footprint
Afghanistan	0.6	0.5	(0.1)
Albania	1.9	0.9	(1.0)
Algeria	1.6	0.6	(1.0)
Angola	1.0	3.0	2.0
Argentina	2.6	7.5	4.9
Armenia	1.8	0.7	(1.0)
Australia	6.8	14.7	7.9
Austria	5.3	3.3	(2.0)
Azerbaijan	1.9	0.8	(1.1)
Bangladesh	0.6	0.4	(0.2)
Belarus	3.8	3.3	(0.5)
Belgium	8.0	1.3	(6.7)
Benin	1.2	0.8	(0.4)
Bolivia	2.6	18.8	16.3
Bosnia and Herzegovina	2.7	1.6	(1.1)
Botswana	2.7	3.8	1.2
Brazil	2.9	9.0	6.1
Bulgaria	4.1	2.1	(1.9)
Burkina Faso	1.3	1.3	(0.0)
Burundi	0.9	0.5	(0.4)
Cambodia	1.0	0.9	(0.1)
Cameroon	1.0	1.9	0.8
Canada	7.0	14.9	7.9
Central African Republic	1.3	8.4	7.1
Chad	1.7	3.2	1.4
Chile	3.2	3.8	0.6
China	2.2	1.0	(1.2)
Colombia	1.9	4.0	2.1
Congo	1.0	13.3	12.3
Congo, Democratic Republic of	0.8	2.8	2.0
Costa Rica	2.7	1.9	(0.8)
Côte d'Ivoire	1.0	1.7	0.7
Croatia	3.7	2.5	(1.2)
Cuba	1.9	0.7	(1.1)
Czech Republic	5.7	2.7	(3.1)
Denmark	8.3	4.9	(3.4)
Dominican Republic	1.5	0.5	(1.0)
Ecuador	1.9	2.3	0.4
Egypt	1.7	0.6	(1.0)
El Salvador	2.0	0.7	(1.4)
Eritrea	0.9	1.6	0.7
Estonia	7.9	9.0	1.1
Ethiopia	1.1	0.7	(0.4)
Finland	6.2	12.5	6.3
France	5.0	3.0	(2.0)
Gabon	1.4	29.3	27.9
Gambia	3.4	1.1	(2.3)
Georgia	1.8	1.2	(0.6)
Germany	5.1	1.9	(3.2)
Ghana	1.8	1.2	(0.6)

Note All Table 4 data is from the Global Footprint Network (2010) 2007 ecological footprint data

Table 4 (cont.)

Ecological footprint data for all available countries (all values in global hectares per capita)

Country	Ecological Footprint of Consumption	Total Biocapacity	Ecological Footprint
Greece	5.4	1.6	(3.8)
Guatemala	1.8	1.1	(0.6)
Guinea	1.7	2.8	1.2
Guinea-Bissau	1.0	3.2	2.3
Haiti	0.7	0.3	(0.4)
Honduras	1.9	1.8	(0.1)
Hungary	3.0	2.2	(0.8)
India	0.9	0.5	(0.4)
Indonesia	1.2	1.4	0.1
Iran, Islamic Republic of	2.7	0.8	(1.9)
Iraq	1.3	0.3	(1.0)
Ireland	6.3	3.5	(2.8)
Israel	4.8	0.3	(4.5)
Italy	5.0	1.1	(3.8)
Jamaica	1.9	0.4	(1.5)
Japan	4.7	0.6	(4.1)
Jordan	2.1	0.2	(1.8)
Kazakhstan	4.5	4.0	(0.5)
Kenya	1.1	0.6	(0.5)
Korea, Democratic People's Republic of	1.3	0.6	(0.7)
Korea, Republic of	4.9	0.3	(4.5)
Kuwait	6.3	0.4	(5.9)
Kyrgyzstan	1.2	1.3	0.1
Lao People's Democratic Republic	1.3	1.6	0.3
Latvia	5.6	7.1	1.4
Lebanon	2.9	0.4	(2.5)
Lesotho	1.1	0.8	(0.3)
Liberia	1.3	2.5	1.2
Libyan Arab Jamahiriya	3.1	0.4	(2.6)
Lithuania	4.7	4.4	(0.3)
Macedonia TFYR	5.7	1.4	(4.2)
Madagascar	1.8	3.1	1.3
Malawi	0.7	0.7	(0.0)
Malaysia	4.9	2.6	(2.3)
Mali	1.9	2.5	0.6
Mauritania	2.6	5.5	2.9
Mauritius	4.3	0.6	(3.7)
Mexico	3.0	1.5	(1.5)
Moldova	1.4	0.7	(0.7)
Mongolia	5.5	15.1	9.6
Morocco	1.2	0.6	(0.6)
Mozambique	0.8	1.9	1.1
Myanmar	1.8	2.0	0.3
Namibia	2.2	7.6	5.4
Nepal	3.6	0.5	(3.0)
Netherlands	6.2	1.0	(5.2)
New Zealand	4.9	10.8	5.9
Nicaragua	1.6	2.8	1.3
Niger	2.3	2.1	(0.3)
Nigeria	1.4	1.1	(0.3)
Norway	5.6	5.5	(0.1)

Table 4 (cont.)

Ecological footprint data for all available countries (all values in global hectares per capita)

Country	Ecological Footprint of Consumption	Total Biocapacity	Ecological Footprint
Oman	5.0	2.1	(2.8)
Pakistan	0.8	0.4	(0.3)
Panama	2.9	3.1	0.3
Papua New Guinea	2.1	3.8	1.6
Paraguay	3.2	11.2	8.0
Peru	1.5	3.9	2.3
Philippines	1.3	0.6	(0.7)
Poland	4.3	2.1	(2.3)
Portugal	4.5	1.3	(3.2)
Qatar	10.5	2.5	(8.0)
Romania	2.7	2.0	(0.8)
Russian Federation	4.4	5.7	1.3
Rwanda	1.0	0.6	(0.5)
Saudi Arabia	5.1	0.8	(4.3)
Senegal	1.1	1.2	0.1
Serbia	2.4	1.2	(1.2)
Sierra Leone	1.1	1.2	0.1
Singapore	5.3	0.0	(5.3)
Slovakia	4.1	2.7	(1.4)
Slovenia	5.3	2.6	(2.7)
Somalia	1.4	1.4	(0.0)
South Africa	2.3	1.1	(1.2)
Spain	5.4	1.6	(3.8)
Sri Lanka	1.2	0.4	(0.8)
Sudan	1.7	2.4	0.7
Swaziland	1.5	1.0	(0.5)
Sweden	5.9	9.7	3.9
Switzerland	5.0	1.2	(3.8)
Syrian Arab Republic	1.5	0.7	(0.8)
Tajikistan	1.0	0.6	(0.4)
Tanzania, United Republic of	1.2	1.0	(0.2)
Thailand	2.4	1.2	(1.2)
Timor-Leste	0.4	1.2	0.8
Togo	1.0	0.6	(0.4)
Trinidad and Tobago	3.1	1.6	(1.5)
Tunisia	1.9	1.0	(0.9)
Tajikistan	1.0	0.6	(0.4)
Turkey	2.7	1.3	(1.4)
Turkmenistan	3.9	3.2	(0.7)
Uganda	1.5	0.8	(0.7)
Ukraine	2.9	1.8	(1.1)
United Arab Emirates	10.7	0.8	(9.8)
United Kingdom	4.9	1.3	(3.6)
United States of America	8.0	3.9	(4.1)
Uruguay	5.1	9.9	4.8
Uzbekistan	1.7	0.9	(0.8)
Venezuela, Bolivarian Republic of	2.9	2.8	(0.1)
Viet Nam	1.4	0.9	(0.5)
Yemen	0.9	0.6	(0.3)
Zambia	0.9	2.3	1.3
Zimbabwe	1.2	0.8	(0.5)

Table 5
Data for countries used in analysis (governmental factors)

Country	Military expenditures (% of GDP)	Presence of a government environmental agency (1 = present)	Proportion of seats held by women in national parliaments(%)
Afghanistan	2.1	1	28
Algeria	3.8	0	8
Angola	4.6	0	37
Argentina	0.8	0	42
Armenia	3.3	0	N/A
Aruba	N/A	0	N/A
Azerbaijan	3.5	0	11
Bahrain	3	0	3
Bangladesh	1.1	1	19
Belarus	1.8	0	32
Belgium	1.2	0	35
Bolivia	1.6	0	17
Bosnia and Herzegovina	1.5	0	12
Botswana	3.2	0	11
Brazil	1.7	1	9
Burkina Faso	1.3	0	15
Cambodia	1.2	1	16
Cameroon	1.5	0	14
Central African Republic	1.6	0	11
Chile	3.1	0	15
China	2	1	21
Colombia	4.1	0	8
Congo, Dem.	1.4	0	8
Costa Rica	0	0	37
Cote d'Ivoire	1.6	0	9
Cuba	N/A	0	43
Czech Republic	1.5	0	16
Dominican Republic	0.6	0	20
Ecuador	3.3	0	32
Egypt	2.2	0	2
El Salvador	0.5	0	17
Equatorial Guinea	N/A	0	10
Ethiopia	1.4	0	22
Gabon	1.1	0	17
Georgia	5.6	0	5
Ghana	0.7	0	8
Greenland	N/A	0	N/A

Table 5 (cont.)
Data for countries used in analysis (governmental factors)

Country	Military expenditures (% of GDP)	Presence of a government environmental agency (1 = present)	Proportion of seats held by women in national parliaments (%)
Guatemala	0.4	0	12
Guyana	N/A	0	30
Haiti	0	0	4
Honduras	0.8	0	23
India	3	1	11
Indonesia	0.9	0	18
Iran	2.8	0	3
Israel	6.9	1	18
Italy	1.7	0	21
Japan	1	0	11
Jordan	6.1	0	6
Kenya	1.9	0	10
Korea, South (Rep. of)	2.9	1	14
Kuwait	3.1	0	8
Laos	0.4	1	25
Lesotho	3	0	25
Libya	1.2	0	8
Madagascar	1.1	0	8
Malawi	1.2	0	21
Malaysia	2	1	11
Maldives	N/A	1	7
Malta	0	0	9
Marshall Islands	N/A	1	3
Mauritius	0.2	0	17
Mexico	0.5	1	28
Mongolia	1.4	1	4
Morocco	3.4	0	11
Mozambique	0.9	0	35
Namibia	3.3	0	27
Nepal	1.6	1	33
New Zealand	1.1	1	33
Nigeria	0.9	1	7
Oman	7.7	0	0
Pakistan	3.1	1	23
Panama	0	0	9
Papua New Guinea	0.5	1	1
Paraguay	0.8	0	13
Peru	1.2	0	28
Philippines	0.8	1	21

Table 5 (cont.)
Data for countries used in analysis (governmental factors)

Country	Military expenditures (% of GDP)	Presence of a government environmental agency (1 = present)	Proportion of seats held by women in national parliaments (%)
Poland	2	0	20
Romania	1.5	0	9
Russia	4.3	0	14
Saudi Arabia	11.2	1	0
Senegal	1.6	0	22
Singapore	4.3	1	25
South Africa	1.5	0	45
Sri Lanka	3.5	0	6
Swaziland	2.2	0	14
Syria (Syrian Arab Republic)	4.2	0	12
Tajikistan	N/A	1	18
Tanzania	1.1	0	30
Thailand	1.8	1	12
Trinidad and Tobago	N/A	0	27
Tunisia	1.4	0	23
Turkey	2.8	0	9
Turkmenistan	N/A	1	17
Uganda	2	0	31
United Arab Emirates	5.6	0	23
Uruguay	1.6	0	12
Uzbekistan	N/A	1	18
Venezuela	1.3	0	19
Vietnam	2.2	1	26
Yemen	4.4	0	0
Zambia	1.7	0	15

Table 6
Data for countries used in analysis (economic factors)

Country	GDP per capita	Percent of employment in industry	Percent of employment in agriculture	Percent of the population which is unemployed
Afghanistan	366	N/A	N/A	8.5
Algeria	4029	N/A	N/A	13.8
Angola	3734	N/A	N/A	N/A
Argentina	7666	23.7	0.8	9.2
Armenia	3873	15.6	46.2	N/A
Aruba	N/A	N/A	N/A	N/A
Azerbaijan	4899	12.8	38.7	6.5
Bahrain	28240	N/A	N/A	N/A
Bangladesh	497	14.5	48.1	4.3
Belarus	551	N/A	N/A	N/A
Belgium	43430	24.4	1.8	7.5
Bolivia	1758	N/A	N/A	N/A
Bosnia and Herzegovina	4546	N/A	N/A	29
Botswana	5965	15.2	29.9	17.6
Brazil	8114	21.4	19.3	9.3
Burkina Faso	517	N/A	N/A	N/A
Cambodia	677	N/A	N/A	N/A
Cameroon	1119	N/A	N/A	N/A
Central African Republic	458	N/A	N/A	N/A
Chile	9645	23.4	12.3	7.2
China	3744	N/A	N/A	4
Colombia	5056	19.6	18.4	10.9
Congo, Dem.	182	N/A	N/A	N/A
Costa Rica	6382	22.2	13.2	4.6
Cote d'Ivoire	1137	N/A	N/A	N/A
Cuba	N/A	18	18.7	1.8
Czech Republic	18139	40.2	3.6	5.3
Dominican Republic	4618	21.9	14.5	15.6
Ecuador	4202	21.8	8.3	7.8
Egypt	2269	22	31.2	9
El Salvador	3605	23	18.9	6.6
Equatorial Guinea	15397	N/A	N/A	N/A
Ethiopia	345	22.1	8.6	17
Gabon	7502	N/A	N/A	N/A
Georgia	2447	10.4	53.4	13.3
Ghana	655	N/A	N/A	N/A
Greenland	30883	N/A	N/A	8.4
Guatemala	2623	22.8	33.2	1.8

Table 6 (cont.)
Data for countries used in analysis (economic factors)

Country	GDP per capita	Percent of employment in industry	Percent of employment in agriculture	Percent of the population which is unemployed
Guyana	1518	N/A	N/A	N/A
Haiti	667	N/A	N/A	N/A
Honduras	1960	20.9	39.2	3.1
India	1134	N/A	N/A	N/A
Indonesia	2349	18.8	41.2	9.1
Iran	4540	32	22.8	10.5
Israel	26175	21.9	1.6	7.3
Italy	35084	30.2	4	6.1
Japan	39727	27.9	4.2	3.9
Jordan	3829	N/A	N/A	12.7
Kenya	759	N/A	N/A	N/A
Korea, South (Rep. of)	17078	25.9	7.4	3.2
Kuwait	54260	N/A	N/A	N/A
Laos	882	N/A	N/A	1.4
Lesotho	851	N/A	N/A	N/A
Libya	9714	N/A	N/A	N/A
Madagascar	461	3.4	82	2.6
Malawi	326	N/A	N/A	N/A
Malaysia	6975	28.5	14.8	3.2
Maldives	4384	24.3	11.5	14.4
Malta	18209	25.9	1.6	6.5
Marshall Islands	2504	N/A	N/A	N/A
Mauritius	7337	32.3	9.1	8.5
Mexico	8144	25.9	13.5	3.4
Mongolia	1573	17.9	37.7	3.3
Morocco	2795	20.3	43.3	9.5
Mozambique	428	N/A	N/A	N/A
Namibia	4338	N/A	N/A	N/A
Nepal	427	N/A	N/A	N/A
New Zealand	27045	21.9	7.2	3.6
Nigeria	1092	N/A	N/A	N/A
Oman	21649	N/A	N/A	N/A
Pakistan	981	21	43.6	5.1
Panama	7155	19.3	14.7	6.8
Papua New Guinea	1172	N/A	N/A	N/A
Paraguay	2365	18.1	29.5	5.6
Peru	4345	42.1	9.3	7
Philippines	1745	15.1	36.1	6.3
Poland	11273	30.7	14.7	9.6
Romania	9300	31.4	29.5	6.4

Table 6 (cont.)
Data for countries used in analysis (economic factors)

Country	GDP per capita	Percent of employment in industry	Percent of employment in agriculture	Percent of the population which is unemployed
Russia	8676	29.2	9	6.1
Saudi Arabia	14540	19.8	4.7	5.6
Senegal	1042	14.8	33.7	11.1
Singapore	36537	22.6	1.1	4
South Africa	5798	26	8.8	23
Sri Lanka	2068	26.6	31.3	6
Swaziland	2478	N/A	N/A	28.2
Syria (Syrian Arab Republic)	2474	N/A	N/A	N/A
Tajikistan	716	N/A	N/A	N/A
Tanzania	509	5	74.6	4.3
Thailand	3894	N/A	41.7	1.2
Trinidad and Tobago	15753	31	4.3	6.5
Tunisia	3792	N/A	N/A	14.2
Turkey	8248	25.5	26.4	9.9
Turkmenistan	3904	N/A	N/A	N/A
Uganda	481	N/A	N/A	N/A
United Arab Emirates	58272	39.8	4.9	3.1
Uruguay	10790	21.7	11	9.2
Uzbekistan	1182	N/A	N/A	N/A
Venezuela	11503	23.3	8.7	7.5
Vietnam	1052	N/A	N/A	N/A
Yemen	1118	N/A	N/A	N/A
Zambia	985	N/A	N/A	N/A

Table 7
Data for countries used in analysis (citizen welfare factors)

Country	CO^2 Emissions (metric tons per capita)	Literacy rates	Life expectancy at birth
Afghanistan	0	N/A	44
Algeria	4.1	73	72
Angola	1.4	70	47
Argentina	4.6	98	75
Armenia	1.6	98	74
Aruba	23	98	75
Azerbaijan	3.7	100	70
Bahrain	29.6	96	76
Bangladesh	0.3	55	66
Belarus	6.9	100	71
Belgium	9.7	N/A	80
Bolivia	1.4	91	66
Bosnia and Herzegovina	7.7	98	75
Botswana	2.6	83	54
Brazil	1.9	90	72
Burkina Faso	0.1	29	53
Cambodia	0.3	78	61
Cameroon	0.3	76	51
Central African Republic	0.1	55	47
Chile	4.3	99	79
China	5	94	73
Colombia	1.4	93	73
Congo, Dem.	0	67	48
Costa Rica	1.8	96	79
Cote d'Ivoire	0.3	55	57
Cuba	2.4	100	79
Czech Republic	12.1	N/A	77
Dominican Republic	2.1	88	73
Ecuador	2.2	84	75
Egypt	2.3	66	70
El Salvador	31	84	71
Equatorial Guinea	7.5	93	50
Ethiopia	0.1	36	55
Gabon	1.4	87	60
Georgia	1.4	100	72
Ghana	0.4	66	57
Greenland	9.2	N/A	68
Guatemala	0.9	74	70
Guyana	2	N/A	67

Table 7 (cont.)
Data for countries used in analysis (citizen welfare factors)

Country	CO^2 Emissions (metric tons per capita)	Literacy rates	Life expectancy at birth
Haiti	0.2	N/A	61
Honduras	1.2	84	72
India	1.4	63	64
Indonesia	1.8	92	71
Iran	7	82	71
Israel	9.3	N/A	81
Italy	7.7	99	82
Japan	9.8	N/A	83
Jordan	3.8	92	73
Kenya	0.3	87	54
Korea, South (Rep. of)	10.4	N/A	80
Kuwait	32.3	94	78
Laos	N/A	73	65
Lesotho	N/A	90	45
Libya	9.3	88	74
Madagascar	0.1	71	60
Malawi	0.1	73	53
Malaysia	7.3	92	74
Maldives	3	98	72
Malta	6.7	92	80
Marshall Islands	1.7	N/A	99
Mauritius	3.1	88	73
Mexico	4.5	93	75
Mongolia	4	97	67
Morocco	1.5	56	71
Mozambique	0.1	54	48
Namibia	1.5	88	62
Nepal	0.1	58	67
New Zealand	7.7	N/A	80
Nigeria	0.6	60	48
Oman	13.7	87	76
Pakistan	1	54	67
Panama	2.2	94	76
Papua New Guinea	0.5	60	61
Paraguay	0.7	95	72
Peru	1.5	90	73
Philippines	0.8	94	72
Poland	8.3	100	76
Romania	1.7	98	73
Russia	10.8	100	68
Saudi Arabia	16.6	86	73

Table 7 (cont.)
Data for countries used in analysis (citizen welfare factors)

Country	CO^2 Emissions (metric tons per capita)	Literacy rates	Life expectancy at birth
Senegal	0.5	42	56
Singapore	11.8	95	81
South Africa	9	89	51
Sri Lanka	0.6	91	74
Swaziland	0.9	87	46
Syria (Syrian Arab Republic)	3.5	84	74
Tajikistan	1.1	100	67
Tanzania	0.1	73	56
Thailand	4.1	94	69
Trinidad and Tobago	27.9	99	69
Tunisia	2.3	78	74
Turkey	4	89	72
Turkmenistan	9.2	100	65
Uganda	0.1	75	53
United Arab Emirates	2.3	90	78
Uruguay	1.9	98	76
Uzbekistan	4.3	99	68
Venezuela	6	95	74
Vietnam	1.3	93	74
Yemen	1	61	63
Zambia	0.2	71	45