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HOW IS ENVIRONMENTAL PERFORMANCE ASSOCIATED WITH ECONOMIC GROWTH? A WORLD CROSS-COUNTRY ANALYSIS

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Abstract: The aim of the paper is to explore the association between environmental performance and income level in the world economy in 2016. Data from Yale University and World Bank are used in a cross-country regression analysis comprising 166 countries. The gross Domestic Product per capita (based in purchased power parity, constant 2011 international dollars) in these countries is positively associated with the environmental performance index (EPI) calculated by Yale and Columbia University in 2016. Furthermore, the causality of this relationship is from GDP per capita to Environmental Performance and both Environmental Health (EH) and Ecosystem Vitality (EV) are positively associated with GDP per capita. Environmental Health (EH) is stronger related to GDP per capita, meaning that investments in public health, sanitation and infrastructure are increasing as countries develop.
Keywords: sustainable development, environmental economics, economic growth, cross-sectional models
JEL Codes: Q01, Q50, O40, C21

Introduction

The growing concern about sustainable development induced in recent years the term of "environmental performance" universally adopted by environmental experts, economists, environmental policy analysts as well as by decision makers.
Human activity and economic growth impact on living and non-living systems, including ecosystems, land, air and water. As a reverse, environmental quality (air, water, plants, animals, biodiversity, climate, soils quality) affects our biological lives as well as the efficiency and effectiveness in producing goods and services.
Worldwide environmental degradation makes people, experts and policy makers worried about the issue of the link between economic growth and environmental degradation or performance, since it is generally believed that a high level of environmental performance is associated with a high environmental quality of life and life standard.

It is difficult to measure the impact of income or economic growth on environmental performance due to the fact that it has several aspects (water, air, soil, biodiversity, etc.) which must be included and combined in one single construction. Furthermore, in order to be relevant for environmental analysts and for environmental policy makers, any composite index of a country's environmental performance should capture national efforts to protect the natural environment.

The Environmental Performance Index (EPI) calculated by Yale University in cooperation with Columbia University focuses on measurable outcomes that can be linked to environmental policy targets, encopassing 22 environmental indicators.

Noting that there are very few studies focused on exploring the environment-income relationship based on this index, the intention of the present authors' paper is to highlight the link between the environmental performance expressed through EPI and the income level in the world economy in 2016.

The paper is organised as follows: after the introduction, the section of literature review exposes the main relevant studies for the paper's topic. The methodology and data are described in the third section, the fourth section is dedicated to main findings and the last one contains the paper's conclusions.

1. Literature review

The issue of income-environment relationship has been the focus of a huge amount of empirical studies in last 25 years.

Shafik and Bandyopadhyay (1992) explored the relationship between economic growth and environmental quality in 66 countries by analyzing patterns of environmental transformation at different income levels. They looked at eight indicators of environmental quality (deforestation, dissolved oxygen, sulfur dioxide, access to safe water and urban sanitation, carbon emissions, municipal waste, suspended particulate matter, fecal coliform) in response to economic growth in a large number of countries and across time. Income has a significant effect on all environmental quality indicators, but the relation between income and environment is not simple: as incomes rise most indicators decrease initially, except access to safe water and urban sanitation - problems that higher incomes will solve. Countries with high rates of investments and economic growth put pressure on natural resources, particularly in term of pollution, but some indicators, as deforestation and sulfur dioxide tend to improve with higher incomes.

Grossman and Krueger (1995) examined also the relationship between income per capita and various environmental indicators (urban air pollution, oxygen regime in rivers basins, fecal contaminations, and contamination by heavy metals) in 42 countries. They found no evidence that environmental quality deteriorates steadily with economic growth and for most environmental indicators economic growth brings an initial phase of deterioration followed by a phase of improvement.

Other authors, such as Islam (1997) demonstrated that there is no rule that environment has to first deteriorate with economic growth and improve later, by estimating the income - environment relationship for Asia and comparing it with the same of other regions of the world. He suggested also that the role of income to explain pollution dynamics is limited.

For a better understanding of the income-environment relationship, its determinants were explored (Panayotou, 1997) and it was decomposed into its structural sources: level effect, composition effect and abatement effect, by using global data. The level and composition effects were found to follow a linear and quadratic evolution and the abatement effect is found to be downward sloping and of backward-J shape (Islam et al., 1998).

This inverted U-shaped pattern identified in several studies as displaying the relationship between income and environmental indicators has given rise to the Environmental Kuznets's Curve Hypothesis. This hypothesis emerged from the initialy theory of Kuznets (1955) stating that the income-inequality relationship should follow an inverse U-shaped along the development process, first rising with industrialisation and then declining, as the labour productivity increases. According to this hypothesis of Kuznets, environmental quality deteriorates in initial phase of growth and then improves at high levels of income.

A vast empirical literature dedicated to Environmental Kuznets's Curve captures the scale, composition, income and technique effects using simple or multiple variables models and various econometric techniques where environmental variables (i.e. pollution, water quality, energy use, biodiversity loss, municipal waste, ecological footprint, deforestation, etc.) are dependent variables and independent variables are income, income squared or income cube (Holtz-Eakin and Selden, 1992; Selden and Song, 1994; Selden and Song, 1994, 1995; Shafiq, 1994; Grossman and Krueger, 1995; Cole et al., 1997; Moomaw and Unruh, 1997; Stern, 1998; de Bruyn et al., 1998; Munasinghe, 1999; Stern and Common, 2001; Harbaugh et al., 2002; Bimonte, 2002; Perman and Stern, 2003; Lee and List, 2004; Dinda, 2004 and 2005; Pertinelli and Strobl, 2005; Shen, 2006; Saboori et al., 2011; Shahbaz et al.,2012; Taguchi, 2012; Tiwari et al. 2013).

There are also a group of studies where no validity of EKC was found (i.e. Seppälä et al. 2001; Stern, 2004; Caviglia-Harris et al. 2009), as well as studies concluding that the Kuznets curves can be true for a cross-section of countries at a specific point in time (Booth, 2017) or founding an inverse global environmental Kuznets curve (Jha and Murthy, 2003). Other studies are concerned on globalization effects on environmental Kuznets Curve (i.e.Tisdell, 2001) or found a reverse Kuznets Curve (i.e.Bulte and van Soest, 2001).

The main problem of all these studies was to measure the environment degradation and several statistical indicators were proposed and used: depletion and degradation of forest, water, land resources, air pollution, greenhouse gases pollution, etc. Several attempts were made to construct composite indexes to express the environmental quality or depreciation, such as: Environmental Quality Index (EQI), Environmental Indicators developed by OECD and Environmental Performance Index (EPI).

EQI was developed for all counties in the United States. It uses indicators from the chemical, natural, built, and social environment, based on data collected and monitorised by US Environmental Protection Agency (EPA).

OECD (2003) developed a set of environmental indicators regarding: climate change, ozone layer depletion, eutrophication, acidification, toxic contamination, urban environmental quality, biodiversity, cultural landscapes, waste, water resources, forest resources, fish resources, soil degradation, material resources and other socio-economic indicators. A part of them are used jointly with the Statistical Office of the European Commission (Eurostat).

The UNDP's experts include in the concept of Environment Sustainability the following statistical indicators: Renewable energy consumption (% of total final energy consumption), Carbon dioxide emissions (tones per capita), Forest area (% of total land), Fresh water withdrawals (% of renewable water resources) (UNDP, 2016).

The EPI builds on measures relevant to two core objectives: (a) reducing environmental stress to human health (the environmental health) and (b) protecting ecosystems and natural resources (the ecosystem vitality). The present paper used this index to explore the income-environment relationship; therefore this index is exposed in the second section, Data and Methodology.

2. Data and methodology

The paper uses regressional analysis techniques in order to put in evidence the association between environmental performance and income level in the world economy in 2016. Specifically, a cross-country regression is developed, taking into consideration the environmental performance as dependent variable and the level of economic development as independent variable.

For the use of this paper, the environmental performance is expressed by the metrics calculated by the Yale Data-Driven Environmental Group at Yale University and Center for International Earth Science Information Network at Columbia University in collaboration with the Samuel Family Foundation, McCall

MacBain Foundation, and the World Economic Forum, namely the Environmental Performance Index (EPI). It ranks countries' performance in two areas: protection of human health and protection of ecosystems. It scores national performance in nine issue areas comprised of 22 indicators measuring the country proximity to meet the internationally established targets and to compare their environmental performance. EPI has two components: Environmental Health (EH) and Ecosystem Vitality (EV). The first component comprises of health impacts expressed by environmental risk exposure (risk of water and air pollution to human health) air quality (population exposure to PM 2.5 and health risk from PM 2.5 exposure, population whose exposure is above WHO thresholds, population exposure to NO2) and water and sanitation (exposure to unsafe sanitation and population lacking access to sanitation, exposure to insafe water quality and population lacking access to drinking water). The second component includes: water resources (wastewater treatment), agriculture (nitrogen use efficiency and nitrogen balance), forests (change in forest cover), fisheries (fishing stock overexploited and collapsed) biodiversity and habitat (protected terrestrial biome area, marine protected areas, species under protection), climate and energy (performance in change in CO2 emissions per unit GDP, change in CO2 emissions from electricity and heat production). The level of aggregation is 50% for each component (Hsu et al., 2016).

The economic development is expressed by GDP per capita based on purchase power parity (PPP) constant 2011 constant international dollars extracted from World Bank Database, for 166 countries corresponding to those the Environmental Performance Index is calculated by Yale and Columbia University. The values of EPI, EH, EV and GDPper capita for the 166 economies are exposed in Annex 1.

We analyse the stochastic dependence between environmental performance and economic development through a regression equation:

$$y = f(x) + \varepsilon \qquad (1)$$

where y is expressed by EPI, x is measured by GDP per capita and ε is the significance error.

We presume that there is linear dependence between the two variables and we intend to check this assumption. In a graphical representation (Figure 1) we notice that the behaviour of the function y is quadratic, not linear, it never reach a maximum or minimum y value and that the impact of independent variable (x) on dependent variable (y) decreases as the value of y increases.

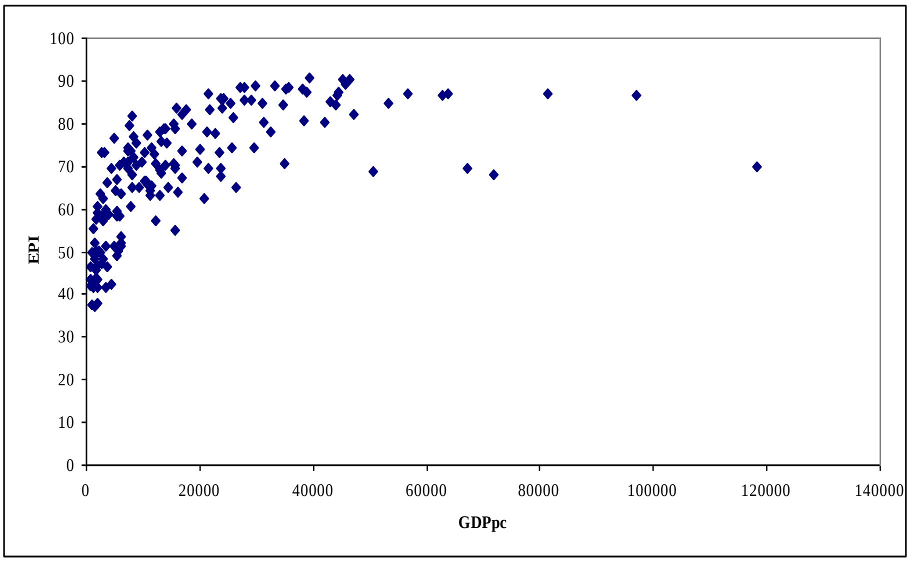

Figure 1 GDP per capita (PPP) versus EPI in the world economy, 2016
Source: authors' own computation based on World Bank and Yale and Columbia University data

Taking into consideration the above conclusions, we choose a linear-log model, as follows:

$$EPI_i = \alpha + \beta \cdot \log GDPpc_i + \varepsilon \quad (2)$$

where EPI_i means Environmental Performance Index for the country *i*, $GDPpc_i$ is the Gross Domestic Produc per capita for country *i*, α is a constant, β is the regression coeficient and ε is the significance error.
In order to explore in detail the impact of economic growth we use the equation 2 for the two compoments of Environmental Performance Index:
Environmental Health (EH):

$$EH_i = \alpha_h + \beta_h \cdot \log GDPpc_i + \varepsilon_h \quad (3)$$

Ecosytem Vitality (EV):

$$EV_i = \alpha_v + \beta_v \cdot \log GDPpc_i + \varepsilon_v \quad (4)$$

We estimated the regression parameters of equations (2)-(4) by using the OLS method within the EViews 9.0 software.

3. Main findings

The estimated equation 2 is the following:

$$EPI = -25.48974 + 23.4682 \cdot \log GDPpc \quad (5)$$
$$(0.0000) \quad (0.0000)$$

We can follow the dependence of EPI to GDPpc in the Figure 2:

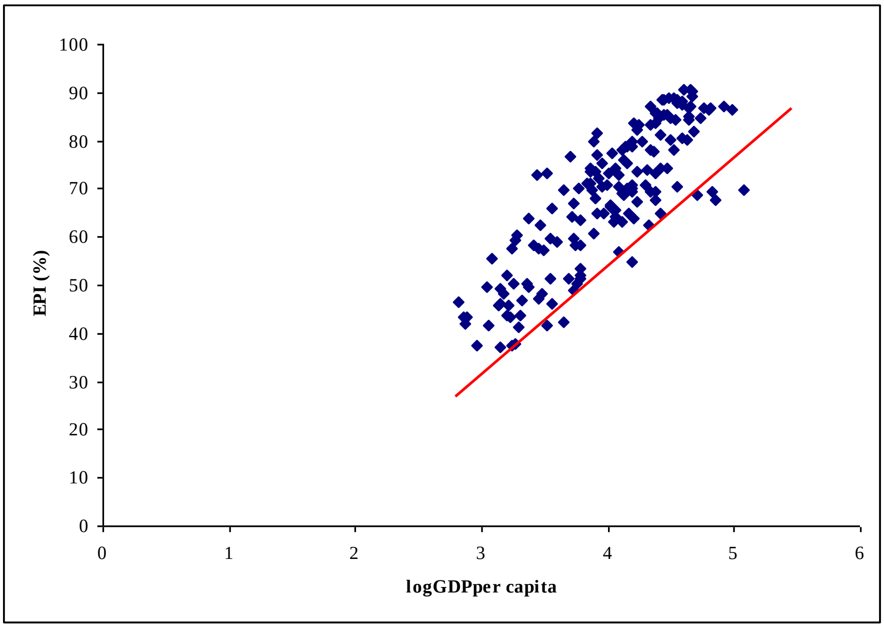

Figure 2 EPI versus logGDP per capita in the world economy, 2016
Source: authors' own computation based on World Bank and Yale and Columbia University data

We notice that, mainly, all examined countries are grouped around the red regression line (Figure 2), but according to the Annex 2, the first 10 countries ranked by GDP per capita are not the first when the ranking criterion is EPI. Finland, Iceland and Sweden are on the first positions according to the values of EPI, but according to GDP level, they are positioned on Finland on the 10-th, Iceland on the 14-th and Sweden on the 12-th places. Qatar, Brunei, United Arab Emirates, the most rich countries in the world have modest environmental performances.
The statistical cross-country model (Table 1) can be validated due to the fact that the value of Prob (F-statistic) is 0.000 lower than 0.05, the significance threshold. The value of Prob. for the constant C and the coefficient of logGDPpc is 0.000 (<0.05).

Table 1- Estimation of equation 2

Dependent Variable: EPI
Method: Least Squares
Date: 07/12/17 Time: 23:02
Sample: 1 166
Included observations: 166

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-25.48974	4.746141	-5.370625	0.0000
LOGGDPPC	23.46822	1.181013	19.87127	0.0000

R-squared	0.706549	Mean dependent var	68.02620
Adjusted R-squared	0.704760	S.D. dependent var	14.58977
S.E. of regression	7.927495	Akaike info criterion	6.990526
Sum squared resid	10306.61	Schwarz criterion	7.028020
Log likelihood	-578.2137	Hannan-Quinn criter.	7.005745
F-statistic	394.8674	Durbin-Watson stat	1.958068
Prob(F-statistic)	0.000000		

Source: authors' computation by using EViews 9.0 software

The determination coefficient (R-squared) is 0.706549 meaning that 70.65% of the variation of EPI can be explained by the variation of logGDP per capita. The value of adjusted R-squared (0.704760) is close to the R-squared meaning that our sample is relevant for an accurate representation of the reality.

The parameter β has the value of 23.46822 showing that for an increase of percetange point of GDP per capita, EPI will increase with 23.46822 units, if other factors are remaining constant.

In order to test the heteroskedasticity of errors, we used the White test (Table 2).

Table 2-Heteroskedasticity test for equation 2

Heteroskedasticity Test: White

F-statistic	1.212489	Prob. F(2,163)	0.3001
Obs*R-squared	2.433408	Prob. Chi-Square(2)	0.2962
Scaled explained SS	2.230022	Prob. Chi-Square(2)	0.3279

Source: authors' computation by using EViews 9.0 software

The value of Obs*R-squared (1.2124289) < $\chi^2_{0,05;2}$=5.99 meaning that the null hypothesis is accepted and the errors are homoskedastic, for a significance level of 5%: the variation of dependent variable being constant for any level of independent variables.
We intend to check the autocorrelation of errors by using the Breusch-Godfrey Serial Correlation LM Test (Table 3). The value of Obs*R-squared (1.294041) < $\chi^2_{0,05;2}$=5.99, meaning that the null hypothesis is accepted and the errors are independent (not autocorrelated).

Table 3- Errors autocorrelation detection

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.636390	Prob. F(2,162)	0.5305
Obs*R-squared	1.294041	Prob. Chi-Square(2)	0.5236

Source: authors' computation by using EViews 9.0 software

In order to check the causality sense of the relationship between logGDP per capita and environmental performance index (EPI), we used the Granger causality test from Eviews 9.0. The result displayed in the Table 4 show us that the value of F-statistic (36.4485) is higher than $F_{0,05;1,\infty}$=3.84, meaning that the null hypothesis is rejected and logGDP per capita does cause EPI.

Table 4-Causality test

Pairwise Granger Causality Tests
Date: 07/12/17 Time: 23:06
Sample: 1 166
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LOGGDPPC does not Granger Cause EPI	164	36.4485	9.E-14
EPI does not Granger Cause LOGGDPPC		0.68069	0.5077

Source: authors' computation by using EViews 9.0 software

Both Environmental Health (EH) and Ecosystem Vitality (EV) are positively associated with GDP per capita (Figure 3a) -b) and Table 5). The link is stronger for Environmental Health, R-squared is 0.684909 compared to 0.380693 for

Ecosystem Vitality. The dispersion of Ecosystem Vitality in the group of examined countries is higher than the Environmental Health (Figure 3a and Figure 3b), reflecting that, in terms of natural resources management and biodiversity protection, the world economy should be more effective and more concern should be given by national authorities to preserve and maintain the vitality of natural heritage as the economic activities evolves.

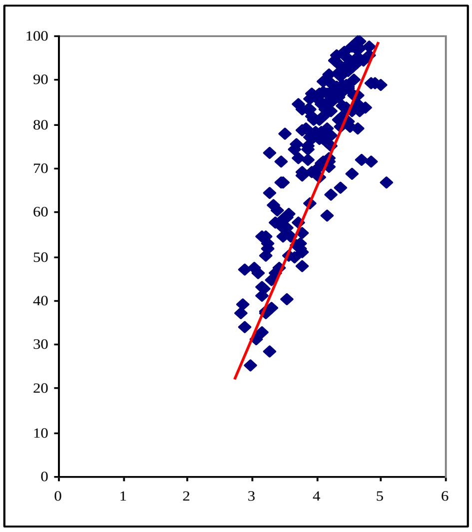

Figure 3a) Environmental Health and logGDP per capita

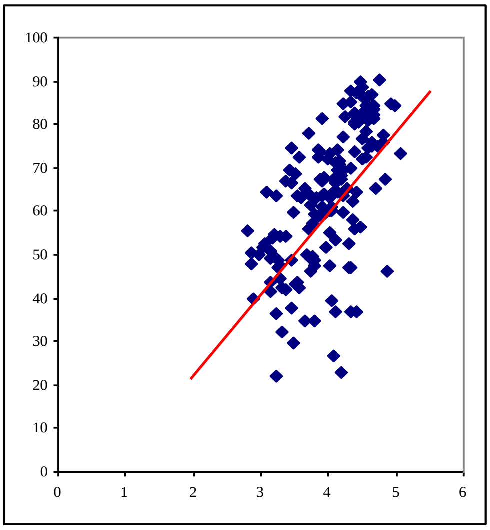

Figure 3b) Ecosystem vitality and logGDP per capita

Source: authors' own computation based on World Bank and Yale and Columbia University data

For both variables (EH and EV), the cross-country regression model can be validated (Table 5), due to the fact that the value of Prob(F-statistic) is 0.000(<0.05).

In the case of Environmental Health (EH), a percentage change of GDP per capita can lead to an increase of 28.50553 units of EH. The influence of GDP per capita on the change of Ecosystem Vitality (EV) is weaker, a change of one percentage point of GDP per capita is leading to an increase of EV with 18.43201 units.

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Table 5 -The relationship between EH, EV and logGDP per capita in the world economy, 2016

Dependent Variable: EH
Method: Least Squares
Date: 07/12/17 Time: 23:08
Sample: 1 166
Included observations: 166

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-40.57450	6.067285	-6.687424	0.0000
LOGGDPPC	28.50553	1.509762	18.88081	0.0000

R-squared	0.684909	Mean dependent var	73.01404
Adjusted R-squared	0.682988	S.D. dependent var	17.99915
S.E. of regression	10.13421	Akaike info criterion	7.481685
Sum squared resid	16843.15	Schwarz criterion	7.519179
Log likelihood	-618.9799	Hannan-Quinn criter.	7.496904
F-statistic	356.4851	Durbin-Watson stat	1.989741
Prob(F-statistic)	0.000000		

$$EH = -40.57450 + 28.50533 \cdot \log GDPpc$$
(6.0672) (1.5097)

Dependent Variable: EV
Method: Least Squares
Date: 07/12/17 Time: 23:11
Sample: 1 166
Included observations: 166

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.40868	7.377382	-1.410890	0.1602
LOGGDPPC	18.43201	1.835762	10.04053	0.0000

R-squared	0.380693	Mean dependent var	63.03904
Adjusted R-squared	0.376917	S.D. dependent var	15.61078
S.E. of regression	12.32247	Akaike info criterion	7.872700
Sum squared resid	24902.28	Schwarz criterion	7.910194
Log likelihood	-651.4341	Hannan-Quinn criter.	7.887919
F-statistic	100.8122	Durbin-Watson stat	2.033616
Prob(F-statistic)	0.000000		

$$EV = -10.40868 + 18.43201 \cdot \log GDPpc$$
(7.3773) (1.8357)

Source: authors' computation by using EViews 9.0 software

4. Conclusions

The aim of the paper was to explore the association between environmental performance and the level of income in the world economy in 2016.

We found a positive strong association between economic growth expressed by log GDP per capita and the values of environmental performance index (EPI) in 2016, in the world economy (166 countries). The cross-country model is statistically validated and reflects the beneficial influence of GDP per capita on the environmental performance, suggesting that as wealth increases, national environmental performance improves.

Both Environmental Health (EH) and Ecosystem Vitality (EV) are positively associated with GDP per capita, but Environmental Health (EH) is stronger related to GDP per capita, meaning that investments in public health, sanitation and infrastructure are increasing as countries develop.

Ecosystem Vitality (EV) scores are more dispersed in their relationship with GDP per capita. For example, rich countries as Qatar, Kuwait, Oman and United Arab

Emirates underperform on their environmental protection to other wealth and developed countries.

The limits of the study consist on the fact that the analysis is made only for one year, 2016. A combined, across time and across country, analysis would highlight more details of the link between environmental performance and economic growth in the world and to show how if there is a difference on how the economic growth rate is associated to the environmental performance in developed and developing countries. Another direction to which the research could be extended is a cross-country comparison of costs to reach a certain environmental performance and rate depending to the GDP per capita, as Ardelean and David (2013) suggested in their paper.

Our findings are relevant for national governments from developed and developing countries alike when they design their public environmental policies meant to preserve and maintain the natural heritage and to improve the ecosystem and natural resources management.

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Annex 1- EPI, EH, EV and GDP per capita in the world economy in 2016

Rank	Country	EPI	EH	EV	GDP pc	log GDPpc
1	Qatar	69,94	66,79	73,1	118.215,30	5,0727
2	Luxembourg	86,58	88,88	84,29	97.018,66	4,9869
3	Singapore	87,04	89,35	84,74	81.443,36	4,9109
4	Brunei Darussalam	67,86	89,33	46,39	71.788,78	4,8561
5	United Arab Emirates	69,35	71,43	67,28	67.133,07	4,8269
6	Norway	86,9	97,82	75,98	63.810,79	4,8049
7	Ireland	86,6	95,6	77,61	62.828,34	4,7982
8	Switzerland	86,93	83,78	90,09	56.625,14	4,7530
9	United States of America	84,72	94,41	75,03	53.272,52	4,7265
10	Saudi Arabia	68,63	72,03	65,22	50.458,17	4,7029
11	Netherlands	82,03	82,85	81,21	47.128,31	4,6733
12	Sweden	90,43	97,29	83,57	46.441,21	4,6669
13	Denmark	89,21	94,29	84,12	45.686,48	4,6598
14	Iceland	90,51	98,67	82,35	45.276,45	4,6559
15	Australia	87,22	98,71	75,73	44.414,03	4,6475
16	Austria	86,64	86,41	86,87	44.143,70	4,6449
17	Germany	84,26	84,66	83,87	44.072,39	4,6442
18	Canada	85,06	95,15	74,96	43.087,76	4,6344
19	Belgium	80,15	79,1	81,21	41.945,69	4,6227
20	Finland	90,68	97,23	84,13	39.422,65	4,5957
21	United Kingdom	87,38	93,85	80,92	38.901,05	4,5900
22	Japan	80,59	86,59	74,58	38.239,77	4,5825
23	France	88,2	89,97	86,44	38.058,87	4,5805
24	Malta	88,48	92,83	84,13	35.694,04	4,5526
25	New Zealand	88	97,81	78,19	35.269,10	4,5474
26	South Korea	70,61	68,85	72,37	34.985,85	4,5439
27	Italy	84,48	82,83	86,14	34.620,13	4,5393
28	Spain	88,91	94,57	83,24	33.261,08	4,5219
29	Israel	78,14	79,43	76,85	32.612,69	4,5134
30	Cyprus	80,24	88,59	71,9	31.195,51	4,4941
31	Czech Republic	84,67	80,81	88,53	31.071,75	4,4924
32	Slovenia	88,98	88,32	89,65	29.803,45	4,4743
33	Trinidad and Tobago	74,34	92,2	56,47	29.578,96	4,4710
34	Slovakia	85,42	83,77	87,07	29.156,09	4,4647
35	Lithuania	85,49	89,13	81,86	27.904,10	4,4457
36	Estonia	88,59	95,26	81,91	27.735,14	4,4430
37	Portugal	88,63	96,55	80,7	27.006,87	4,4315
38	Seychelles	64,92	92,85	36,99	26.319,16	4,4203
39	Poland	81,26	80,54	81,98	26.003,01	4,4150
40	Malaysia	74,23	84,21	64,25	25.660,46	4,4093

41	Hungary	84,6	81,89	87,3	25.381,29	4,4045
42	Greece	85,81	89,09	82,54	24.263,88	4,3850
43	Russia	83,52	87,06	79,98	24.026,00	4,3807
44	Latvia	85,71	91	80,42	23.712,09	4,3750
45	Turkey	67,68	79,6	55,76	23.679,40	4,3744
46	Equatorial Guinea	69,59	65,42	73,77	23.671,40	4,3742
47	Kazakhstan	73,29	88,42	58,15	23.419,91	4,3696
48	Chile	77,67	93,23	62,11	22.706,72	4,3562
49	Romania	83,24	81,19	85,28	21.647,81	4,3354
50	The Bahamas	69,34	91,85	46,83	21.481,73	4,3321
51	Croatia	86,98	86,37	87,59	21.408,55	4,3306
52	Panama	78	86,15	69,85	21.334,94	4,3291
53	Antigua and Barbuda	62,55	88,43	36,67	20.777,61	4,3176
54	Uruguay	73,98	95,48	52,48	20.046,93	4,3020
55	Mauritius	70,85	94,56	47,13	19.548,64	4,2911
56	Argentina	79,84	94,5	65,18	18.479,44	4,2667
57	Bulgaria	83,4	85,18	81,62	17.709,08	4,2482
58	Mexico	73,59	77,58	69,61	16.831,12	4,2261
59	Gabon	67,37	75,06	59,68	16.786,00	4,2249
60	Belarus	82,3	87,37	77,24	16.742,26	4,2238
61	Iraq	63,97	64,19	63,75	16.086,92	4,2065
62	Azerbaijan	83,78	82,96	84,6	15.994,01	4,2040
63	Thailand	69,54	71,61	67,46	15.681,81	4,1954
64	Montenegro	78,89	89,6	68,19	15.658,11	4,1947
65	Turkmenistan	70,24	70,44	70,04	15.648,37	4,1945
66	Barbados	54,96	86,83	23,09	15.588,27	4,1928
67	Botswana	70,72	72,37	69,07	15.513,44	4,1907
68	Costa Rica	80,03	91,15	68,91	15.401,49	4,1876
69	China	65,1	59,41	70,79	14.400,89	4,1584
70	Dominican Republic	75,32	78,91	71,73	14.098,88	4,1492
71	Brazil	78,9	87,14	70,67	14.023,69	4,1469
72	Algeria	70,28	76,07	64,5	13.974,67	4,1453
73	Serbia	78,67	83,35	73,98	13.720,09	4,1374
74	Colombia	75,93	82,2	69,66	13.124,32	4,1181
75	Suriname	68,58	83,81	53,34	13.113,86	4,1177
76	Macedonia	78,02	84,71	71,33	13.054,78	4,1158
77	Lebanon	69,14	71,69	66,6	12.974,17	4,1131
78	Grenada	63,28	89,79	36,78	12.910,99	4,1110
79	South Africa	70,52	76,66	64,38	12.260,17	4,0885
80	Maldives	57,1	87,43	26,77	12.235,55	4,0876
81	Peru	72,95	78,39	67,51	12.071,59	4,0818
82	Albania	74,38	84,74	64,03	11.424,63	4,0578
83	Sri Lanka	65,55	71,07	60,02	11.417,26	4,0576
84	Mongolia	64,39	67,86	60,92	11.328,48	4,0542
85	Bosnia and Herzegovina	63,28	87,09	39,48	11.179,35	4,0484
86	Indonesia	65,85	76,82	54,88	10.764,55	4,0320
87	Tunisia	77,28	81,1	73,46	10.752,02	4,0315
88	Ecuador	66,58	85,61	47,55	10.462,44	4,0196
89	Egypt	66,45	69,97	62,93	10.319,26	4,0136
90	Dominica	73,25	86,53	59,98	10.174,04	4,0075
91	Namibia	70,84	69,72	71,96	9.812,41	3,9918

92	Georgia	64,96	78,12	51,81	9.267,30	3,9670
93	Paraguay	70,36	81,14	59,58	8.877,61	3,9483
94	Fiji	75,29	86,6	63,99	8.862,74	3,9476
95	Jordan	72,24	76,67	67,81	8.389,54	3,9237
96	Jamaica	77,02	86,96	67,09	8.190,00	3,9133
97	Armenia	81,6	81,76	81,44	8.174,37	3,9125
98	Bhutan	64,99	69,14	60,84	8.105,80	3,9088
99	El Salvador	68,07	77,25	58,88	7.990,00	3,9025
100	Belize	73,55	83,39	63,71	7.831,45	3,8938
101	Swaziland	60,63	62,03	59,23	7.733,81	3,8884
102	Ukraine	79,69	85,74	73,63	7.668,06	3,8847
103	Guatemala	69,64	71,78	67,49	7.366,77	3,8673
104	Morocco	74,18	74,28	74,09	7.265,85	3,8613
105	Guyana	71,14	83,53	58,76	7.248,23	3,8602
106	Philippines	73,7	75,14	72,27	7.236,47	3,8595
107	Bolivia	71,09	78,91	63,26	6.707,96	3,8266
108	India	53,58	47,99	59,17	6.092,65	3,7848
109	Cape Verde	51,98	69,32	34,64	6.074,75	3,7835
110	Uzbekistan	63,67	78,49	48,85	6.038,87	3,7810
111	Angola	51,32	55,18	47,46	6.024,73	3,7799
112	Viet Nam	58,5	68,24	48,76	5.955,26	3,7749
113	Samoa	70,2	83,33	57,06	5.882,15	3,7695
114	Laos	50,29	51,18	49,39	5.734,59	3,7585
115	Nigeria	58,27	53,01	63,53	5.438,92	3,7355
116	Myanmar	48,98	51,82	46,14	5.351,55	3,7285
117	Tonga	66,86	84,42	49,3	5.332,47	3,7269
118	Congo	59,56	57,72	61,4	5.301,40	3,7244
119	Nicaragua	64,19	72,37	56,02	5.136,84	3,7107
120	Moldova	76,69	75,3	78,08	4.944,34	3,6941
121	Pakistan	51,42	52,73	50,11	4.866,16	3,6872
122	Honduras	69,64	74,19	65,09	4.392,27	3,6427
123	Sudan	42,25	49,63	34,87	4.385,05	3,6420
124	Ghana	58,89	54,47	63,31	3.980,20	3,5999
125	Zambia	66,06	59,53	72,59	3.636,06	3,5606
126	Mauritania	46,31	50,1	42,53	3.572,28	3,5529
127	Cambodia	51,24	58,8	43,67	3.462,84	3,5394
128	Cote d'Ivoire	59,89	56,41	63,36	3.448,14	3,5376
129	Bangladesh	41,77	40,36	43,18	3.319,35	3,5211
130	Kyrgyz Republic	73,13	77,73	68,54	3.291,97	3,5175
131	Cameroon	57,13	54,47	59,78	3.045,92	3,4837
132	Sao Tome and Principe	48,28	66,92	29,64	2.993,38	3,4762
133	Kenya	62,49	58,6	66,39	2.925,60	3,4662
134	Vanuatu	57,74	66,63	48,85	2.856,48	3,4558
135	Lesotho	47,17	56,74	37,59	2.808,24	3,4484
136	Tajikistan	73,05	71,41	74,7	2.762,59	3,4413
137	Tanzania	58,34	47,25	69,43	2.583,28	3,4122
138	Senegal	63,73	60,36	67,1	2.380,39	3,3766
139	Yemen	49,79	57,63	41,94	2.325,07	3,3664
140	Nepal	50,21	46,16	54,26	2.287,72	3,3594
141	Solomon Islands	46,92	61,55	32,3	2.072,71	3,3165
142	Benin	43,66	44,75	42,57	2.009,96	3,3032

143	Mali	41,48	38,36	44,59	1.962,69	3,2929
144	Kiribati	60,48	73,64	47,33	1.897,81	3,2783
145	Zimbabwe	59,25	64,28	54,22	1.859,94	3,2695
146	Chad	37,83	28,46	47,21	1.845,91	3,2662
147	Rwanda	50,34	51,88	48,79	1.773,75	3,2489
148	Afghanistan	37,5	52,92	22,08	1.739,58	3,2404
149	Uganda	57,56	51,71	63,4	1.713,85	3,2340
150	Haiti	43,28	50,01	36,55	1.653,96	3,2185
151	Ethiopia	45,83	36,96	54,69	1.608,29	3,2064
152	Burkina Faso	43,71	37,65	49,77	1.594,58	3,2026
153	The Gambia	52,09	54,69	49,49	1.565,80	3,1947
154	Guinea-Bissau	48,2	42,67	53,72	1.466,27	3,1662
155	Comoros	49,2	54,68	43,72	1.411,15	3,1496
156	Madagascar	37,1	32,69	41,51	1.396,09	3,1449
157	Togo	46,1	42,96	49,24	1.382,11	3,1405
158	Sierra Leone	45,98	41,05	50,91	1.365,87	3,1354
159	Guinea	55,4	46,26	64,54	1.215,03	3,0846
160	Mozambique	41,82	31,24	52,4	1.128,28	3,0524
161	Malawi	49,69	47,53	51,86	1.083,97	3,0350
162	Niger	37,48	25,11	49,86	906,99	2,9576
163	Liberia	43,42	46,88	39,97	753,56	2,8771
164	Dem. Rep. Congo	42,05	33,85	50,25	742,31	2,8706
165	Burundi	43,37	38,94	47,81	721,18	2,8580
166	Central African Republic	46,46	37,29	55,62	647,88	2,8115