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Environmental Performance Index and Economic Growth: evidence from some Developing Countries

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Abstract: The Sustainable economic development is indebted to appropriate use of water, soil, natural resources and the available capacity of human force. The purpose of present paper is to estimate and evaluate the relationship between Environmental Performance Index (EPI) and economic growth in selected developing countries. The studies about this issue have emphasized on economic growth in environment's demolition. But the impact of improvements in environment quality is pointed in this paper, which is the main distinction of this study in comparison with other studies on this issue. To do so we have used a sample of 20 developing countries for which the necessary data were available in 2008. Our findings based on cross-section Weighted Least Squares (WLS)econometrics method indicate that the impact of Environmental Performance Index on economic growth in the countries under consideration is positive and significance.

Key words: Environmental Performance Index (EPI); Economic Growth; Developing countries

INTRODUCTION

The Environmental Performance Index (EPI) is a new and strongly performance-oriented composite index. It builds on the Pilot Environmental Performance Index that was published in 2002 and is designed to be a powerful supplement to the environmental targets set forth in the U.N. Millennium Development Goals (Chess, *et al.,* 2005). The EPI measures progress toward a set of targets of desirable environmental outcomes, taking into account a country's current policies. It is anticipated to be of particular value to decision makers because of its strict input-output framework and short-term to medium-term time horizon, which promotes accountability and performance evaluation at the policy level. (Buckland *et al.,* 2005; Jafari *et al.,* 2008).

The EPI permits cross-country peer-reviews to identify best practices, leaders, and laggards, but it primarily tracks performance changes over time with respect to clearly identified, achievable targets. These targets are based on existing international agreements, scientific evidence on the harmful impacts of pollution on humans and ecosystems, and economically feasible environmental protection strategies. (Skillius and Wennberg, 1998; Stakeholder, 2002).

The EPI scores provide a basis to make sound comparisons across the overall environmental performances of the countries. Furthermore, by comparing each country's performance in Air Quality, Water Resources, Biodiversity and Habitat, Productive Natural Resources, Climate Change and Environmental Health categories, it enables a more detailed assessment among countries. The EPI is also oriented towards supplementing the environmental targets specified in the United Nations_ Millennium Development Goals. It will thus contribute to achieving long-term environmental sustainability targets. (Fare *et al.,* 2004; International, 2005; Statistical *et al.,* 2007).

Fueled by advances in information technologies, data-driven decision-making has transformed every corner of society, from business to sports. In the government domain, quantitative performance metrics have reshaped policymaking in economics, health care, and education. The 2008 Environmental Performance Index (EPI) brings a similar fact-based and empirical approach to environmental protection and global sustainability. (Smeets and Weterings, 1999).

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The EPI focuses on two overarching objectives:

1) Reducing environmental stresses on human health
2) Promoting ecosystem vitality and sound natural resource management.

These broad goals reflect the policy priorities of environmental authorities around the world as well as the environmental dimension of the Millennium Development Goals (MDGs). (Fare *et al.,* 2004; Jafari Samimi and Mohsen Hossini, 2008; Skilius and Wennberg, 1998).

It must be stressed that the EPI's real value lies not in the numerical rankings but rather in careful analysis of the underlying data and performance metrics. With results displayed by issue, policy category, peer group, and country, the EPI facilitates the identification of leaders and laggards, highlights best policy practices, and identifies priorities for action. More generally, the EPI provides a powerful tool for steering environmental investments, refining policy choices, and understanding what drives policy outcomes. (Buckland *et al.,* 2005; Stakeholder, 2002).

The EPI Framework::

The EPI offers a composite index of current national environmental protection results (Pilot 2006 and 2008 Environmental Performance Index). It highlights peer-reviews on a cross-country basis to evaluate the current performances of countries. It mainly tracks performance changes over time with respect to clearly identified, achievable targets. (United, 2005)

The EPI builds on measures relevant to the goal of reducing environmental stresses on human health, which we call the Environmental Health objective. It also includes measures relevant to the goal of reducing the loss or degradation of ecosystems and natural resources we call this the Ecosystem Vitality objective. (Buckland *et al.,* 2005; Smeets and Weterings, 1999)

The quantitative metrics of the EPI encompass 25 indicators or datasets. These indicators were chosen through a broad-based review of the environmental policy literature, the policy consensus emerging from the Millennium Development Goal dialogue, and expert judgment. Together they span the range of priority environmental issues that are measurable through currently available data sources. (Statistical and Social, 2007; Untied, 2005).

For each indicator, we have also identified a relevant long-term public health or ecosystem sustainability goal. Drawn from international agreements, standards set by international organizations or national authorities, or prevailing consensus among environmental scientists, the targets do not vary by country. Rather, they serve as absolute benchmarks for long-term environmental sustainability.

Using the 16 indicators, we are able to evaluate environmental health and ecosystem vitality performance at three levels of aggregation.

To make the 25 indicators comparable, each was converted to a proximity-to-target measure with a theoretical range of zero to 100. (Fare *et al.,* 2004; Jafari Samimi and Mohsen Hosseini, 2008; Skillius and Weterings, 1999; Statistical and Social, 2007; United, 2005).

To ensure the use of the most relevant and best available metrics, the following indicator selection criteria were applied:

- Relevance: The indicator clearly tracks the environmental issue of concern in a way that is relevant to countries under a wide range of circumstances, including various geographic, climatic, and economic conditions.
- Performance orientation: The indicator tracks ambient conditions or on-the-ground results (or is a _best available data_ proxy for such outcome measures).
- Transparency: The indicator provides a clear baseline measurement, ability to track changes over time, and transparency as to data sources and methods.
- Data quality: The data used by the indicator should meet basic quality requirements and represent the best measure available.

It should be mentioned that the EPI utilizes the best available global datasets on environmental performance, but the overall data quality and availability is alarmingly poor. The absence of broadly-collected and methodologically-consistent indicators for even the most basic concerns such as water quality–and the complete lack of time series data for most countries–hampers efforts to shift pollution control and natural resource management onto more empirical foundations. To address these gaps, policymakers should (1) invest in environmental data monitoring, indicators, and reporting. (2) set clear policy targets on the full range of important issues; and (3) undergird environmental protection efforts with performance metrics at the global, regional, national, state/provincial, local, and corporate scales.

2. Environmental Performance in developing countries:

The aim of this section is to identify the current performances of developing countries on the core environmental issues such as air and water pollution, land protection and greenhouse emissions, in light of the data and information taken from the Pilot 2006-2008 Environmental Performance Index (EPI). The index is being prepared and published by the Yale University's Environment School and Earth Institute at Columbia University in collaboration with World Economic Forum and Joint Research Centre of the European Commission. The Pilot 2006- 2008 EPI identifies targets for environmental performances and measures how close each country comes to achieving these goals. Specifically, the report evaluates overall environmental performance of developing countries and the performance of each developing countries individually, in this regard.

It should be mentioned that developing countries consist of 26 countries whiles the data of EPI were available and used in this study only for 20 countries.

Average score of EPI in developing countries in 2006 was 60.61 of possible 100 shows the performance levels are not very satisfactory. Furthermore, developing countries have not performed satisfactorily with regard to the Environmental Health, Air Quality, Water Resources, Biodiversity and Habitat, and Sustainable Energy categories. On the other hand, they appear to have performed quite satisfactorily in term of the Productive Natural Resources category.

Based on data of Yale Center for Environmental Law & Policy top 5 performing developing countries in the EPI score in 2006 are Lebanon, Israel, United Arab Emirates, Turkey and Iran, respectively. Lebanon, showed better performance as compared to other developing countries in 2006.

Analysis of the relative performances of developing countries in each of the selected 6 policy categories (Environmental Health, Air Quality, Water Resources, Biodiversity and Habitat, Productive Natural Resources, and Sustainable Energy) within the EPI in 2006 reveals that only Israel, Lebanon and United Arab Emirates have scores above 90 in the Environmental Health category. Lebanon, which is the best performing developing countries in the EPI in 2006, ranked 2th in environmental health scores. Thus, its performance in environmental health appeared to be slightly weaker than Israel. It appears that there are only a few developing countries achieved significant performance in the EPI in 2006. In general, the performances of developing countries are not satisfactory in this category in 2006.

Average score of EPI in developing countries in 2008 was 69.6 indicating the performance levels are not still very satisfactory but it is better than the average score of 2006. Furthermore, developing countries have not performed satisfactorily with regard to the Water Resources, Biodiversity and Habitat and Climate Change categories. On the other hand, they appear to have performed quite satisfactorily in terms of the Environmental Health, Air Quality and Productive Natural Resources categories.

Based on data of Yale Center for Environmental Law & Policy top 5 performing developing countries in the EPI in 2008 are Georgia, Israel, Armania, Iran and Egypt, respectively. Georgia, showed better performance as compared to 2006. In general, the performances of developing countries still are not satisfactory in 2008.

Analysis of the relative performances of developing countries in each of the selected 6 policy categories (Environmental Health, Air Quality, Water Resources, Biodiversity and Habitat, Productive Natural Resources, and Climate Change) within the EPI in 2008 reveals that only Israel, Lebanon, Kuwait, Kazakhstan and Turkey (5 countries) scores above 90 in the Environmental Health category. Georgia, which has the best performance among developing countries in the EPI in 2008, ranked 8th in environmental health scores.. It appears that there are only a few developing countries that achieved relatively high significant performance in the EPI in 2008.

Model, Data, and Estimation Methodology:

We study the case of 20 countries from developing countries and use data for 2008. Data on Environmental Performance Index (EPI), Real GDP, Investment (Gross fixed capital formation) and labor force are from World Bank, International Monetary Fund, World Factbook and Yale Center for Environmental Law & Policy.

The basic model to be estimated on cross-section data for 20 countries from developing countries is a simple Cobb-Douglas production function for 2008.

$$GDP = A_i K_i^{\beta_1} L_i^{\beta_2} O_i^{\beta_3} EPI_i^{\beta_4} 10^{\varepsilon_i} \quad (1)$$

The variables for country i:
GDP is gross domestic production

L is labor force
K is gross capital formation
O is the openness degree of economy
EPI is Environmental Performance Index
The model can be rewritten as follows:

$$\log GDP_i = \alpha_i + \beta_1 \log K_i + \beta_2 \log L_i + \beta_3 \log O_i + \beta_4 \log EPI_i + \varepsilon_i \quad (2)$$

Table 1 presents the WLS regression estimation results

Table 1: WLS regression results

Dependent Variable: LGDP
Method: Least Squares
Date: 12/31/09 Time: 11:23
Sample: 1 20
Included observations: 20
Weighting series: LOPEN
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LK	0.354854	0.082504	4.301038	0.0005
LL	0.568035	0.114673	4.953539	0.0001
LOPEN	1.467365	0.480327	3.054932	0.0076
LEPI	1.933827	0.422284	4.579448	0.0003
	Weighted Statistics			
R-squared	0.998464	Mean dependent var		10.45581
Adjusted R-squared	0.998176	S.D. dependent var		9.354698
S.E. of regression	0.399535	Akaike info criterion		1.179827
Sum squared resid	2.554055	Schwarz criterion		1.378974
Log likelihood	-7.798271	Durbin-Watson stat		2.571659
	Unweighted Statistics			
R-squared	0.446911	Mean dependent var		10.22702
Adjusted R-squared	0.343207	S.D. dependent var		0.909911
S.E. of regression	0.737417	Sum squared resid		8.700536
Durbin-Watson stat	2.544093			

Table 2: Coefficient Covariance Matrix

	LK	LL	LOPEN	LEPI
LK	0.006807	-0.00499	0.006449	-0.01496
LL	-0.00499	0.01315	-0.00056	-0.02484
LOPEN	0.006449	-0.00056	0.230714	0.015693
LEPI	-0.01496	-0.02484	0.015693	0.178324

Table 3: Summary Statistics

	LGDP	LK	LL	LEPI	LOPEN
Mean	10.22702	9.226415	6.74159	1.839778	-0.18115
Median	10.39057	9.514653	6.754861	1.84992	-0.1754
Maximum	11.35522	10.62364	7.703979	1.914747	0.133266
Minimum	7.626485	6.655072	5.986234	1.696303	-0.43672
Std. Dev.	0.909911	1.244018	0.48473	0.054565	0.161378
Observations	20	20	20	20	20

Appendix. List of countries			
1	Armenia	11	Pakistan
2	Azerbaijan	12	Saudi
3	Egypt	13	Sudan
4	Georgia	14	Syria
5	Iran Islamic Rep.	15	Tajikistan
6	Israel	16	Turkey
7	Kazakhstan	17	Turkmenistan
8	kuwait	18	United Arab Emirates
9	Kyrgyzstan	19	Yemen
10	Lebanon	20	

Findings and Concluding Remark:

Based on regression results in table 1 all parameters estimated in equation (2) are positive and statistically significance. In other words as a result of increase in investment, labor, the openness degree of economy and EPI economic growth will also increase.

Based on the results of the paper and compared to the world average, it appears that the majority of developing countries are required to improve their performances in the Environmental Health, Air Quality, Water Resources, Biodiversity and Habitat and Sustainable Energy categories in order to achieve higher environmental quality. Thus, developing countries need to enhance efforts in achieving better performance in Environmental burden of disease, Adequate sanitation, Drinking water, Urban particulates, Indoor air pollution, Local ozone (Environmental Health indicators), Regional Ozone concentrations and Sulfur dioxide emissions (Air Quality indicator), Water quality, Water stress (Water Resources indicators), Conservation risk index, Effective conservation, Critical habitat protection, Marine Protected Areas (Biodiversity and Habitat indicators), Growing stock change, Marine Tropic Index, Trawling intensity, Irrigation Stress, Agricultural Subsidies, Intensive cropland, Burnt Land Area, Pesticide Regulation (Productive Natural Resources) Emissions per capita, Emissions per electricity generation, Industrial carbon intensity (Climate Change).

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