Factors Affecting Environmental Performance Index (EPI) in Selected OPEC Countries

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Abstract

Nowadays, conservation, maintenance and monitoring of natural resources according to estimated benefits and costs, plays an important role in economic growth and sustainable development. Economic development along with environmental protection, while preserving economic competitiveness by providing eco-friendly technologies, will prevent of loss and waste of environmental resources. One of the most comprehensive and complete environmental indicators which today used to provide a clear and comprehensive picture of environment in each country is Environmental Performance Index (EPI). Therefore, the main purpose of this study is investigation of affecting factors on environmental performance index in selected OPEC countries during the period 2000-2012 by using panel data approach. The results show that governance index, internet users and natural resource abundance index variables have positive and significant effect and openness and the carbon dioxide emissions per GDP have negative and significant effect on environmental performance index in selected OPEC countries. Also the coefficient of human development index (HDI) is positive and insignificant and value added of industry sector is negative and insignificant.
Keywords: Governance, Environmental Economics, Panel Data, Natural Resources Abundance.
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1. Introduction

Economics is the science of efficient use of resources. Awareness of this science and its utilization use enables human to use scarce natural

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resources effectively. It should be noted that individual benefit does not necessarily in one direction by the society benefit (necessarily individual benefits are not aligns with society benefits). Thus, to efficient use of natural resources pay attention to must be done by the society benefits and the interests of future generations and to minimizing environmental degradation and pollution are inevitable. Overall, there is a reciprocal reaction between economy and environment. Firms by using economic resources including raw materials and energy produce goods and services and finally some parts of the used inputs in the production process will return to the environment as lesions and wastes. These lesions that are mainly in the form of waste gases such as carbon monoxide, carbon dioxide, sulfur dioxide or solid waste and sewage disposal cause pollutions or impose external costs to society. Thus, it is seen that making decisions on the economy are facing the opportunity's cost or missed opportunities (Abbaspour, 2007). According to many scientists, higher levels of economic activities (production or consumption) require more energy and raw materials and as a result, greater amounts of secondary wastes are generated and it leads to environmental degradations (Panayotou, 2003). However, interaction with the environment and optimal utilization of natural resources and environmental conditions and facilities lead to the stability and continuity development. While if environmental conditions are not appropriate, the outcome of development will face with problems and development will stop. Therefore, increasing revenue through economic development and growth may result in decreasing pollution growth and the absolute level of pollutants emissions (Grossman and Kruger, 1994). It is quite true natural that poor countries trying to develop, ignoring the quality of the environment and only think about thinks to maximizing their economic growth. But with increasing public welfare, people are slowly realizing their environmental conditions and by the pressure on the government, will provide to enact laws and regulations to control and reduce the growth of emissions (Tisdell, 2001).

Thus, discussions related to preserve, protect and maintenance of the environment quality are at the center of sustainable development and in recent years, one of the indicators that used to measure the

situation of the environment is called the Environmental Performance Index (EPI). Environmental Performance Index is based on two key policies: Environmental health that measures environmental stresses on human health and vitality of ecosystem that measures ecosystem health and natural resource management. This index is revealed countries attempts in order to enhance environmental management and community capacity to promote environmental performance index toward the sustainable development agenda. Ranking and scoring of environmental performance index take place by comparing subjects in 5 groups including environmental systems, reducing environmental stresses, reducing human vulnerability, social - institutional capacity and global surveillance in the form of 20 indicators and 76 variables. Environmental performance index for each country and each indicator is calculated by the difference between what was achieved and what was predicted to achieve. Since 2000,this index has been published annually by the Center of Environmental Law and Policy of Yale University (YCELP), Center for International Earth Science Information Network (CIESIN) of Columbia University and World Economic Forum (WEF: Annual Report of Environmental Performance Index, 2012).

So, this study's aim is to examine factors affecting Environmental Performance Index (EPI) and provide tips used for economic policy makers and decision makers, use to selected members of Organization of the Petroleum Exporting Countries (OPEC) during the period 2000-2012.

The bulk share of the OPEC countries revenues forms by the fossil fuel revenues, therefore, these countries have potential capacities to make move toward clean environment. The purpose of selection a sample of OPEC in the present paper is to demonstrate Factors Affecting Environmental Performance improvement in order to steer orientation and aggregation oil revenues toward resolution of the environmental problems, especially in the Islamic Republic of Iran. Also it should be noted that, studied countries and time period have been selected according to available statistical data. In the most studies of environmental economy, air pollution especially carbon dioxide, is considered as representative of the pollution and environmental degradation, but this index ignores other parts of the environment. In this regard, the present study by selection of

environmental performance index, this will resolve as possible attempt to present a more comprehensive view about pollution and environmental degradation.

This study is arranged in four sections: the next section, materials and methods is described, the third section analyzes and discusses the results of the model estimation and finally in the fourth section, conclusions and recommendations are presented.

2. Materials and Methods

According to the theoretical and experimental mentioned studies in the previous section, especially Dahiya (2012) and Talberth and Bohara (2006) studies, we estimate the model as follows.

$$EPI = f(HDI, Industry, Open, CO_{\Upsilon}, Internet, Resource, Governance) \qquad (1)$$

$$LEPI_{it} = \delta_0 + \delta_1 LHDI_{it} + \delta_2 LIndustry_{it} + \delta_3 LOpen_{it} + \delta_4 LCO2_{it}$$
$$+ \delta_5 LInternet_{it} + \delta_6 L\text{Re}source_{it} + \delta_7 LGovernance_{it} + \varepsilon_{it} \qquad (2)$$

All variables in equation (2) are logarithm. LEPI is dependent variable. It denotes the logarithm of Environmental Performance Index. It should be noted that in order to estimate model Stata 12, is used. Now, we introduce the variables used in the estimated model.

EPI: Environmental Performance Index, **HDI**: Human Development Index (includes three indicators of health, education and living standards), **Industry**: Industry value added as a percentage of GDP, **Open**: openness (sum of the total value of imports and exports divided by GDP in terms of constant prices), **CO_2**: Carbon dioxide emissions per unit of GDP, **Internet**: Internet users as a percentage of total population, **Resource:** Natural resource abundance index (the total value of fuel exports divided by the total value of merchandise exports in terms of constant prices), **Governance:** Governance index[1] (includes six indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulation quality, rule of law and control of corruption).

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1. Remarkably, to have logarithm of the governance index and since this index is negative in the most studied countries, by adding positive value, all the indexes become positive and logarithms are calculated.

It should be noted the extraction resource of environment performance index is annual reports of environmental performance index and used resources for all independent variables are World Bank database.

First, we analyze F-Limmer test, for realized pooling or panel data of the statistical data. The null hypothesis of F-Limmer statistic is based on being pooled. If it is rejected, the hypothesis based on panel data for the data is accepted (if we reject it … will accept.). The F statistic is calculated using the following formula:

$$F_{(n-1,\ nt-n-k)} = \frac{\left[RRSS - URSS\right]\big/(n-1)}{\left[URSS\right]\big/(nt-n-k)} \qquad (3)$$

The above statistics (RRSS) is the coefficient of determination of the constrained model (ordinary least squares method), and (URSS) is the coefficient of determination from the unconstrained model (using panel data). In the above, n is the total number of countries, t is the number of observations and k is the number of explanatory variables. F- Limmer test′s results (Table 1) indicate that data in selected OPEC countries with a confidence level greater than 95% is Panel Data. After ensuring the existence of panel data model in the all cases, the Hausman test is used to choose between fixed or random effects model. The null hypothesis of Hausman test of statistical data is based on a random effects model. If the null hypothesis is rejected, it shows that the alternative hypothesis i.e., the presence of fixed effect model is accepted. In other word, If Hausman test statistic is greater than its critical values or statistical probability (prob) is smaller than 5%, the null hypothesis reject and the theory of endorsing a fixed effects model will be accepted. The results of Hausman test reported in Table (1) approve the use of fix effects model because the probability of Hausman test is less than 5 percent.

Table 1: Hausman and F-Limmer Tests' Results

Cross-Section Fixed Effects Tests: F-Statistic[Prob]	415.53 [0.00]
Hausman Test: Chi-squared [Prob]	107.79 [0.00]

Resource: Estimate Calculation

3. Introducing the Elements of EPI
3.1 Human Development Index (HDI)
According to Table 2, the coefficient of the Human Development Index (HDI)[1] is positive and insignificant that is consistent of the results of Rudi Rahimi and Ashford (2005). Improving education and increasing years of education, increasing per capita incomes and improving the health status by rearing a generation of graduates who are aware of the general principles of environmental protection, are considered as the first necessary steps to preserve the environmental quality. But the coefficient of HDI is insignificant in this study.

3.2 Value Added of the Industrial Sector as a Percentage of GDP (Industry)
According to Table 2, the coefficient of value added of industry sector is negative and insignificant and is consistent by the results of Mirshojaeian Hosseini and Kaneko (2013) and Huang et al (2008) studies. Increasing industrial activities through various means such as using of polluting vehicles, manufactures and more kinds of wastes and trashes, play a substantial role in environmental pollution and endangerment of ecosystem health in countries. This means that the value added of industrial sector has a negative effect on Environmental Performance Index.

3.3 Openness (Open)
According to Table 2, coefficient of openness is negative and significant and is compatible by the results of Talberth and Bohara (2006) and Khalil and Inam (2006) studies. It is important to note that according to statistics and in the studied period, the ratio of imports to exports in OPEC countries is more than one. It means that the effect of openness on EPI in OPEC countries is negative that due to the strengthening of the national currency and adopts other inappropriate economic policies that increase imports on the one hand and reduced the motivation of production and exports activities on the other hand.

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1. Human Development Index is a composite index that is achieved by the average school years (years that people by more than 25 years have spent in school) as education index, life expectancy as health index, per capita national income by the purchasing power parity as living standards index with same weights.

3.4 Carbon Dioxide Emissions per Unit of GDP (CO_2)

According to Table 2, the coefficient of carbon dioxide emissions is negative and significant. This index shows per dollar of GDP, how many thousand tons of carbon dioxide is released. Uncontrolled emissions of carbon dioxide have the adverse effects on the environment including acid rain, making conditions unfavorable for growth and development of plants and also have negative effect on the other organism life cycle including humans.

3.5 Internet Users as a Percentage of the Total Population (Internet)

Table 2 indicates the coefficient of internet users is positive and significant; the current result is consistent of the results of Lindhjem and Navrud (2011) and this results contrast with the results of Auci and Becchetti (2006) and Fallahi et al (2012). Using the Internet in banking, administration, sales, education and training in addition to reducing costs and accelerating tasks, have many benefits, such as reducing personal referrals and traffic and thus, reducing the entry of contaminants to the environment.

3.6 Natural Resources Abundance Index (Resource)

Table 2 shows that the coefficient of natural resources abundance index is positive and significant and is aligned with the Ang (2007) and Dietz and Rosa (1997) studies. The bulk of foreign exchange revenues comes from supply of non-renewable wealth in OPEC countries and because of the lower valuation of real exchange rates in these countries, there are more willing to expand imports with back of oil revenues than expansion of domestic products and thus because of the possibility of imports from developed countries that often using new technologies to prevent environmental contamination in their products, requirements for environmental protection are provided.

3.7 Governance Index (Governance)

According to Table 2, the coefficient of the governance index is positive and significant and is consistent with the results of Mirshojaeian Hosseini and Kaneko (2013) and Dahiya (2012) studies. Improving governance by different channels such as macroeconomic policies consistent with environmental protection and the deviation of relative prices to

conservation of natural resources and prevent damaging to the environment have been effective in improving environmental performance. It can be stated that an increase in political rights and information freedom can increase awareness and activities of the environmental groups and finally, this issue leads to increase public awareness and social pressures to pass environmental protection laws.

Table 2: Estimation Results for Selected OPEC

Variable		Variable	
C	3.32^{***}	LResource	0.03^{**}
	(3.6)		(2.09)
LHDI	0.04	LGovernance	0.55^{***}
	(0.33)		(4.84)
LIndustry	-0.01	R^2	0.55
	(-0.39)		
LOpen	-0.13^{***}	F-statistic	18.42
	(-3.74)	[Prob]	[0.00]
LCo_2	-0.22^{***}	Number of observations	110
	(-3)		
LInternet	0.05^{***}	Root MSE	0.15
	(3.29)		

Resource: Estimate Calculation

The number in parentheses represents the t-statistic.

***, ** and * show significant at 1%, 5% and 10%, respectively.

4. Conclusion

The aim of this study was to investigate factors affecting the Environmental Performance Index (EPI) of selected OPEC countries during the period 2000-2012 using panel data approach. Environmental Performance Index is an index comprised of various variables that covers the bulk properties of environment. Therefore, in this study to show a better environmental situation, this index is used. The results indicates that, estimated coefficient of governance on Environmental Performance Index in selected OPEC countries is positive and significant and have the highest coefficient among variables affecting Environmental Performance Index. Also the results indicates that coefficients of human development index is positive and insignificant, value added of industry sector is negative and insignificant, coefficients of openness and carbon dioxide emissions per dollar of GDP, is negative and significant and coefficients of the number of internet users and natural resource abundance index, is positive and significant.

Therefore, according to the role of environment and increasing global attention to it, the following recommendations are presented to policy makers of selected OPEC countries in order to improve environmental performance and reduce damages to environmental reserves and functions: 1) Improving governance by different ways such reducing corruption and bribery, passing rules and regulations that are designed suitably to achieve macroeconomic objectives. 2) Increasing access to internet and deployment of e-government and founding internet payment systems and office automation according to environmental conservationist culture. 3) Making culture in order to save fossil fuels and move towards the use of cleaner fuels. 4) More use of environmental friendly technologies and products based on the technology in different industries by protecting domestic inventors. 5) Creation and establishment of pro-environmental regulations on industrial activities such as establishing tax pollution, make requirement for industrial enterprises to use of filters to recycle air pollutants, harmful water, wastes and ultimately determine different types of incentives such as tax discounts for creative industries in the field of scientific.

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