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Global Climate Risk and Economic Growth

[1]Ahmad Jafari Samimi, [2]Saman Ghaderi, [3]Salahaddin Ghaderi

[1]University of Mazandaran, Babolsar, Iran.
[2]Islamic Azad University, Sanandaj Branch, Sanandaj, Iran.
[3]Young Researchers club, Islamic Azad University, Tabriz Branch, Tabriz, Iran

ABSTRACT

The purpose of this paper is to estimate the relationship between the Global Climate Risk Index (CRI) and economic growth in selected countries around the World. To do so Concentrating on Environmental Kuznets Curve (EKC) hypothesis, we have estimated a panel regression model using the available data during 2004-2008. The Global Climate Risk Index (CRI) developed by Germanwatch deals with the quantified impacts of extreme weather events indicates the average ranking of the countries in four indicators, (i.e. number of deaths, number of deaths per 100 000 inhabitants, sum of losses in US$ in purchasing power parity (PPP) as well as and losses per unit of Gross Domestic Product (GDP) with the countries ranking highest being those most impacted. However, our findings regarding the estimated panel regression analysis during 2004-2008 contradict the normal Kuznets Curve. In other word, we found a U-shaped curve regarding the relationship between global climate risk and economic growth.

Key words: Global Climate Risk Index (CRI), Economic Growth, Environmental Kuznets Curve (EKC).

Introduction

1.1 Background of the Germanwatch Climate Risk Index (CRI):

Extreme weather events are not the only phenomenon revealing the impacts of climate change on development. Other very influential factors include glacier melting, sea-level rise etc. However, extreme weather events play an important role in public discussions about climate change, because they usually attract high media attention. Nevertheless, discussions about extreme events often only refer to absolute numbers of deaths and/or maxima of dead persons and economic losses.

Germanwatch developed the global Climate Risk Index (CRI) to regularly sensitive the public and the media for the consequences of weather extremes and to inform them about the interlink ages with climate change. We hope to initiate a differentiated discussion about the consequences of climate change. Above this, we intend to move forward the debate about risk reduction strategies from greenhouse gas reduction to adaptation and insurance options. We put a special focus on less developed countries.

The Climate Risk Index was first published by Germanwatch in 2006 using data until 2004. The present version 2008 is supposed to provide a differentiated view of consequences of weather extremes, especially in the year 2006, and to particularly show

- *Which countries or country groups were mostly affected by weather extremes.*
- *In which way numbers of deaths and losses are related to country specific conditions.*
- *to which extent especially less developed countries suffer from the consequences which are neglected by an examination which only focuses on the absolute amount of losses* (Harmeling, 2011).

1.2 Methodological Remarks and Limitations:

The presented examinations are based on the data collection and analysis, acknowledged worldwide, provided by the division GeoRiskResearch (NatCat*SERVICE*®) of Munich Re. They comprise "all elementary loss events which have caused substantial damage to property or persons". For the countries of the world, Munich Re collects the number of total losses caused by weather events, the number of deaths, the insured damages and total economic damages. The last two indicators are stated in million US$ (original values, inflation adjusted).

In the analysis, only weather related events – storms, floods, as well as temperature extremes and mass movements (heat and cold waves etc.) – are incorporated. Geological factors like earthquakes, volcanic eruptions or tsunamis, for which data is also available, do not play a role in this context because they do not depend on the weather and therefore are not related to climate change. To enhance the manageability of the large amount of data, the different categories within the weather related events were combined.

Corresponding Author: Ahmad Jafari Samimi, University of Mazandaran, Babolsar, Iran.
E-mail: jafarisa@umz.ac.ir.

For single cases – for especially devastating events – it is stated whether they concern floods, storms, or another type of event.

It is important to note that this event-related examination does not allow for an assessment of continuous changes of important climate parameters. A long-term decline in precipitation that was shown for some African countries as a consequence of climate change cannot be displayed by the index. Such parameters nevertheless often substantially influence important development factors like agricultural outputs and the availability of drinking water.

The present data does also not allow for conclusions about the distribution of damages below the national level, although this would be interesting. However, the data quality would only be sufficient for a limited number of countries.

1.3 Analysed Indicators:

For this examination the following indicators were analysed in this paper:
1. number of deaths,
2. number of deaths per 100 000 inhabitants,
3. sum of losses in US$ in purchasing power parity (PPP) as well as
4. losses per unit of Gross Domestic Product (GDP).

For the indicators 2. to 4., economic and population data primarily by the International Monetary Fund was taken into account. However, it has to be added that especially for small (e.g. Pacific small island states) or politically extremely instable countries (e.g. Somalia), the required data is not always available in sufficient quality for the whole observed time period. For those countries, reliable analyses are sometimes not possible.

The Climate Risk Index 2010 is based on the figures from 2008 and 1990-2008, but only takes into account countries which are Parties to the United Nations Framework Convention on Climate Change (UNFCCC). This ranking represents the most affected countries. Each country´s index score has been derived from a country's average ranking in all four analyses, according to the following weighting: death toll 1/6, deaths per inhabitants 1/3, absolute losses 1/6, and losses per GDP 1/3.

The analysis of the already observable changes in climate conditions in different regions presented here indicates which countries are particularly endangered by future climate change. Although looking at socio-economic variables in comparison to damages and deaths caused by weather extremes – as was done in the present analysis – does not allow for an exact measurement of the vulnerability, it can be seen as at least an indication. In most cases, already afflicted countries will probably also be especially endangered by possible future changes in climate conditions. Despite the historic analysis, a deterministic recording of the past to the future is not appropriate. On the one hand, the likelihood for past trends in extreme weather events to continue unchanged is very low.

Additionally, new phenomena can occur in states or regions. In the year 2004, for example, a hurricane was registered in the South Atlantic, off Brazil's coast, for the first time ever. The cyclone that hit Oman in 2007 is of similar significance. Accordingly, the analyses of the Climate Risk Index should not be seen as the only evidence for which countries are already afflicted or will undoubtedly be affected by the anthropogenic climate change. After all, people can in principle fall back on different adaptation measures.

However, to which extent these can be implemented effectively depends on several factors which altogether determine the degree of vulnerability.

Background:

Traditional economic theory posits a tradeoff between economic progress and environmental quality. More recently, it has been suggested that increased wealth is a prerequisite for environmental improvements (Grossman and Krueger 1995). Several empirical studies have likewise shown that wealth is an important factor in explaining environmental policy results, but not alone determinative of environmental policy (Esty and Porter 2005)

Although other causes of economic growth are less certain, climate risk is widely accepted to reduce growth in developing and developed nations. Economic growth itself is often believed to lead to higher quality in environmental conditions in a given country. The Environmental Kuznets Curve is sometimes used to describe this relationship. Developing countries are forced to exploit their environment and cannot afford to protect the environment from pollution as they begin to develop. But as they carry out this exploitation, these developing countries reach a level of income where they are able to afford environmentally friendly production methods and can increase government resources devoted to protection of the environment. At that point, increasing per capita income is associated with an increase in environmental quality.

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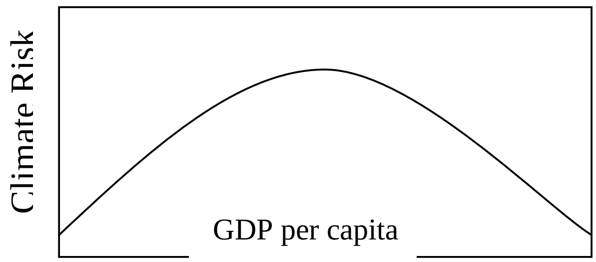

Fig. 2: Environmental Kuznets Curve

At the empirical level there are a large number of studies seeking to verify the early findings of the inverted U-shaped EKC, to expand the idea of the EKC to more pollutants, or to improve on the econometrics used.

Although the initial findings of the World Bank (1992) and Grossman and Krueger (1995) regarding the EKC seem to have gained acceptance over the last decade, Harbaugh, Levinson and Wilson (2002) suggest that the pollution-income relationship is less robust than previously thought in changes in data, extension of the lag-structure of the GDP per capita and inclusion of additional country specific covariates.

Another closely related issue is the relationship between environmental regulation and competitiveness. The conventional wisdom suggests that the cost of environmental regulation slows productivity growth and impedes competitiveness in international markets. The opposite view, expressed by the so-called Porter hypothesis and supported by a series of case studies, where firms under strict environmental regulation prove to be very successful, suggests that tough environmental regulation in the form of economic incentives can trigger innovation that may eventually increase a firm's competitiveness and may outweigh the short run private costs of this regulation (Porter 1991, Porter and van der Linde 1995). On the theoretical level the validity of this hypothesis has not been established without resorting to specific assumptions regarding X-efficiency, or strategic trade models (Simpson and Bradford 1996). It has also been criticized for introducing a "free lunch" idea and potentially distracting attention from the cost-benefit analysis of environmental policy (Palmer, Oates and Portney 1995). It has also been shown (Xepapadeas and de Zeeuw 1999) that modernization of capital stock induced by a tougher environmental policy might not provide the full benefits assumed by the Porter hypothesis, but is expected to increase the productivity of the capital stock, along with a relatively less severe impact on profits and more emission reductions.

Model and Data:

The present research using panel data estimates hypothesis for some developing countries. Applied model for estimation is as follows:

$$CRI_{it} = \beta_1 + \beta_2 GDPP_{it} + \beta_3 GDPP^2{}_{it} + \beta_4 INDUST_{it} + \beta_5 URBAN_{it} + \beta_6 GS_{it}$$

$$i = 1,2,\ldots,N$$

$$t = 1,2,\ldots,T$$

$$\beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 < 0, \beta_6 > 0$$

CRI: Climate Risk Index
GDPP: Gross Domestic Product Per Capita.
INDUST: Industry value added (% of GDP) as Industrialization.
URBAN: Urban population growth (annual %) as urbanization.
GS: Government Size that is represented by the share of government consumption in GDP
We used overall CRI data from Germanwatch website and other variable from WDI.

Empirical Results:

In this paper, we use panel data model and for choosing between OLS the pooled model, Fixed Effects (FE) and Random Effects (RE) employ Chow, Lagrange Multiplier (LM) (by Breusch-Pagan) and Hausman tests (For more details about panel technique and the related tests, see Baltagi, 2005 , Hsiao, 2005 and Gujarati, 2004) by Stata 9.1 and Eviews 7.

Table 1 presents Chow, Lagrange Multiplier and Hausman tests for model.

Table 1: Chow, Lagrange Multiplier and Hausman Tests

Test	Test-Statistic	P-value	Result
Chow	7.21	0.0000	FE
LM	8.20	0.0000	RE
Hausman	0.93	0.9676	RE

Based on result of table 1, model is RE and the results of random effects panel data model are presented in table 2.

Table 2: Results of Estimation of Model

Depended Variable: Climate Risk Index

$$CRI_{it} = \beta_1 + \beta_2 GDPP_{it} + \beta_3 GDPP^2{}_{it}$$
$$+ \beta_4 INDUST_{it} + \beta_5 URBAN_{it} + \beta_6 GS_{it}$$

Independent Variable	Coefficient	t-Statistic	Prob.
GDPP	-0.001725	-5.564451	0.0000
$GDPP^2$	2.19E-08	2.447847	0.0149
INDUST	1.206862	10.90965	0.0000
URBAN	-2.144546	-3.660129	0.0003
GS	1.951094	9.717197	0.0000
C	63.86545	23.19923	0.0000
F	4.4160		
P-value	0.0000		
R^2	0.5398		
Adjusted R^2	0.4176		

Results of table 2 show that according to the theoretical priors, the coefficient of GDPP is negative and statistically significant and the coefficient of $GDPP^2$ is positive and significant. Thus, results don’t support the Environmental Kuznets Curve (EKC) hypothesis.

Also, we find that the coefficients of Industrialization and government size are positive and significance. The coefficient of urbanization is negative and statistically significant.

Conclusion:

The Germanwatch Global Climate Risk Index is an analysis based on the most reliable available data on the impacts of extreme weather events and associated socio-economic data. The Climate Risk Index indicates a level of exposure and vulnerability to extreme events which countries should see as a warning signal to prepare for more severe events in the future.

In this paper, we estimated the relationship between Climate Risk Index and economic growth for 79 countries base of Environmental Kuznets Curve (EKC) hypothesis. The results regarding the estimated panel regression analysis during 2004-2008 show that there is a U-shaped curve regarding the relationship between global climate risk and economic growth. In other words, results contradict the normal Kuznets Curve.

References

Baltagi, H.B., 2005. "Econometric Analysis of panel Data". Johnwiley and Sonc, Third Edation.

Esty, D.C. and M.E. Porter, 2005. “National Environmental Performance: An Empirical Analysis of Policy Results and Determinants”, Environment and Development Economics, 10: 391–434 (Cambridge University Press).

Grossman, Gene M. and Alan B. Krueger, 1995. “Economic Growth and the Environment”, Quarterly Journal of Economics. CX(2): 353-77.

Gujarati, D.N., 2004. Basic Econometrics. Forth Edition, McGraw-hill.

Harbaugh, W., A. Levinson and D.M. Wilson, 2002. “Reexamining the empirical evidence for an environmental Kuznets curves”, Review of Economics and Statistics., 84(3): 541-551.

Harmeling, S., 2011. “Global Climate Risk Index” Germanwatch (updated yearly), www.germanwatch.org/cri

Hsiao, C., 2005. Analysis of panel Data. Cambridge University Press, Second Edition.

Palmer, K., W. Oates, and P. Portney, 1995. “Tightening environmental standards: The benefit-cost or the no-cost paradigm?” Journal of Economic Perspectives, 9: 119-132.

Porter, M. and C. van der Linde, 1995. “Toward a new conception of the environment competitiveness relationship”, Journal of Economic Perspectives., 9: 97-118.

Simpson, R. David and Robert L. Bardford, 1996. “Taxing Variable Cost: Environmental Regulation as Industrial Policy”, Journal of Environmental Economics and Industrial Policy, 30: 282-300.

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World Bank, 1992. World Development Report 1992: "Development and the Environment", (Oxford University Press, New York).

World Bank, 2011. World Development Indicators CD-ROM 2011, Washington, DC.

Xepapadeas, A. and A. de Zeeuw, 1999. "Environmental policy and competitiveness: The Porter hypothesis and the composition of capital", Journal of Environmental Economics Management., 37: 165-182.