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Climatic Change and Economic Growth: An Evidence from Low-Income Economies

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Abstract

Climate change is a threat not only to the affected country but to the entire world. Over the last few decades, incidents of climatic change have increased drastically, and these incidents have both direct and indirect impacts on the economy. The United Nations Environment Programme (UNEP) Adaptation Gap Report 2016 warns of the increasing impacts of climatic risks and, as a result, an increase in global adaptation costs. The prediction is that international costs will increase by two to three times by 2030 and four to five times by 2050. This study investigates the short-run and long-term impacts of climate change on economic growth across low-income countries from 2005 to 2018. The study uses the Panel Autoregressive Distributed Lag (PARDL) approach. This model allows us to study both the short-run and long-term effects of climate change on economic growth and capture the possible links in the short run. For the study purposes, twenty-two low-income countries were chosen from almost all continents on the basis of their income levels. The data for the GDP, as a proxy of a country's economic growth, is taken from the World Development Indicators (WDI), and for climate change, we use the global climatic risk index (CRI) developed by German watch (CRI) is used as an explanatory variable in the model. The empirical results show that climatic change, especially weather-related events, negatively impacts the economic growth of low-income countries during the studied period in the long run. But in the short run, climatic change does not significantly affect the economic growth of countries. Moreover, climate change has been severely affecting low-income countries over the last few decades, as reported in the study. As climatic risk increases, the vulnerability in these countries also increases, and this study supports the need for a global mitigation approach.

Keywords: Climate change, economic growth, and low-income countries.
JEL Classification: O5. O4. Q540.

1. INTRODUCTION

Climate change is a threat not only to the affected nation but also to the whole world. Over the last few decades, incidents of climatic change have increased drastically, and these incidents have both direct and indirect impacts on the economy. Assessing the direct and indirect effects of climatic change faces a fundamental challenge of complexity (Hsiang *et al.*, 2017; Oh & Reuveny, 2010). The set of mechanisms through which climate may positively or negatively influence economic outcomes is a challenging task to investigate comprehensively. Considering climatic change and its impact on economic growth and the mechanism is known, but still, there is a challenge how various means interact to shape macroeconomic outcomes.

Commonly occurring weather-related events become disasters when they directly affect the physical and human capital and, in some cases, output too. The extreme level of weather-related incidents leads to shocks in the economy. These exogenous shocks directly or indirectly reverberate throughout the economy and affect macroeconomic balances crippling the nation towards depth and poverty traps (Schellnhuber *et al*., 2006). These exogenous shocks due to climatic change have a wide range of negative implications for ecosystems and the economy and society, which could irreversibly affect both present and future generations (IPCC 2014; Stern 2006; Ackerman *et al*., 2014). Broadly, climatic change is defined as when variables of climate or weather changes result in huge floods, droughts, storms, and massive changes in temperature associated with heat and cold waves, which

affect not only flora and fauna but also other spheres such as the atmosphere, hydrosphere, biosphere, and cryosphere (Phelan, 2011). No doubt when climate changes, climatic risk too will change depending on the intensity of change in the climate.

The UNEP Adaptation Gap Report 2016 warns of the increasing impacts of climatic risks and, as a result, an increase in global adaptation costs. The prediction is that international costs will increase by two to three times by 2030 and four to five times by 2050. Further, it is assumed that it will likely be more than currently expected as in 2016 (Lemoine & Kapnick, 2016; Watts, 2019). Indeed, increased climatic risk will push up the frequency of extreme weather events and undoubtedly have heterogeneous impacts yet leave no one excluded (Jones, Olken, & Dell, 2009). But, the bottom strata of society are more vulnerable to climatic change. Though, there has been an exponential increase in studies examining the link of pollutants of the Environment such as CO2 and economic growth. Surprisingly, the relations of climatic change with economic growth, especially for (low-income countries) are ignored. Simultaneously, acquiring knowledge about these countries and how climatic change impacts them is the first step towards understanding how badly they're affected. Therefore, to address the knowledge gap in research, the current study uses the panel ARDL approach to estimate how climatic change (risk) possibly impacts the economic growth of these low-income countries from 2005 to 2018.

2. CLIMATIC RISK INDEX

The present study is based on the Global climatic risk index (CRI) developed by German watch, which analyses the quantified impact of extreme weather events and categorizes the country which is more affected by the climatic change as per the defined indicators, which include fatalities and economic losses that occurred based on the data from Munich Re NatCat SERVICE whose database is considered most reliable. Broken down by countries and territories, Munich Recollects the number of total losses caused by weather events, deaths, and gross domestic product damages. In this study, only extreme level weather-related events - storms, floods, extreme levels of change in temperatures, and heat and cold waves are considered (Global Climate Risk Index, n.d.). Geological or other related events are not incorporated in this study. In brief, only those events are incorporated, which directly damages physical and human capital. This index allows for broad conclusions only at the national level, and below the national level, it doesn't allow for comprehensive conclusions.

3. DATA AND METHODOLOGY

3.1 Data

The current study focuses on the period from 2005 to 2018 to investigate whether climate change, especially weather-related events, impacts economic growth or not. The data is collected from the global climatic risk index developed by German watch. On the basis of climatic risk index, the countries are characterized as whether this country is impacted by climatic change. And data of gross domestic product is collected from world bank in US$.

3.2 Methodology

The current paper focuses on the annual data from 2005 to 2018 to strengthen and to estimate whether climate change impacts economic growth for low-income countries. We took the growth rate of the gross domestic period (GDP) as the dependent variable, and we aimed to assess how GDP is impacted by climate change. And for data Global climate risk index is used on the basis of the CRI score.

The CRI score is based on the loss of figures from 1998 to 2018, and the CRI score represents the affected countries. Normalization technique was used, and the sci score is derived from a country's average ranking in all the four categories, according to the following weighting: death toll,1/6; deaths per 100000 inhabitants 1/3; the sum of losses in US$(PPP) 1/6; and losses per unit of GDP 1/3. The choice of methodology referred mainly to the technique introduced by Pesaran et al. (1999) to obtain consistent and efficient estimates of the parameters. The research applies Panel ARDL analysis to the cointegration method using specific valuable software's E-Views (EViews 10), STATA and R.

4. RESULTS AND DISCUSSIONS

The basic statistics of economic growth and CRI-score are given in Table 4.1 to understand the data's relevant properties; we employed analytical tools such as mean and standard deviation. In contrast, the mean indicates the average value of the sample, and the standard deviation is the positive square root of variance.

Table 4.1: Basic Statistics

Variable	Observations	Mean	St. Dev	Min	Max
Cri Score	308	55.97143	30.98062	1.83	126.17
Growth Rate	308	7.08211	3.88778	-14.11	19.74

Source: Cri score denotes the climatic risk index score.

Mostly Low-income economies (World Bank) are defined as those economies whose GNI per capita is $1,025 or less in 2018 calculated by using the World Bank Atlas method. On the one hand, these economies are characterised by low income. On the other hand, these countries are more vulnerable to climatic change. This erratic climatic change had affected these countries' economic growth, and other macroeconomic balances paved the way towards dept and poverty traps (Tol, 2011). Consequently, from the last two decades, the vulnerability has increased in almost all these countries and mentioned some of the most affected low-income countries as the Philippines, Pakistan, India, Myanmar, Cambodia, Vietnam, and Bangladesh. India, the second-largest country by population, is also affected by weather-related events. In 2014, India was hit by several spots of rain in the northern part and affected human population, crop land, and losses worth billions. In 2015 stuck by heatwaves in southeast India and recorded the highest ever temperature in this century. Every year India was listed in the top 20 most affected counties, and recent floods in Kerala were the worst flood of this century, and damage was amounted to around US$2.8 billion.

Consequently, as these weather-related events increase and exceed the maximum level lead to disasters and, as a direct impact of weather events, affect the country's economic growth. In the last two decades, the vulnerability has increased, and too there is a threat for affected country development.no doubt high-income countries are also affected by weather-related events. Still, they can come out from these events while low income has many other challenges apart from this climate change.

Table 4.2 reveal Panel unit root validation for the data of low-income countries during the period 2005-2018. Panel unit root analysis provides different results related to the stabilization level of the study period. We employ four different panel unit root tests: the Pesaran, and Shin (LPS) test, ADF-Fisher (ADF)test, Levin -Lin Chu test, and Breitung test. Panel unit root indicates that the selected sample is stationary and statistically significant at 1%level. This refers to a stable correlation between growth rate and Cri score.

Table 4.2: Panel Unit Root Tests

Variables	**Pesaran-Shin**		**ADF-Fisher**		**Levin-Lin-Chu**		**Breitung**		**Level Of Integration**
	Statistics	**P Value**	**Statistics**	**P Value**	**Statistics**	**P Value**	**Statistics**	**P Value**	
Growth Rate	-4.2227	0.000	-9.0592	0.000	-5.5674	O.000	-7.7786	0.000	I(0)
Cri Score	-2.5214	0.000	-5.6457	0.000	-7.2969	0.000	-3.0796	0.000	I(0)

Source: authors estimation

Table 4.3: Hausman test (cri score)

MG	PMG	Difference	S.E.
Prob>chi2 = 0.6569			
DFE	PMG	Difference	S.E.
0.002527	-0.014435	0.169624	0.039411
Prob>chi2 = 0.6669			

Note: Cri score denotes the climatic risk index score.

Table 4.4 Panel Pooled mean group estimates.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
Dependent variable: Growth rate. **Long Run Equation**				
CRI_SCORE	-0.2898	0.0731	-3.96449	0.0001
Short Run Equation				
COINTEQ01	-1.02199	0.022543	-45.3356	0.000
D(CRI_SCORE)	3.989605	0.634896	6.283869	0.000
C	72.93059	17.05008	4.277434	0.000
Mean dependent var	-1.94444	S.D. dependent var		426.4402
S.E. of regression	235.7004	Akaike info criterion		10.0985
Sum squared residual	13388676	Schwarz criterion		10.90992
Log-likelihood	-1488.17	Hannan-Quinn criterion		10.42294

Source and note: authors estimation Cri score denotes the climatic risk index score.

The estimation is conducted by using the Autoregressive Distributed Lag model ARDL. Table 4.4 reports the results based on the Pooled Mean Group estimator. The results suggest that climate change shares a negative relationship with economic growth. As evident from table 4.4, the coefficient of the CRI score is -0.2898, which means that for every one percent change in the climatic risk index, the economic growth reduces by two percentage points.

According to the Hausman test, Table 4.3 we accept the PMG as a consistent and efficient estimator. In line with climate change and its impact on the economic growth of low-income countries, the PMG estimator results indicate the existence of a statistically negative relationship between economic growth and climate change in low-income countries in the long run.

5. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, we examined, on the one hand, the different aspects of the relationship between economic growth and climatic change both in the long run and short run. We tried to estimate how this change impacts the economic growth of low developing countries when there is a change in the climate. The significant results are as follows: firstly, the climatic change affects economic growth in the long run. Our econometric results based on the PMG method show that when CRI score increases by one percent on these low-income countries, it will impact economic growth by 2percent. This finding can be explained mainly by the fact that there is a need to protect this Environment because it is not only economic growth being impacted by climatic change, but also whole ecological balance got impacted by climatic change. Secondly, climatic change impact disappears in the long run. The conclusions support that there is a need for global mitigation approach for climatic change so that the threat should be minimised.

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