**[*PAPER/Poster* *TITLE*]**

**he relationship between economic growth and CO2 emissions in Saudi Arabia: An empirical analysis of the environmental Kuznets curve**

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## Overview

The connection and interactions between economic development and environmental degradation have been a topic of many studies over the recent past. Saudi Arabia has seen an increased amount of emissions of carbon dioxide as a result of continued economic growth. The relationship between these variables can be tested using the environmental Kuznets curve (EKC). The Environmental Kuznets curve (EKC) states that at first, there exists a direct proportion relationship between economic development and environmental pollution (de Bruyn et al., 1998). After achieving a certain level of income, the relationship becomes inverted or reversed. In our current study, we try to examine the relationship between pollutant emissions and economic growth for an open developing country, Saudi Arabia, during the period 1980–2019. This study is made on basis of the environmental Kuznets curve hypothesis (EKC), using time series data and cointegration analysis. We use Carbon dioxide (CO2) as the environmental indicator and GDP as the economic indicator.

## Methods

In our empirical analysis, we use per capita carbon dioxide (CO2) as the environmental indicators (measured in metric tons), and per capita GDP in constant 2010 US dollars as the economic indicator. The pollutant emissions is chosen according to their environmental relevance and because it is available on a national basis and for the longest time period. The CO2 emissions are those stemming from the burning of fossil fuels (including solid fuel, liquid fuel and gas flaring) and the manufacture of cement. The CO2 emissions cause problems on a global scale, which are classified as one of the main driving forces behind global warming today. All data used in this study covering the period 1980-2019. Per capita GDP and per capita CO2 emissions are taken from the World Bank’s *World Development Indicators* (2021). The objectives of our empirical estimation are to examine how the variables are related in the long-run and to assess the dynamic causal relationship between these variables. In line with these objectives, our methodological approach in this paper is structured as follows: First, we test for stationarity in the time series for all the variables using three unit root tests: the augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979), the Phillips-Perron (PP) test (Phillips and Perron, 1988) and the Kwiatkowiski-Phillips-Schmidt-Shin (KPSS) test (Kwiatkowiski et al., 1992). The second step is to test for cointegration using the Johansen technique (Johansen, 1995), which is carried out in a context of a vector autoregression (VAR) model. Whether or not the variables included in the VAR model are cointegrated has implications for the form of that model and for the type of causality test that is appropriate. If the Johansen tests support the conclusion that the variables are not cointegrated, then causality tests must be based on a VAR model in first differences. If, however, the variables are cointegrated, then causality tests should be based on an error correction model (ECM). So, the third step is to test for causality by employing the appropriate types of causality tests.

## Results

According to the EKC hypothesis, the long-run relationship between economic growth and environmental degradation can be expressed as a logarithmic cubic function of the income, given by:



Eq. (3) allows us to test the various forms of environmental-economic relationships;  and  reveals an N-shaped relationship;  and  reveals an inverse N-shaped relationship;  and  reveals a U-shaped relationship;  and  reveals an inverse U-shaped relationship, representing the EKC hypothesis, the turning point of the EKC is computed by ;  and  reveals a monotonically increasing linear relationship;  and  reveals a monotonically decreasing linear relationship.

We use Carbon dioxide (CO2) as the environmental indicator (*Pt*) and GDP as the economic indicator (*Yt*). Our primary results (our empirical research has not finished yet) show that there is a long-run cointegrating relationship between the per capita carbon dioxide (CO2) emissions. Actually, a monotonically increasing relationship with GDP is found more appropriate for CO2 emissions. Therefore, our empirical findings do not support the hypothesis of an inverted U-shaped EKC for CO2 emissions in Saudi Arabia. However, the causality results show that the relationship between income and CO2 emissions is one of unidirectional causality emissions with income causing environmental changes and not vice versa, both in the short-run and long-run. This implies that emission abatement policies and more investment in mega green projects will not hurt economic growth. It could be a feasible policy tool for Saudi Arabia to achieve its sustainable growth in the long-run.

## Conclusions

In our current paper we examine the relationship between pollutant emissions and economic growth for an open developing country, Saudi Arabia, during the period 1980–2019. This study is made on basis of the environmental Kuznets curve hypothesis (EKC), using time series data and cointegration analysis. We use Carbon dioxide (CO2) as the environmental indicator and GDP as the economic indicator. . Our results show that there is a long-run cointegrating relationship between the per capita carbon dioxide (CO2) emissions. Actually, a monotonically increasing relationship with GDP is found more appropriate for CO2 emissions. Therefore, our empirical findings do not support the hypothesis of an inverted U-shaped EKC for CO2 emissions in Saudi Arabia. However, the causality results show that the relationship between income and CO2 emissions is one of unidirectional causality emissions with income causing environmental changes and not vice versa, both in the short-run and long-run. This implies that emission abatement policies and more investment in mega green projects will not hurt economic growth. It could be a feasible policy tool for Saudi Arabia to achieve its sustainable growth in the long-run.

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