

# ***DETERMINANTS OF CARBON DIOXIDE EMISSIONS: ROLE OF RENEWABLE ENERGY CONSUMPTION, ECONOMIC GROWTH, URBANIZATION AND GOVERNANCE***

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## **Overview**

Environmental pollution is one of the leading global debates, and an existential threat to humanity, due to the rise in the global average temperature (IPCC, 2019). The increase in temperature is associated with the meltdown of glaciers, especially in the high mountains of Asia (Rounce et al., 2020). In East African Community (EAC) countries (Kenya, Tanzania, Uganda, Rwanda, and Burundi), the average temperature is projected to rise due to continuous warming in the Indian-Pacific warm pool with a devastating effect on the loss of animals, crops and biodiversity (Niang et al., 2015). There have been attempts to comprehend the causes of environmental degradation in the empirical literature. The seminal work of Grossman and Krueger (1991) provides a deeper examination of the effects of pollution on the environment. They examined the scale effect, composition effect and technique effect as mechanisms that affect the level of pollution and deterioration of environmental assets. The primary research questions for the present study are twofold, What are the drivers of CO<sub>2</sub> emissions in EAC countries? What kind of causal connection exists between CO<sub>2</sub> emissions, the use of renewable energy, governance, urbanization, and economic growth in the EAC countries? The current study differs from many past studies as follows: it examines the determinants of environmental pollution using a multi-theoretical approach based on the EKC theory and STIRPAT model making it more robust (Liddle, 2015). Second, the standard Kuznets curve pollution of income model for the environment and STIRPAT model are integrated and broadened to take into account governance which has been ignored in EAC countries and beyond. By looking at how governance affects CO<sub>2</sub> emissions for EAC countries, this study fills in this vacuum. Third, the study tested for common unobserved factors across EAC countries and applied the second generational panel unit root test, which yields estimates that are more accurate, effective, and robust in the presence of cross-section dependence (CD). Four, the study avoids omitted variable bias by using a multivariate framework.

## **Methods**

The study used a panel data spanning from 1996 to 2019 to examine the drivers of CO<sub>2</sub> emissions in EAC countries. Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least squares (DOLS) estimators were employed in the study. The study's findings verified the bell-shaped EKC hypothesis. The bridged environmental Kuznets curve and stochastic regression on population, affluence, and technology models are used in the current study. Before estimating DOLS and FMOLS we first checked for cross-sectional dependence, panel unit roots, and cointegration.

## **Results**

The study's findings verified the bell-shaped EKC hypothesis. In addition, using renewable energy and improving governance is key to lowering the CO<sub>2</sub> emissions in EAC countries, while urbanization promotes CO<sub>2</sub> emissions. The bidirectional causal associations are exhibited between urbanization and CO<sub>2</sub> emissions; governance and CO<sub>2</sub> emissions; GDP per capita and urbanization; consumption of renewable energy and urbanization; and governance and urbanization. In addition, a single-way causal relationship runs from CO<sub>2</sub> emissions to renewable energy consumption; from GDP per capita to CO<sub>2</sub> emissions; from renewable energy consumption to governance; and from GDP per capita to renewable energy consumption.

## Conclusions

The study tested for the drivers of CO<sub>2</sub> emissions in EAC countries using DOLS and FMOLS. The study's empirical findings enable some enlightening deductions that could have important policy ramifications. EAC countries have an estimated population of 300 million and a combined Gross Domestic Product (GDP) at market prices of USD 278.1 billion (EAC, 2022). Economic growth associated with regional integration is likely to increase pollution levels now and in the future, and if nothing is done, there will be no climate change reversal (Espoir et al., 2022). However, the effects of global warming have a significant impact on the population (Kimaro and Mogaka, 2020). The demand for hydrocarbons will continue to rise under the economic regional integration (Pasara, 2019) and in turn, will result in more pollutant emissions. The scale effect based on the EKC, the increase in production will be associated with an increase in pollution but the remedy is to use green energy in the production process to curtail the level of stock pollutants. To address this, more money needs to be spent on renewable energy research and development, including wind, solar, hydro, geothermal, and nuclear. Besides, rigorous environmental legislation should go along with the utilization of renewable energy. Further, the EAC countries should develop cutting-edge initiatives that can slow down the consumption of fossil fuels in cities and cut CO<sub>2</sub> emissions and their equivalent during the protracted process of urbanization. Therefore, it is important to implement clean energy cooking and efficient transportation systems in urban areas to reduce CO<sub>2</sub> emissions. Mass Rapid Transit, such as the use of electric buses and trains, can also help urban areas become more environmentally sustainable in the next decades. However, without a sound institution, it is impossible to maintain environmental quality, since governance has the potential to decrease CO<sub>2</sub> emissions. It is therefore for the EAC countries to improve the quality of their governance and build strong institutions that work.

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