ECONOMIC GROWTH AND ENERGY CONSUMPTION IN OECD COUNTRIES: A CAUSALITY ANALYSIS

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ABSTRACT

Understanding the relationship between energy consumption and economic development is crucial in formulating effective policies and developing energy resources in sustainable ways. "Economic Growth and Energy Consumption in OECD Countries: A Causality Analysis" examines the nexus between economic growth and different energy sources in OECD countries. The study aims to determine whether GDP and energy consumption are cointegrated and whether causality exists in a panel of OECD countries from 1965 to 2011.

METHODOLOGY

A panel cointegration analysis was performed for each measure of energy consumption.

RESULTS

Unit Root Test Results
- GDP is integrated of order 1 or I(1) for every country individually.
- Total energy is usually I(1) except for Belgium, Canada, and Japan for both time periods.
- Oil is I(1) except for Australia, Finland, Germany, Japan, Norway, and the Netherlands.
- Natural gas is I(1) except for Germany, Hungary, and the Netherlands.

Cointegration Test
- Granger Causality
  - Total Energy and GDP
  - Coal and GDP
  - Natural Gas and GDP
  - Oil and GDP
  - Total Energy and CO2 emissions growth

Granger Causality
- Total Energy Consumption and Economic Growth
  - Energy consumption causes economic growth in Australia, Belgium, France, and Netherlands.
  - Economic growth causes energy consumption in Canada, Mexico, Norway, Turkey, and the US.
  - Bidirectional causality is found in Ireland and Spain.

Total Energy Consumption and Economic Growth (1965-2004)
- Unidirectional causality from GDP to energy consumption in Belgium, Japan, and the US.
- Unidirectional causality from GDP to energy consumption in Canada, Mexico, Turkey, and the US.

Components of Energy
- Oil: Granger-causes economic growth in Belgium, Austria, and Canada; the opposite direction in Greece, India, Spain, Turkey, and the US.
- Natural gas Granger-causes GDP in Japan; there is bidirectional causation in Australia and Mexico, while GDP has a causal effect on natural gas in Canada, Spain, and the US.
- Coal: unidirectional causality running from coal to GDP in Hungary and Greece, while Germany, Japan, Mexico, and the US show evidence of causation in the other direction.

CONCLUSIONS

Energy Consumption
- Economic Growth
  - The strengthened relationship in Austria, Belgium, and France.
  - The governments should increase investment in energy sector and reduce inefficiency in the supply and use of energy.
  - Energy conservation policies aimed to control raising emissions of carbon dioxide in countries that heavily rely on coal and oil would adversely affect economic growth.
  - Switching to clean energy sources and improving energy efficiency may promote economic development in these countries.

Economic Growth
- Energy Consumption
  - The strengthened relationship in Canada, Mexico, and the US.
  - Energy conservation policies can be applied without negatively affecting economic development.
  - Raising energy efficiency could be one of the strategies to reduce the amount of energy consumed.

Economic Growth and Energy Consumption: The strengthening relationship in Iran and Spain
- Energy consumption promotes economic growth and vice versa.
- Total energy consumption and economic growth are complements.
- The adverse effect of energy conservation measures on economic development may have a negative impact on energy consumption as well.
- If the goal of policymakers to lower emissions, then demand and supply of alternative energy sources should be stimulated.

No Causality
- Energy consumption does not have a significant impact on economic growth.
- Energy conservation policies can be applied without jeopardizing economic growth.

This paper is a starting point in a further investigation of causal relationship. To completely understand the link between energy consumption and economic growth, inclusion of other economic and environmental factors such as energy prices, employment and emissions of carbon dioxide would result in more reliable results.