

## The Relationships between Carbon Dioxide (CO<sub>2</sub>) Emissions, Energy Consumption and GDP for Iran: Time Series Analysis, 1980-2010

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**Abstract :** The relationships between environmental quality, energy use and economic output have created growing attention over the past decades among researchers and policy makers. Focusing on the empirical aspects of the role of carbon dioxide (CO<sub>2</sub>) emissions and energy use in affecting the economic output, this paper is an effort to fulfill the gap in a comprehensive case study at a country level using modern econometric techniques. To achieve the goal, this country-specific study examines the short-run and long-run relationships among energy consumption (using disaggregated energy sources: Crude oil, coal, natural gas, and electricity), CO<sub>2</sub> emissions and gross domestic product (GDP) for Iran using time series analysis from the year 1980-2010. To investigate the relationships between the variables, this paper employs the Augmented Dickey-Fuller (ADF) test for stationarity, Johansen's maximum likelihood method for cointegration and a Vector Error Correction Model (VECM) for both short- and long-run causality among the research variables for the sample. All the variables in this study show very strong significant effects on GDP in the country for the long term. The long-run equilibrium in VECM suggests that all energy consumption variables in this study have significant impacts on GDP in the long term. The consumption of petroleum products and the direct combustion of crude oil and natural gas decrease GDP, while the coal and electricity use enhanced the GDP between 1980-2010 in Iran. In the short term, only electricity use enhances the GDP as well as its long-run effects. All variables of this study, except the CO<sub>2</sub> emissions, show significant effects on the GDP in the country for the long term. The long-run equilibrium in VECM suggests that the consumption of petroleum products and the direct combustion of crude oil and natural gas use have positive impacts on the GDP while the consumptions of electricity and coal have adverse impacts on the GDP in the long term. In the short run, electricity use enhances the GDP over period of 1980-2010 in Iran. Overall, the results partly support arguments that there are relationships between energy use and economic output, but the associations can be differed by the sources of energy in the case of Iran over period of 1980-2010. However, there is no significant relationship between the CO<sub>2</sub> emissions and the GDP and between the CO<sub>2</sub> emissions and the energy use both in the short term and long term.

**Keywords :** CO<sub>2</sub> emissions, energy consumption, GDP, Iran, time series analysis

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