

## The Relationships between Carbon Dioxide (CO<sub>2</sub>) Emissions, Energy Consumption, and GDP for Turkey: 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 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, electricity), carbon dioxide (CO<sub>2</sub>) emissions and gross domestic product (GDP) for Turkey using time series analysis from the year 1980-2010. To investigate the relationships between the variables, this paper employs the Phillips-Perron (PP) test for stationarity, Johansen 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 the VECM suggests negative long-run causalities from consumption of petroleum products and the direct combustion of crude oil, coal and natural gas to GDP. Conversely, positive impacts of CO<sub>2</sub> emissions and electricity consumption on GDP are found to be significant in Turkey during the period. There exists a short-run bidirectional relationship between electricity consumption and natural gas consumption. There exists a positive unidirectional causality running from electricity consumption to natural gas consumption, while there exists a negative unidirectional causality running from natural gas consumption to electricity consumption. Moreover, GDP has a negative effect on electricity consumption in Turkey in the short run. Overall, the results support arguments that there are relationships among environmental quality, energy use and economic output but the associations can to be differed by the sources of energy in the case of Turkey over of period 1980-2010.

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

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