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The Environmental Kuznets Curve for Green House Gases- Causality structures

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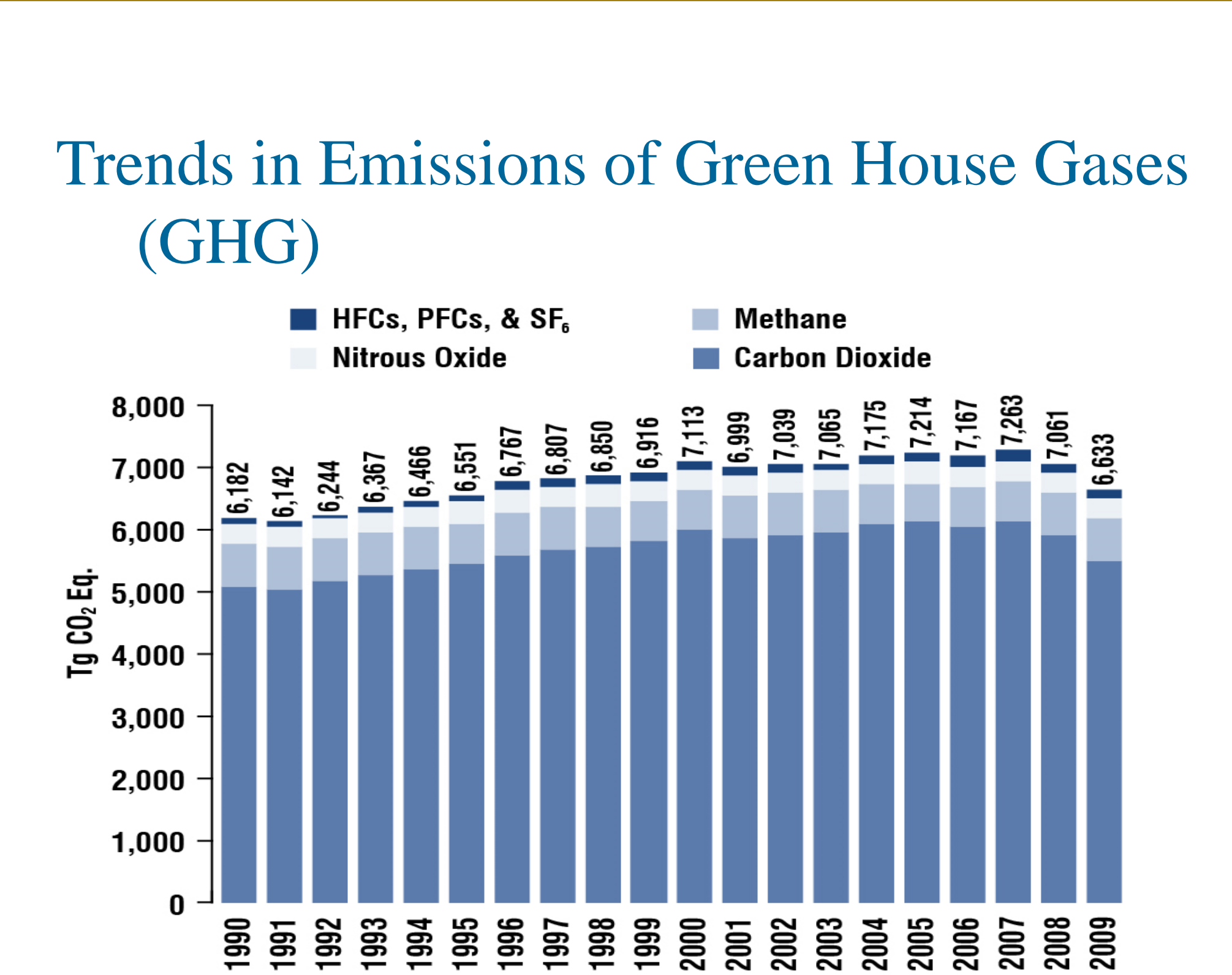
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Abstract
The inverted U shaped hypothesis between various indicators of environmental degradation and income per capita otherwise known as the Environmental Kuznets Curve (EKC) has gained immense popularity over the past twenty years. Cross-country panel data methods are generally adopted to study the relationship amongst the variables of interest with a possible drawback being that a certain causality structure is presumed to be true. The Directed Acyclical Graph technique reveals the underlying causal structure amongst variables. This could aid in the selection of a better regression model

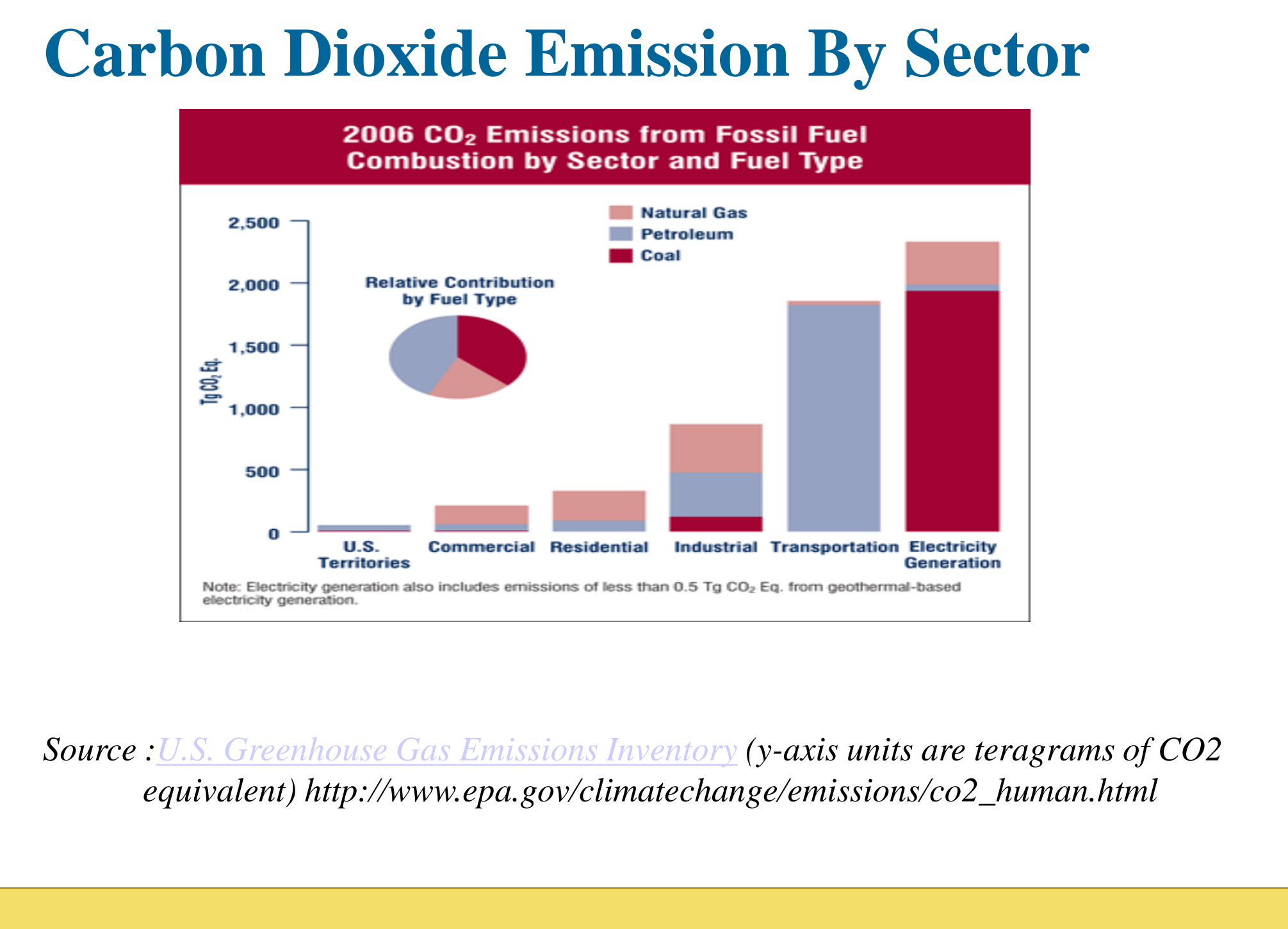
Objective
➤The aim of this analysis is to explore the nature of causality between variables that measure of environmental quality or standards and income using fairly recent data in OECD countries.
➤this analysis will focus on the causality relationships between Green House gases, especially carbon monoxide which will broken up into emissions by the different sectors.

Directed Acyclical Graphs (DAGs)
➤Causal flows between the variables are investigated using Directed Acyclical Graphs (DAGs). The principal idea of DAGs is to determine the causal relationship among a set of variables then portray it using an arrow graph or picture.
➤In the graphs, given two variables X and Y, there are five possibilities: no causal relationship when edges are removed; Y causes X ($Y \rightarrow X$); X causes Y ($X \rightarrow Y$); Y and X simultaneously cause each other ($Y \leftrightarrow X$); and the causal flow cannot be directed by information contained in the sample ($X \dashv\dashv Y$) (Wang and Bessler, 2006).

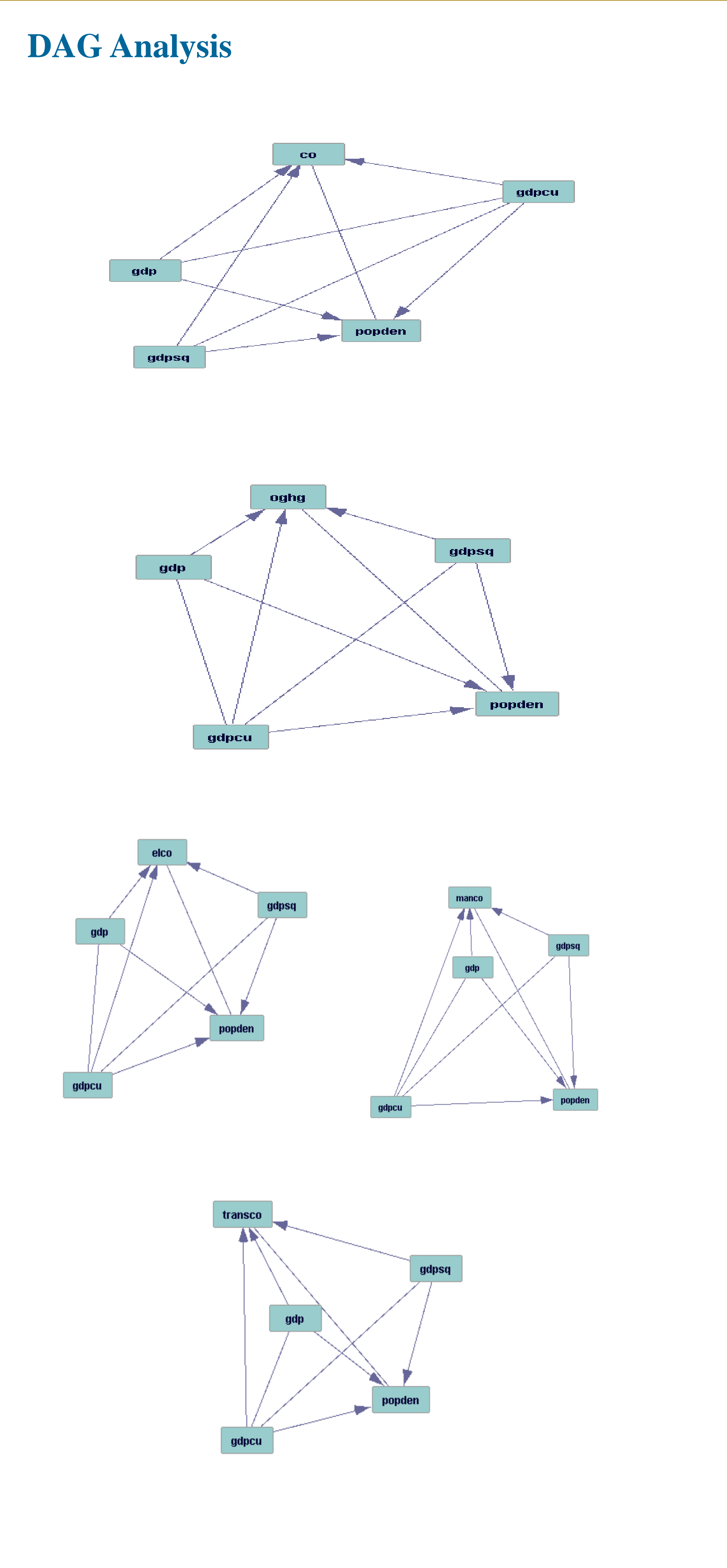
Data
Annual Data for Certain OCED countries from 1961-2009 was used. Data on both the economic and demographic indicators, as well as indicators on economic degradation were obtained from the World Bank development indicator series. The Variables included are Population density, Gross Domestic Product (GDP) per capita, GDP per capita squared and GDP per capita cubed. The variables included to measure environmental degradation due to Green House Gases include emissions of carbon monoxide and other Green Houses Gases. Emissions of Carbon Monoxide by different sector are also considered separately.



Source :Reference: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009, USEPA #430-R-11-005 <http://www.epa.gov/climatechange/emissions/usginventory.html>



Source :U.S. Greenhouse Gas Emissions Inventory (y-axis units are teragrams of CO₂ equivalent) http://www.epa.gov/climatechange/emissions/co2_human.html



The variables
Co- Carbon Dioxide emissions
Oghg –Other Green House Gases
Elco-Carbon Dioxide emissions from electricity
Manco- Carbon Dioxide emissions from manufacturing
Tranco- Carbon Dioxide emissions from transport
Gdp- Per capita Gross Domestic Product
Gdpsq- Per capita gross Domestic Product squared
Gdpcu-Per capita gross Domestic Product Cubed
Popden- Population density

Results and Conclusions from panel data estimation
➤The results of the DAGS indicate that there appears to be a lot of similarity in the causality structures of the Carbon dioxide and other Green House Gases
➤ This causal structure does not change even when the carbon dioxide emissions is broken up by sector.
➤ All the income variables affect the emission of Green House Gases (GHGS). Except for population density.
➤ The relationship between population density and emissions is not clear from the information given. This could be a potential source of endogeneity
➤There appears to be considerable multicollinearity between population density and the income variables. Also between Per capita GDP and GDP cubed.

References
Reference: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009, USEPA #430-R-11-005 <http://www.epa.gov/climatechange/emissions/usginventory.html>
Source :U.S. Greenhouse Gas Emissions Inventory (y-axis units are teragrams of CO₂ equivalent) http://www.epa.gov/climatechange/emissions/co2_human.html
Wang, Z. and D.A. Bessler. 2006. "Price and Quantity Endogeneity in Demand Analysis: Evidence from Directed Acyclic Graphs," *Agricultural Economics* 34:87-95.