IMPACT OF OIL PRICE FLUCTUATIONS ON THE CARBON DIOXIDE EMISSIONS MODELLING: A CASE WITH HIGH-INCOME ECONOMIES

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Per capita carbon dioxide emissions were found to fall with rising income at per capita income levels reached in rich nations during the 1970s. Such trend was seen by some as the proof for the existence of an inverse U-shaped curve, known as the Environmental Kuznets Curve (EKC), in which the pollution first rises and then falls as income rises further. Slowing down of the rate of increase of per capita CO_2 emissions in rich nations during the 1970s, which got interpreted as the proof for the existence of an EKC pattern, was in fact caused not by the increasing income, but by the 'oil shocks of the 70's. This study uses a novel approach to model the impact of oil price fluctuations on the per capita emissions of a country. Four crucial high-income economies, namely United States, Japan, France and Australia, each one of them having a per capita emissions history that is radically different from the other but representative of a group of high-income economies, are chosen for this study.

The per capita variables, CO_2 emissions and income, used in this study are not the natural logarithms of the per capita variables used in most of the other emissions modelling studies. They are variables normalized in such a manner that they both span the range of 0 to 1. The regression models developed using these normalized variables has the advantage of not having to estimate the constant term for countries for which both the variables begin from zero. The basic linear model of the normalized per capita variables is further enriched by introducing both intercept and slope dummy variables.

In choosing the dummy variables, the years are grouped into 7 sets. This year grouping is guided solely by the crude oil price fluctuations. This approach is shown to have the capacity to model the per capita emissions, however complex is its dependence upon the per capita income of the country considered, with a very high value of R^2. Anderson-Darling, Ryan-Joiner, Kolmogorov-Smirnov tests confirmed that the residuals are normally distributed. F-test and Levene's test confirmed the constancy of the variance. The Durbin-Watson statistic of this model is about 2 for the cases studied, representing the absence of autocorrelation. It appears that the model developed in this study has the in-built capacity to remove the autocorrelation otherwise strongly present in the per capita linear model.

The statistical significance of the per capita emissions models developed in this study, which include dummy variables accounting for oil price fluctuations, proves that the relationship between the per capita emissions and per capita income is extremely sensitive to the crude oil prices. It is therefore evident that the prime factor that causes dramatic changes in the relationship between the emissions and the income of a country is the oil price fluctuations, at least for the case of high-income economies.