THE ROLE OF NATURAL GAS IN MITIGATING GREENHOUSE GAS EMISSIONS: THE ENVIRONMENTAL KUZNETS CURVE HYPOTHESIS FOR THE SELECTED GAS PRODUCING COUNTRIES

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Overview

Since global warming has become a serious threat and GHG emissions are one of the main causes of it, analyzing the interactions between the variables related to climate change has gained importance. This study investigates the nexus of per capita CO2 emissions, per capita real GDP or income, per capita natural gas consumption, urban population, and trade openness by examining the validity of the Environmental Kuznets Curve (EKC) hypothesis for a panel of selected gas producing countries over the period 1990–2020. To this data, the panel time-series toolbox is applied: slope homogeneity test, Granger causality in panels, stationarity tests, cointegration tests. A particular focus is on procedures that allow for cross-sectional dependence. Admitting slope heterogeneity, the estimators provide mixed results. The findings, however, do provide evidence in favor of the EKC hypothesis in at least some of our sample countries.

Methods

We examine the relationship between CO2 emissions per capita as a dependent variable, GDP per capita (income), natural gas consumption per capita, urban population (urbanization), and trade openness as the explanatory variables.

In this study, the following linear-logarithmic model is employed to investigate the validity of the EKC hypothesis and determinants of carbon emissions for a sample of 12 major gas producing countries:

$$CO2_{it} = \propto_0 + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_3 GC_{it} + \beta_4 U_{it} + \beta_5 TO_{it} + \varepsilon_{it}$$

Similar to Atasoy, B. S. (2017), the estimators that are used are the Mean Group Estimator (MG) of Pesaran and Smith, the Augmented Mean Group Estimator (AMG) of Eberhardt and Teal, and the Common Correlated Effects Mean Group (CCEMG) Estimator of Pesaran. The Pooled Mean Group (PMG) estimator of Pesaran et al. is also used to examine the short-run and long-run relationship between income per capita and carbon emissions.

Results

Among four full panel estimates of the long-run relationship, the only models that have statistically significant variables are the FMOLS and DOLS. With FMOLS the estimated effect of income on CO2 emissions is negative and statistically significant at a 1% level. Nonetheless, the estimated coefficient on the quadratic income term is positive, providing the presence of the U-shaped EKC hypothesis. On the other hand, the DOLS model shows that the coefficient on the income and squared income term supports the evidence of the EKC hypothesis. However, in this model no significant relationship is found between urbanization and CO2 emissions.

The CCEMG and AMG models neither have significant variables, nor do they support the EKC hypothesis. Inevitably we accept the fact that the evidence does not support the EKC hypothesis for the full panel of 12 major gas producing countries.

The panel causality test reveals a strong bidirectional causal link between CO2 emissions and trade openness, CO2 emissions and income, income and urbanization, as well as urbanization and trade openness. The results also indicate unidirectional panel causality running from CO2 emissions toward urbanization and natural gas consumption, from income to natural gas consumption and trade openness, and from urbanization to natural gas consumption.

Conclusions

Using robust methods, this study aims to provide consistent and unbiased answers to its main research questions: the validity of the EKC hypothesis for the sample of 12 major gas producing countries during 1990-2020, and the role of natural gas consumption in mitigating CO2 emissions in these countries.

Considering cross-sectional dependence, the slope homogeneity test, as well as the Granger causality framework, including stationarity tests, cointegration test, and causality tests, are employed allowing for cross-sectional dependence. Moreover, the D-H panel causality test is used for causality analysis.

Among four full panel estimates (i.e., panel FMOLS, DOLS, CCEMG, and AMG estimators), the only procedures that yield statistically significant variables are FMOLS and DOLS. However, in FMOLS the estimated coefficient on the quadratic income term is positive, failing to support the U-shaped EKC hypothesis. The results of DOLS support the EKC hypothesis. No significant relationship is found between urbanization and CO2 emissions. The CCEMG and AMG models neither have significant variables nor support the EKC hypothesis. Therefore, we conclude that the evidence does not favor the EKC hypothesis for the full panel.

Regarding the country-specific results, four estimators provided mixed results. Accordingly, the FMOLS estimator shows that the EKC does not hold in sample countries, while the individual DOLS estimator shows that the EKC holds in 6 out of 12 countries. The CCEMG and AMG estimators specify that the EKC hypothesis holds in 3 and 4 countries, respectively. Therefore, we conclude that the EKC hypothesis is valid in 4 countries, namely Azerbaijan, Egypt, Turkmenistan, and Malaysia. Accordingly, environmental degradation increases as income levels increase with economic development. Beyond a certain level of income per capita, however, the trend reverses. Therefore, economic growth leads to environmental improvement at high-income levels in the above-mentioned countries.

The findings of this study also highlight important policy implications.

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