

The effect of energy usage on GDP and environment

In the era of energy-based economies, the pursuit of economic growth through enhancing productivity of goods and services means that the demand for energy also increases. The study by Anwar et al.(2020) tries to capture the relationship between energy consumption, carbon emission by sources and income for ASEAN countries. Since most of ASEAN members are the emerging economies, where competitiveness is taking off and every economy is trying to climb the production ranking, they neglect to safely manage the CO₂ emission and fail to prevent natural resources depletion. Most emerging economies are struggling with issues of unemployment, low industrialization, inflation and poverty, the effort to develop the economy and increasing GDP per capita imply that the energy consumption will be higher. However, ASEAN still heavily relies on coal, natural gas, and oil as nonrenewable energy due to the fact that they are natural resources abundant. As a result, escalating productivity gives rise to higher natural resource depletion, environmental degradation, and global warming, which could ,in return, interfere with the development of economies in the long run. Therefore, the study aims to clarify the heterogeneity that associates between energy-emissions under the framework of Environmental Kuznets's Curve (EKC). EKC hypothesizes that when the economy is growing at the initial phase, the environment is starting to degrade due to exploitation of natural resources, contamination among ecosystems, and pollution. However, as the economy developed, the quality of the environment started to improve.

When it comes to methodology of the study, it is the first attempt to apply "Method of Moments Quantile Regression" (MMQR) in the area of energy consumption towards ASEAN economy. With MMQR, researchers are able to identify various conditional quantiles distribution of heterogeneous energy-emissions relationships, while conventional mean regression is limited

to identify this effect. Acquiring the data from World Development Indicators, the variables in MMQR model consist of CO₂ emission (CO₂), gross domestic product (GDP), and square of gross domestic product (GDP²). The model also includes renewable energy consumption (REC) such as consumption of hydroelectricity, nuclear, wind and solar whereas consumption of oil, natural gas, and coal are denoted as non-renewable energy consumption (NEC). The outcomes of MMQR shows that energy usage is directly correlated with CO₂ emission, as a 1% growth in NEC, upsurges CO₂ emissions by 0.29%. Furthermore, the results confirm that GDP and CO₂ emission have a positive relationship, the slow rising rate of income at the early stage of economic development leads to small CO₂ emission while the CO₂ emission starts to upsurge in the late phase of economic development where income also rises. However, GDP² has a negative impact on pollution. Thus, outcomes validate the occurrence of the EKC hypothesis, when the economy reaches a certain point of growth, it moves toward environmentally friendly economic development. Lastly, as REC increases, CO₂ emissions decrease.

The strength of this study is that they formulate precise and detailed models to capture the effect of energy consumption among ASEAN economies. Also, the KCE hypothesis helps understand that gaining higher income comes at the expense of natural resources depletion but the effect can be mitigated through environmentally friendly economic development, specifically, adoption of renewable energy. However, the limitation of this study is some of the results are statistically insignificant, for example, 60th to 90th quantile of REC and CO₂ emission. To develop an effective policy, the further research should focus on the unique characteristics of each ASEAN member on energy consumption to create a tailored-made policy and a successful outcome.

Reference

Ahsan Anwar, Muhammad Siddique, Eyup Dogan, Arshian Sharif, The moderating role of renewable and non-renewable energy in environment-income nexus for ASEAN countries: Evidence from Method of Moments Quantile Regression, *Renewable Energy*, Volume 164, 2021, Pages 956-967, ISSN 0960-1481, <https://doi.org/10.1016/j.renene.2020.09.128>.
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