The energy-growth nexus in 3 Latin American Countries within the framework of the EKC: in case of Argentina, Brazil, and Chile

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Overview

In this paper, we examine the effects of economic growth and different types of energy consumption on environmental quality in terms of carbon dioxide emissions (CO2) in the framework of the Environmental Kuznets Curve (EKC) in three Latin American countries, namely Argentina, Brazil, and Chile from 1975 to 2018. Specifically, four different types of energy sources were considered (oil, natural gas, hydroelectricity, and renewable energy) in addition to agricultural lands and trade openness as our control variables.

Methods

Before applying ARDL technique, we studied the cointegration relationship among the variables by using cointegration bounds test, then we examined the validity of the EKC hypothesis and the impacts of the variables in the short and long run through the Autoregressive Distributed lag (ARDL) in the form of Error Correction Mechanism (ECM). Lastly, after ARDL-ECM estimation, we carried out Toda-Yamamoto Granger causality test to identify the direction of causality between the variables.

Results

Our estimation results confirm that there is a cointegration relationship between CO2 emissions and explanatory variables we selected, as in all cases, F-statistics of cointegration bounds test were above the upper bound critical value at 1% significance level. In ARDL-ECM estimation, we only could verify the EKC hypothesis (inverted U-shaped curve between income growth and CO_2 emissions) in Argentina in the long run while in Brazil and Chile, the opposite patterns (U-shaped curves) were observed in the long run. Moreover, we also found the evidence of a long-run equilibrium relationship among the variables in ARDL-ECM estimation since Error Correction Term had a negative sign and statistically significant at 1% level in all three models for each country we analyzed, in this way, supporting the results of the previous cointegration bounds test. Furthermore, we could observe that fossil fuel energy, especially oil consumption, had a strong negative impact on environmental quality as it leads to increasing CO2 emissions both in the short and the long term in all three countries. As for natural gas, we found that it contributes to increasing CO2 emissions but to a significantly lesser extent than oil both in the short and the long term in Argentina, Brazil, and Chile. In relation to hydroelectricity, it had a significant negative impact on CO2 emissions only in Brazil and Chile. Finally, renewable energy consumption had a statistically significant negative impact on CO_2 emissions only in Chile while in Brazil, it had a positive impact in the long run. Regarding Toda-Yamamoto Granger Causality test, it tells us that oil consumption can be drastically reduced and replaced by other clean energy sources which emit

significantly less amounts of CO_2 when economic growth takes place in Argentina, Brazil, and Chile since the conservation hypothesis tells us that the reduction in oil consumption does not hinder economic growth in these countries. Furthermore, energy consumption from natural gas, hydropower, and renewables leads to economic growth in Argentina and Chile (these 3 types of energy all granger caused economic growth in Chile while only hydropower did in case of Argentina), thus promote their consumption might help to boost economic growth along with achieving environmental protection goal in Argentina and Chile.

Conclusions

The findings in this paper tell us that renewable energy might have a great potential to reduce CO_2 emissions in the future but this advantage is not fully exploited since we found only a significant negative impact on CO_2 emissions in Chile. Our findings also suggest that other less carbon-intensive energy sources such as natural gas and hydropower combined with renewable energy might produce synergetic effect and they can contribute to enhancing energy security (by diversifying energy mix and reducing the risk of intermittency of renewable energy) and achieving successful low-carbon energy transition in Argentina,Brazil, and Chile.

References

Ahmed, M. & Shimada, K. (2019). The Effect of Renewable Energy Consumption on Sustainable Economic Development: Evidence from Emerging and Developing Economies. *Energies (Basel)*, 12(15): 2954. doi: 10.3390/en12152954.

Akram, R., Chen, F., Khalid, F., Ye, Z. & Majeed, M.T. (2020). Heterogeneous effects of energy efficiency and renewable energy on carbon emissions: Evidence from developing countries. *Journal of Cleaner Production*, 247: 119122. doi: 10.1016/j.jclepro.2019.119122.

Albulescu, C.T., Tiwari, A.K., Yoon, S. & Kang, S.H. (2019). FDI, income, and environmental pollution in Latin America: Replication and extension using panel quantiles regression analysis. *Energy Economics*, 84: 104504. doi: 10.1016/j.eneco.2019.104504.

Ali, W., Abdullah, A. and Azam, M., 2017. Re-visiting the environmental Kuznets curve hypothesis for Malaysia: fresh evidence from ARDL bounds testing approach. Renewable and sustainable energy reviews, 77, pp.990-1000.

Anser, M.K., Hanif, I., Alharthi, M. & Chaudhry, I.S. (2020). Impact of fossil fuels, renewable energy consumption and industrial growth on carbon emissions in Latin American and Caribbean economies. *Atmósfera*, 33(3): 201. doi: 10.20937/ATM.52732.

Bai, J., Choi, S.H. & Liao, Y. (2021). Feasible generalized least squares for panel data with cross-sectional and serial correlations. *Empirical Economics*, 60(1): 309-326.