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Investigating the Relationship between CO_2 Emissions, Renewable Energy Generation and Forest Coverage Using the ARDL Approach

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Abstract

Renewable energy, combined with increased forest coverage, is increasingly identified as a key solution to address environmental pollution via CO_2 emissions, and the energy crisis in Sri Lanka. Therefore, this study aims to reveal the relationships of CO_2 emissions (Mt CO_2-eq), renewable energy generation (GWh) and forest coverage in Sri Lanka. Data on annual CO_2 emissions, renewable energy generation and forest area as a percentage of land area were obtained from the World Bank comprehensive data, Climate Watch data and the Ceylon Electricity Board. The period under consideration was from 1990 to 2021. The Auto Regressive Distributed Lag (ARDL) approach to cointegration is employed for the analysis of data. Error correction model and Granger Causality test are also applied subsequently. The relationships between the variables were estimated using the ARDL (2,2,1) model. According to the results of the ARDL Bounds testing, CO_2 emissions, renewable energy generation and forest area are in a long-run equilibrium relationship. The model was found to be stable and satisfies all the requirements related to diagnostic tests, including tests for serial correlation, normality, and heteroscedasticity. The lagged CO_2 emissions significantly contribute to current CO_2 levels while the hydroelectric power production and the lagged values of forest coverage exhibit a notable impact on CO_2 emissions, emphasizing their importance in determining the atmospheric CO_2 concentration in the long run. In the short run, there is a significant impact from hydroelectric power generation. The coefficient of the Error Correction Term (ECT) is negative and statistically significant, revealing that approximately 9.26% of the disequilibrium in CO_2 emissions converges back to the long-term equilibrium within a year. The Granger causality test results reveal that unidirectional causality exists from renewable energy generation and forest cover towards CO_2 emissions in Sri Lanka. These insights provide valuable guidance for policymakers in developing strategies that expand renewable energy generation and lead to forestry initiatives to promote environmental sustainability in Sri Lanka.

Keywords: *CO_2 emissions, Renewable energy generation, Forest coverage, ARDL methodology, Error correction model*

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