

Exploring the impact of environment-related technologies, environmental taxes, renewable electricity generation and economic growth on environmental quality: evidence from European countries using panel ARDL approach

International
Journal of Energy
Sector
Management

Received 12 March 2025
Revised 24 November 2025
Accepted 14 December 2025

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Abstract

Purpose – The primary objective of this study is to investigate how economic growth, environmental taxes, renewable electricity production and patents on environmental technologies influence environmental quality, using the ecological footprint as an indicator. By examining short- and long-term effects, this study aims to determine whether environmental policies and technological innovations contribute to sustainability. Additionally, the study tests the validity of the environmental Kuznets curve (EKC) hypothesis in European countries. Through causality analysis, it also seeks to uncover the directional relationships among these key variables, providing valuable insights for policymakers aiming to balance economic growth with environmental sustainability.

Design/methodology/approach – This study uses the pooled mean group autoregressive distributed lag (PARDL) method to analyze the short- and long-term effects of economic growth, environmental taxes, renewable electricity production and patents on environmental technologies on the ecological footprint in European countries from 1994 to 2019. Additionally, the Dumitrescu and Hurlin (2012) causality test is applied to examine causal relationships among the variables.

Findings – The results indicate that economic growth negatively affects environmental quality in both the short- and long term, confirming the validity of the EKC hypothesis. Patents on environmental technologies do not show significant short-term effects but contribute positively to environmental quality in the long term. Similarly, renewable electricity production improves environmental quality in the long term, while environmental taxes are found to be ineffective in the short term but beneficial in the long term. Causality analysis reveals one-way causal relationships from economic growth, renewable electricity production, patents on environmental technologies and environmental taxes to the ecological footprint, highlighting the importance of long-term sustainability policies.

Originality/value – This study contributes to the literature by using a comprehensive data set to analyze the impact of economic and environmental factors on ecological footprint in European countries over a 25-year period. By using the PARDL method, it provides nuanced insights into both short- and long-term effects, unlike many studies that focus only on one timeframe. The inclusion of patents on environmental



International Journal of Energy
Sector Management
© Emerald Publishing Limited
1750-6220
DOI 10.1108/IJESM-03-2025-007

IJESM

technologies as an independent variable adds originality, as their role in environmental sustainability is relatively underexplored. Additionally, the study highlights the effectiveness of environmental policies, reinforcing the importance of technological innovation and regulatory measures in achieving long-term environmental quality.

Keywords Economic growth, Environmental taxes, Renewable electricity production, Patents on environmental technologies, Ecological footprint

Paper type Research paper

Introduction

Increasing concerns about climate change have placed the Sustainable Development Goals (SDGs) at the forefront of global policy priorities. Adopted by the United Nations in 2015, the