14th International Conference on Sustainable Development, 9-10 September 2026, Rome, Italy
https://ecsdev.org

Circular Economy, Economic Performance and Import Dependency: Panel Evidence from EU27

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Introduction

The circular economy (CE) is central to the EU's Green Deal and, since REPowerEU (2022), increasingly framed as a resilience strategy against material and energy shocks. Yet empFigures 1 and 2 display 95% confidence intervals for each predictor's coefficient. An interval crossing the dashed zero line indicates a statistically insignificant effect. In Model 1, only EIG's interval lies entirely above zero. In Model 2, EIG is again clearly significant, while IC's interval just touches zero from below — consistent with its marginal significance (p = 0.057). CMU and RES cross zero comfortably in both models.irical evidence linking circularity to economic resilience remains scarce. This study tests whether CE practices contribute to resilience across EU27 (2010–2022) via two channels: economic performance and energy import dependency.

Aim:

Test whether circular material use contributes to economic resilience in EU27, via GDP growth and energy import dependency

Method:

Fixed effects (FE) panel regression, country fixed effects

Data:

EU27, 2010–2022, balanced panel, 351 observations

Variables:

- Dependent: GDP_R (Model 1), Energy import dependency (EID) (Model 2).
- Predictor: Circular Matarial Use (CMU).
- Controls: Renewables (RES), Innovation capacity (IC), Economic globalization (EIG)

Figures 1 and 2 display 95% confidence intervals for each predictor's coefficient. Confidence intervals crossing the dashed zero line denote statistical insignificance. Only EIG's interval lies clearly out of zero in both models; IC's interval in Model 1 just touches zero, reflecting its marginal (p = 0.057) significance.

Acknowledgement: VEGA 1/0636/25, GAMA 2025-1, KEGA 032-4/2026, KEGA 052PU-4/2026

Abstract:

This study investigates whether circular economy (CE) practices contribute to economic resilience across EU27 member states (2010–2022), assessed through two complementary dimensions: economic performance and energy import dependency. Using fixed effects panel regression with country fixed effects, we test the effects of circular material use rate (CMU), renewable energy share (RES), environmental patents per capita (IC), and economic globalisation (EIG). CMU shows no statistically significant within-country effect on either outcome, suggesting that circularity's macroeconomic returns accumulate through cross-country structural differences over long time horizons rather than short-run within-country change. Economic globalisation (EIG) is the sole robust predictor in both models; innovation capacity (IC) shows a tentative negative association with import dependency.

Key Words: Circular Economy, Economic Resilience, Energy Import Dependency, EU27, Panel Data Analysis, Fixed Effects

Main findings

- **Circularity alone doesn't yet show up in the numbers.** Countries that recycle more materials don't show faster GDP growth or lower energy import dependence once we account for each country's own structural differences.
- **Economic openness is the strongest driver** — more globally integrated economies grow faster, but they also import more energy (both effects significant at the 1% level).
- **Green innovation shows a promising, if not yet conclusive, signal** — countries with more environmental patents tend to import less energy.
- **Renewables didn't show an effect once other factors were controlled for** — its strong link to lower import dependence disappears once country differences are accounted for, pointing to a structural rather than short-term relationship.

Concluding remarks

- CE's macroeconomic returns likely accrue over decades, not within a 13-year within-country window — longer-term evaluation frameworks needed
- Globalisation drives both growth and import exposure — a structural tension EU policy must address
- CE strategies need complementary domestic policies: renewable deployment, storage, material self-sufficiency
- Country-group analyses (importers vs. exporters, old vs. new member states) may yield richer insight than aggregate EU estimates.

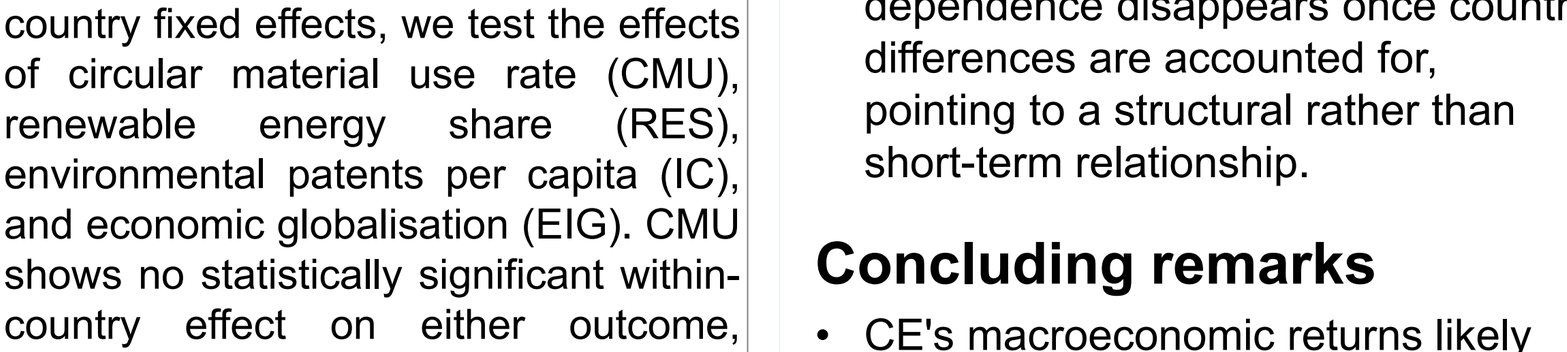

Figure 1: Fixed Effects Regression Coefficients — Model 1 (Real GDP Growth)

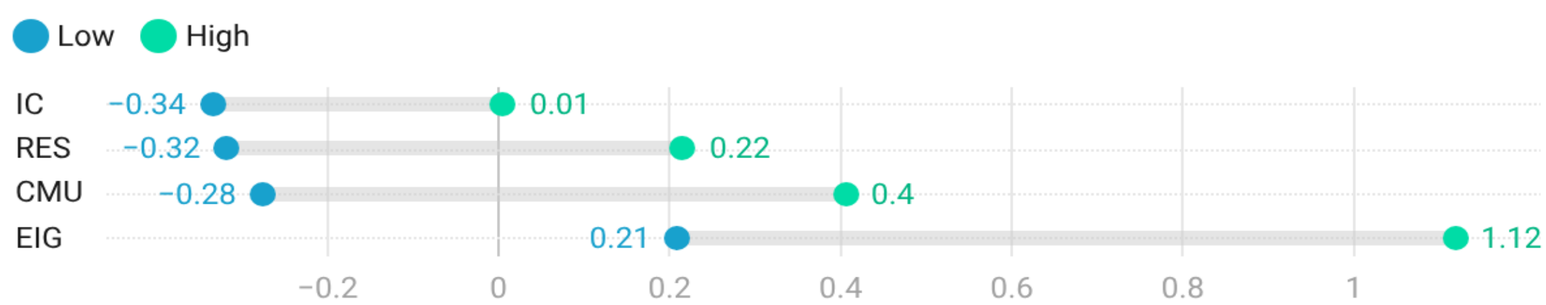

Figure 2: Fixed Effects Regression Coefficients — Model 2 (Energy Import Dependency).