Has energy transition impacted the income elasticity of electricity demand? A Portuguese sectoral analysis

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Overview

This paper examines the evolving relationship between income and electricity demand in Portugal, focusing on the effects of energy transition and economic changes. Using a time-varying panel econometric model, the study analyzes regional data across different sectors from 1995 to 2022.

Key findings indicate a declining income elasticity of electricity demand, suggesting a decoupling from economic growth (mainly on the industry and services sector. For agriculture there is time-invariant decoupling). Factors influencing this trend include energy efficiency as well as self-consumption. The research highlights the implications for energy policy and planning (on the planning and development of the power grid) and provides valuable insights for policymakers regarding future electricity consumption trends in Portugal.

Methods

The paper employs a time-varying panel econometric model (TVP) to analyze the relationship between income and electricity demand in Portugal, using regional data disaggregated by economic sectors from 1995 to 2022. This methodology allows for the assessment of changes in income elasticity over time, capturing the dynamic nature of electricity consumption in response to economic fluctuations. The analysis incorporates various factors, including weather conditions, electricity prices and socio-economic variables, to provide a comprehensive understanding of the drivers behind electricity demand across different sectors. Robustness checks are also conducted to validate the findings and ensure the reliability of the results.

Results

The results of the study reveal a declining income elasticity of electricity demand in Portugal, indicating a gradual decoupling from economic growth. Results suggest a declining, but positive, income elasticity of aggregated electricity demand and in the residential, services and industry sectors. For agriculture there is time invariant decoupling. Robustness checks indicate that results are robust to several modifications (kernel function, bandwidth, etc).The findings suggest that factors such as energy efficiency policies, self-consumption and structural economics changes are influencing this shift, highlighting the complexities of electricity demand in the context of energy transition.

Conclusions

The paper concludes that the relationship between income and electricity demand in Portugal has evolved significantly, with a notable decline in income elasticity suggesting a decoupling from economic growth. This trend is attributed to various factors, including energy efficiency policies, self-consumption and structural economics changes that are outpacing electrification impact on income elasticity. The findings underscore the importance of considering sectoral differences in energy policy formulation and planning (for example when approving development of network in investment plans or when using demand forecasts to set tariffs), as well as the need for further research to understand the implications of these dynamics for future electricity demand. Overall, the paper provides valuable insights for policymakers aiming to navigate the challenges of energy transition and ensure sustainable electricity consumption.

References

References are fully provided with the submitted paper.