

THE BUCHAREST UNIVERSITY OF ECONOMICS
FACULTY OF CYBERNETICS, STATISTICS AND ECONOMIC INFORMATICS
DOCTORAL SCHOOL: ECONOMIC CYBERNETICS AND STATISTICS

HABILITATION THESIS

**INVESTIGATING QUANTITATIVE APPROACHES ACROSS DIVERSE SOCIO-
ECONOMIC CONTEXTS**

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English Summary

This habilitation thesis presents a selection of the scientific, teaching and professional achievements obtained in recent years and outlines the main directions for further development of my academic career.

In the first part, the thesis brings together a series of empirical studies that investigate, through advanced quantitative methods, the interactions between the economy, energy systems, the environment, and decision-making processes under uncertainty.

The first chapter examines the determinants of deforestation in Romania using the ARDL model and various cointegration tests, highlighting the impact of renewable energy consumption, economic growth, urbanization and foreign direct investments on forest area dynamics. This analysis is extended through a comparative analysis of Finland. A complementary research direction focuses on energy system transformations in Southeast Europe and the Nordic countries, analyzing causality and cointegration relationships between macroeconomic variables, urbanization, CO₂ emissions and electricity consumption from renewable sources using panel econometric techniques.

The second chapter integrates fuzzy multi-criteria decision-making methods with ARDL model to evaluate circular economy strategies in Romania. The relationship between circular economy and economic development is further examined at the European level using panel data analysis. Interdependencies between digitalization, competitiveness, and economic growth are investigated through canonical correspondence analysis, highlighting the role of human capital and innovation. The chapter also includes applications based on artificial neural networks and principal component analysis to assess digitalization and economic performance in the European Union. In addition, the impact of social media on consumer behavior is analyzed using sentiment analysis techniques and classification methods, including neural networks and binary logistic regression.

The third chapter is dedicated to modeling the interactions between energy, the environment, and the economy in the context of emerging economies (the BRIC countries) and transition economies (the Balkan region). I explored how economic growth, energy structure, demographic dynamics and investments influence CO₂ emissions. The first part of the chapter investigates the BRIC countries using advanced panel models (FMOLS, DOLS, and panel ARDL) to examine the relationship between economic growth, population, renewable energy consumption and carbon emissions. The second part focuses on the Balkan countries, applying quantile regression and panel causality tests to identify heterogeneity in the economic and energy-related effects on CO₂ emissions. The results highlight significant differences between the two groups of countries and emphasize the role of changes in energy structure and sustainable urbanization in reducing environmental impacts.

In the second part, the thesis outlines my academic and professional trajectory, teaching and research activities, national and international collaborations, and future development directions. These directions are oriented towards student education, their involvement in research activities, and the continuous development of interdisciplinary competences required to address economic and environmental challenges.