ENGLISH SUMMARY

This doctoral thesis investigates the functioning of the Romanian electricity market, with a particular focus on the price formation mechanisms within the Day-Ahead Market (Piața pentru Ziua Următoare – PZU). The research employs both theoretical foundations and advanced statistical methodologies to explore this domain.

The thesis is structured in two parts and comprises four research chapters. The first part, corresponding to Chapter One, offers a comprehensive analysis of the electricity market, highlighting the liberalization processes, the roles of key stakeholders, and the impact of various structural factors on price dynamics. This section also includes a systematic review of existing literature, identifying the main directions of scientific inquiry in the field.

The second part provides an empirical examination of how different structural factors influence spot market prices, developed across the next three chapters. Chapter Two explores the causal relationship between the price of carbon emission certificates and electricity prices, demonstrating—through the application of the Granger causality test—the significant influence of environmental costs on PZU pricing. Chapter Three investigates the price elasticity of electricity demand, confirming the rigid nature of consumption and suggesting the limited effectiveness of purely price-based mechanisms for managing demand. The final research chapter compares the forecasting performance of traditional models (SARIMA) with machine learning algorithms (N-Beats) using two distinct datasets: national electricity consumption and the consumption of a specific customer portfolio. These two datasets were selected to reflect their contrasting characteristics: while national consumption provides a stable, aggregated perspective, the portfolio data is dynamic and geographically constrained, influenced by monthly client turnover and the intensity of commercial presence in certain areas. The results highlight the superiority of neural network-based methods in forecasting electricity consumption, particularly when dealing with complex time series.

The original contributions of this research lie in the integration of theoretical and empirical perspectives on the energy market, offering concrete evidence of causal relationships between economic factors and electricity prices. The practical implications for policymakers and market participants point to the need for multidimensional approaches in energy policy design—approaches that go beyond simple price signals and incorporate advanced technological solutions to optimize the energy system.

Keywords: Energy, Electricity, SARIMA, N-Beats, Prosumers, Romania