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From AI to Carbon: The Financial Ripple of Technological Advancements

Mehmet Balcilar
University of New Haven, The United States

Abstract

This study investigates the impact of recent Artificial Intelligence (AI)-driven technological innovations on carbon prices across different quantiles, assessing the influence of AI stock prices on energy prices based on European carbon allowances and controlling for other macroeconomic factors. Using robust methods such as quantile-on-quantile regression, wavelet analysis, and transfer entropy, the research quantifies the information flow between AI market and carbon allowances. Based on daily data with four alternative AI stock prices from September 14, 2016, to December 29, 2023, findings reveal a strong effect of AI returns on carbon prices, with significant fluctuations across price quantiles and a consistent long-term average growth in market returns. The quantile-on-quantile regression analysis indicates that short-term changes in carbon prices significantly impact AI stock returns, with the most pronounced impact below the 20th and above the 80th quantiles of carbon prices, indicating larger responses to extreme events. Additionally, large positive AI price shocks lead to substantial changes in carbon prices, particularly when carbon prices are near their long-term average. Compared to the short term, long-term responses are about 15 times smaller. Insights from Rényi transfer entropy confirm these findings, while Shannon transfer entropy estimates indicate a discernible and statistically significant information flow from AI prices to carbon prices. These findings offer critical insights for investors and policymakers, deepening the understanding of AI's influence on carbon market dynamics.

Keywords: artificial intelligence; carbon market; European Carbon Allowance prices; information flow; technological innovation