Enhancing Clean Energy Risk Management through a min-CVaR Framework

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ABSTRACT

This study investigates the dynamic linkages between the renewable energy market and major financial assets to strengthen portfolio diversification and risk management. Using the ECO index as a proxy for the clean energy market, the analysis applies a minimum Conditional Value at Risk (min-CVaR) framework to estimate optimal hedge ratios and compares its performance with the conventional minimum variance (MV) model. The methodology integrates wavelet coherence and wavelet-VaR techniques to capture multi-scale interdependencies and risk spillovers across different time horizons. Unlike traditional approaches, this framework jointly accounts for tail risk and time–frequency variations, offering a more robust assessment of hedging strategies. Empirical results reveal that Empirical evidence suggests that the performance differences between the two hedging models are not statistically significant; however, the min-CVaR strategy provides more stable and resilient hedging outcomes under volatile market conditions. The findings contribute to the growing literature on sustainable finance by highlighting the role of wavelet-based risk measures in optimizing clean energy investment strategies.

Keywords: Clean energy; Hedging effectiveness; Risk spillover; min-CVaR framework; Wavelet tools