

# Dynamic Connectedness in Returns and Volatility among Clean and Conventional Energy ETFs

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## Abstract

This paper examines the dynamic relationships and volatility spillover effects among conventional and clean energy assets listed on the US market from September 2014 to March 2023. We enhance the dynamic connectedness measures introduced by [Diebold and Yilmaz \(2012, 2014\)](#) with a time-varying parameter vector autoregressive model (TVP-VAR) proposed by [Antonakakis and Gabauer \(2017\)](#). The TVP-VAR model extends the traditional VAR model by allowing the parameters, such as coefficients and covariance matrices, to change over time. Thus, it captures time-varying dynamics and structural changes in the relationships among variables. We identify the time-varying correlation of returns and volatility between clean energy and conventional energy Exchange Traded Funds (ETFs) and crude oil, natural gas, and volatility indices by estimating the dynamic conditional correlation (DCC) model. Then, we use the time-varying parameter VAR model to analyze the total and net spillover effects. Our results show that the dynamic total connectedness across assets in the energy market varies with time, and there are differences between conventional and clean energy assets. A stronger impact of crude oil on energy assets is observed than natural gas.

**Keywords:** Energy Exchange Traded Funds (ETFs), dynamic conditional correlation (DCC), volatility spillover, Time-Varying Parameter Vector Autoregression (TVP-VAR), connectedness

## References

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