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## Multifractal Cross-correlations Between Crude Oil and Tanker Freight Rate

Abstract:

Analysis of crude oil price and tanker freight rate volatility attract more attention as the mechanism is not only the basis of industrialization but also a vital role in economics, especially after the year 2008 when financial crisis notably blew the maritime transportation. In this paper, we studied the cross-correlations between the West Texas International crude oil (WTI) and Baltic Exchange Dirty Tanker Index (BDTI) employing the Multifractal Detrended Cross-Correlation Analysis (MF-DCCA). Empirical results show that the degree of short-term cross-correlation is higher than that in the long term and that the strength of multifractality after financial crisis is larger than that before. Moreover, the components of multifractal spectrum are quantified with the finite-size effect taken into consideration and an improved method in terms of constructing the surrogated time series provided. Numerical results show that the multifractality is generated mostly from the nonlinear and the fat-tailed probability distribution (PDF) part. Also, it is apparent that the PDF part changes a lot after the financial crisis. The research is contributory to risk management by providing various instructions for participants in shipping markets. Our main contribution is that we investigated both the multifractal features and the origin of multifractality and provided confirming evidence of multifractality through numerical results while applying quantitative analysis based on MF-DCCA; furthermore, the research is contributory to risk management since it provides instructions in both economic market and stock market simultaneously. However, constructing the surrogated series in order to obtain consistence seems less convincing which requires further discussion and attempts.

*Key words:* Multifractal Detrended Cross-correlation analysis (MF-DCCA); WTI; BDTI; Finite size effect; Non-linearity; Multifractality.

## 1. Introduction

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