

Nonlinear Structure in Time Series of the Energy Markets

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Abstract

This paper applies statistical techniques to assess the existence of nonlinear structures in the time series data generating mechanism of the energy sector of the aggregate economy. The statistical techniques incorporate the most well-known univariate tests for nonlinearity, with distinct power functions over alternatives, as well as different null hypotheses. This study utilizes monthly observations on U.S. field production of crude oil for over 90 years, as well as daily spot prices on five major products in the energy market for over 16 years. Incorporating the production side of the energy sector, which is the variable that responds to the price, provides a more inclusive study of the energy market, and distinguishes the approach of this paper from the existing methods of analyzing the energy markets' structures. All the tests detect strong evidence of nonlinear structure in the time series data, indicating that the employed series in both quantity and prices are generated by a nonlinear mechanism. The results show that each individual series exhibits general nonlinear serial dependence, as well as nonlinearity in the mean, variance and skewness function. The findings imply that nonlinear time series modeling that is more agreeable with the data generating process will provide more plausible empirical results.

Key words: Nonlinearity, Energy Market, Time Series Analysis

JEL classification: C22, Q43, C46

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