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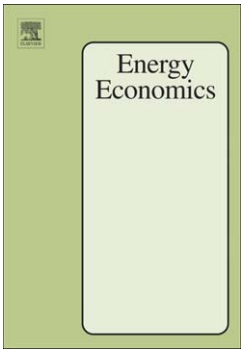

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Linear and nonlinear Granger causality investigation between carbon market and crude oil market: A multi-scale approach

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Abstract: This paper investigates the causality between carbon market and crude oil market using a multi-scale analysis approach, in which two main steps are involved: multi-scale analysis and causality testing. In multi-scale analysis, bivariate empirical mode decomposition (BEMD) is employed to decompose the two series of market returns at different time-scales. In causality testing, a linear and nonlinear integrated Granger test is formulated to investigate the relationship among each pair of matched components on a similar time-scale. With the European Union emission allowance (EUA) futures and Brent futures as study samples, some interesting findings can be obtained. (1) At the original data level (without multi-scale decomposition), this study finds evidence supporting a neutrality hypothesis, i.e., no Granger causality between the carbon and crude oil markets. (2) On small time-scale (within one week excluding non-work days), the two markets might be uncorrelated and driven by their own respective supply-demand disequilibriums. (3) For medium time-scale (above one week but below one year), there is a strong bi-directional linear and nonlinear spillover effect between the two markets, due to certain extra factors with medium-term effects, e.g., significant events and policy changes. (4) For long time-scale, the long-term trends of the two markets appear an obvious linear relationship.

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