HOW TO MEASURE FINANCIAL MARKET EFFICIENCY? A QUANTITATIVE EVALUATION OF HIGHER ORDER DEPENDENCIES – THE CASE OF THE EUROPEAN CARBON MARKET

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Overview

This paper analyses informational efficiency of the European Union Emissions Trading Scheme. Currently existing studies overall find that the EU ETS becomes efficient over time. Charles et al (2011), for instance, find prices during Phase I to be predictiable; in Phase II, however, the market is weak-form efficient. Niblock and Harrison (2013) offer some more refined insights: the authors use Phase II data only, but split the sample into an early period (February 2008 - February 2010) and a late period (February 2010 - February 2012). They find that the early period is still characterized by predictibality; while for the late period no evidence of predictability is found. Due to the non-availability of corresponding empirical techniques, however, the vast majority of papers which study financial market efficiency employ qualitative measures of market efficiency. These analyses, however, are restricted to testing whether or not a certain market is efficient in a certain period. Campbell et al. (1997) put forward the idea of using quantitative rather than qualitative measures of market efficiency. This generally allows for addressing questions such as how efficient a certain market is in a certain period and whether or not this degree of efficiency is changing over time. In addition, cross-market comparisons are also possible. Recent methodological advancements now make possible to walk this path.

Methods

We propose a new interpretation of the intermittency parameter in the multifractal random walk (MRW) model by Bacry and Muzy (2001) as a degree of price deviation from a random walk. In this light, we bridge between the multi-scaling (multifractal) property of financial volatility and the concept of efficient financial markets, which are characterized by completely random and unpredictable price movements (Fama, 1970).The multi-scaling (multifractal) property is a nonlinear dependence manifested between returns with different return periods (minute, daily, monthly returns, etc.) which arises due to the interaction among different groups of agents and due to the flow of information from long-term to short-term traders (Alfarano and Lux, 2007). This anomalous scaling generates dependencies between higher-order returns powers over long lags, simulating long-memory dynamics in volatility (Ding et al. 1993). The intermittency parameter, denoted by lambda_sq, measures the intensity of price deviation from a random walk due to the presence of higher-order dependencies. At the same time, the multi-scaling property generically leads to fat tails in return distributions and to volatility clustering. The new interpretation of the intermittency parameter proposed in this paper allows one to compare different markets (either geographically separated markets or sub-periods of trading on the same market) with respect to their relative degree of efficiency, continuing . This line of reasoning is also consistent with the concept of market adaptiveness introduced by Lo (2004), who emphasizes the evolution of markets in time from a biological and evolutionary perspective.

Results

We analyse price data from the currently largest existing market for tradable pollution permits, the European Union Emission Trading Scheme (EU ETS), alongside a comparison with the US stock market. Our results can be summarised as follows. First, we can reject the random walk hypothesis at very small significance levels. Second, we find that the informational efficiency of the EU ETS remains largely unchanged during the period 2008--2019. This is noteworthy insofar as the expectation that this market would further gain in informational efficiency with growing maturity would have not been entirely unjustified. This finding of no further improvement in market efficiency is attributable to the largely horizontal price movement witnessed between 2013 and 2017. Third, our comparison with the US stock market, furthermore, points out that for the time periods under consideration, the EU ETS is presumably more efficient than the US stock market. This is plausible insofar as the US stock market has been affected by the financial crisis of 2007--2008 to a considerably larger extent than the EU ETS. Overall, the shocks a market such as

the US stock market is exposed to occur more frequently and at any time, whereas prices in the EU ETS are largely determined by supply decisions which the European Commission sets in advance.

Conclusions

In light of the fact that various observers expressed concerns with regards to informational efficiency of a newly established market such as the EU ETS, the results obtained in this paper are remarkable. Among the possible explanations for this finding are, first, that the US stock market has been affected by the financial crisis of 2007-2008 to a larger extent than the EU ETS. Second, a market such as the US stock market is generally more exposed to external shocks as it is affected by global macroeconomic and financial developments. By contrast, prices for pollution permits in the EU ETS are mainly determined by supply decisions for this market; those, however, are made in advance by the European Commission. Demand for pollution permits is largely influenced by economic activity in the European Union. Some researchers also find that the EU ETS is a particularly political market; however important political or regulatory decisions are made very infrequently.

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