

The Volume-Volatility Relationship Conditional to Market Efficiency

Authors : Massimiliano Frezza, Sergio Bianchi, Augusto Pianese

Abstract : The relation between stock price volatility and trading volume represents a controversial issue which has received a remarkable attention over the past decades. In fact, an extensive literature shows a positive relation between price volatility and trading volume in the financial markets, but the causal relationship which originates such association is an open question, from both a theoretical and empirical point of view. In this regard, various models, which can be considered as complementary rather than competitive, have been introduced to explain this relationship. They include the long debated Mixture of Distributions Hypothesis (MDH); the Sequential Arrival of Information Hypothesis (SAIH); the Dispersion of Beliefs Hypothesis (DBH); the Noise Trader Hypothesis (NTH). In this work, we analyze whether stock market efficiency can explain the diversity of results achieved during the years. For this purpose, we propose an alternative measure of market efficiency, based on the pointwise regularity of a stochastic process, which is the Hurst-Hölder dynamic exponent. In particular, we model the stock market by means of the multifractional Brownian motion (mBm) that displays the property of a time-changing regularity. Mostly, such models have in common the fact that they locally behave as a fractional Brownian motion, in the sense that their local regularity at time t_0 (measured by the local Hurst-Hölder exponent in a neighborhood of t_0 equals the exponent of a fractional Brownian motion of parameter $H(t_0)$). Assuming that the stock price follows an mBm, we introduce and theoretically justify the Hurst-Hölder dynamical exponent as a measure of market efficiency. This allows to measure, at any time t , markets' departures from the martingale property, i.e. from efficiency as stated by the Efficient Market Hypothesis. This approach is applied to financial markets; using data for the SP500 index from 1978 to 2017, on the one hand we find that when efficiency is not accounted for, a positive contemporaneous relationship emerges and is stable over time. Conversely, it disappears as soon as efficiency is taken into account. In particular, this association is more pronounced during time frames of high volatility and tends to disappear when market becomes fully efficient.

Keywords : volume-volatility relationship, efficient market hypothesis, martingale model, Hurst-Hölder exponent

Conference Title : ICAFM 2023 : International Conference on Applications of Financial Mathematics

Conference Location : Barcelona, Spain

Conference Dates : May 22-23, 2023