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Does trading volume really explain stock returns volatility?

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Abstract

Assuming that the variance of daily price changes and trading volume are both driven by the same latent variable measuring the number of price-relevant information arriving on the market, the mixture of distribution hypothesis represents an intuitive and appealing explanation for the empirically observed correlation between volume and volatility.

This paper investigates to which extent the temporal dependence of volatility and volume is compatible with a MDH model through a systematic analysis of the long memory properties of power transformations of both series.

It is found that the fractional differencing parameter of the volatility series reaches its maximum for a power transformation around 0.75 and then decreases for other order moments while the differencing parameter of the trading volume remains remarkably unchanged. Similarly, the generalized Hurst exponent of the volatility series appears to be a concave function of the power transformation, indicating the presence of a *multi*-fractal process, while it remains constant for the trading volume, revealing its *uni*-fractal structure.

The volatility process thus exhibits a high degree of intermittence whereas the volume dynamic appears much smoother. The results suggest that volatility and volume may share common short-term movements but that their long-run behavior is fundamentally different.

JEL classification: C13; C52; G15

Keywords: Volatility persistence; Long memory; Trading volume

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1. Introduction

The relations among trading volume, stock returns and price volatility, the subject of empirical and theoretical studies over many years, have recently received renewed attention with the increased availability of high frequency data. A vast amount of the empirical research has documented what is now known as the "stylized facts" about asset returns and trading volume. In particular, speculative asset returns are found to be leptokurtic relative to the normal distribution and exhibit a high degree of volatility persistence. The same abnormality is found for the trading volume which also happens to be positively correlated with squared or absolute returns.

A meaningful approach for rationalizing the strong contemporaneous correlation between trading volume and volatility – as measured by absolute or squared returns – is provided by the so-called mixture of distribution hypothesis (MDH) introduced by Clark (1973). In this model, the variance of daily price changes and trading volume are both driven by the same latent variable measuring the number of price-relevant information arriving on the market. The arrival of unexpected "good news" results in a price increase whereas "bad news" produces a price decrease. Both events are accompanied by above-average trading activity in the market as it adjusts to a new equilibrium. The absolute return (volatility) and trading volume will thus exhibit a positive correlation due to their common dependence on the latent information flow process.

Another successful specification for characterizing the dynamic behavior of asset price volatility is based on the autoregressive conditionally heteroskedastic (ARCH) model of Engle (1982) and the generalized ARCH (GARCH) of Bollerslev (1986). In this class of models, the conditional variance of price changes is a simple function of past information contained in previous price changes. The autoregressive structure in the variance specification allows for the persistence of volatility shocks, enabling the model to capture the frequently observed clustering of similar-sized price changes, the so-called GARCH effects.

These univariate time series models, however, are rather silent about the sources of the persistence in the volatility process. In the search of the origin of these GARCH effects, Lamoureux and Lastrapes (1990) analyze whether they can be attributed to a corresponding time series behavior of the information arrival process in Clark's mixture model. Inserting the contemporaneous trading volume in the conditional variance specification shows that this variable has significant explanatory power and that previous price changes contain negligible additional information when volume is included in the variance equation.

This inference, however, is based on the assumption that trading volume is weakly exogenous, which is not adequate if price changes and trading volume are jointly determined. As explained by Andersen (1996) it seems to be necessary to analyze the origin of GARCH effects in a setting where trading volume is treated as an endogenous variable. Tauchen and Pitts (1983) refined Clark's univariate mixture specification by including the trading volume as an endogenous variable and proposed a bivariate mixture model (BMM) in which volatility and trading volume are jointly directed by the latent number of information arrivals. This implies that the dynamic of both variables are restricted to depend only on the time series behavior of the information arrival process. Hence, if the bivariate mixture model is the correct specification, the trading volume and volatility should inherit the same time-dependence structure.

Although from a market microstructure perspective, the BMM representation is intuitively appealing, the absence of strong empirical support for the model seems to suggest that volatility and trading volume have too different dynamics to be directed by the same latent process as suggested by the BMM. It also appears that the fundamental differences of behavior, making the BMM untenable, should be looked for in the structure of temporal dependencies of both series.