Measuring Causality between Volatility and Returns with High-Frequency Data*

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ABSTRACT

In this paper we measure the relationship between volatility and return with high-frequency equity returns. The leverage hypothesis claims that return shocks lead to changes in conditional volatility. The feedback effect theory, based on the existence of a time-varying risk premium, implies that return shocks are caused by changes in conditional volatility. Within the framework of a vector autoregressive linear model of returns and realized volatility (bipower variation), we quantify these effects by applying short-run and long-run causality measures proposed by Dufour and Taamouti (2005). These causality measures go beyond simple correlation measures used recently by Bollerslev, Litvinova, and Tauchen (2006). Using 5-minute observations on S&P 500 Index futures contracts, we measure a strong dynamic leverage effect for the first hour in hourly data and the first three days in daily data. The volatility feedback effect is found to be insignificant at all horizons. We also use these causality measures to quantify and test statistically the dynamic impact of good and bad news on volatility. First, we assess by simulation the ability of causality measures to detect the differential effect of good and bad news in various parametric volatility models. Then, empirically, we measure a much stronger impact for bad news at several horizons. Statistically, the impact of bad news is found to be significant for the first three days, whereas the impact of good news is insignificant at all horizons.

Keywords: Volatility asymmetry, Leverage effect, Volatility Feedback Effect, Multi-Horizon Causality, Causality Measure, High-frequency Data, Realized volatility, bipower variation.