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Realized volatility and transactions

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Abstract

This paper re-examines the impact of number of trades, trade size and order imbalance on daily stock returns volatility. In contrast to prior studies, we estimate daily volatility using realized volatility obtained by summing up intraday squared returns. Consistent with the theory of quadratic variation, realized volatility estimates are shown to be less noisy than standard volatility measures such as absolute returns used in previous studies. In general, our results confirm [Jones, C.M., Kaul, G., Lipson, M.L., 1994. Transactions, volume, and volatility. Review of Financial Studies 7, 631–651] that number of trades is the dominant factor behind the volume–volatility relation. Neither trade size nor order imbalance adds significantly more explanatory power to realized volatility beyond number of trades. This finding is robust to different time periods, firm sizes and regression specifications. The implications of our results for microstructure theory are discussed.

JEL classification: G10; G12; G13

Keywords: Absolute residuals; Realized volatility; Number of trades; Average trade size and order imbalance

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1. Introduction

There is a large empirical literature on the relationship between trading volume and volatility. This research is important in providing insights into how market participants process and react to new information. Efforts in this direction can be seen from recent research focusing on the impact of different components of trading volume on volatility. For example, Jones et al. (1994) decomposes daily trading volume into number of trades and average trade size and examines their impact on the volatility of NASDAQ stocks. They find that number of trades explains virtually all of daily volatility, with trade size playing a minor role. This result is startling as it runs counter to standard market microstructure theories which emphasize the role of trade size as a signal of informed trading.

Traditional microstructure theories e.g., Kyle (1985) and Admati and Pfleiderer (1988) also focus on order imbalance as a signal of informed trades. It is assumed in these models that market makers will adjust prices upwards (downwards) when there are excess buy (sell) orders. Thus, price volatility may be induced by net order flow. Consistent with this prediction, Chan and Fong (2000) find that a substantial portion of daily stock returns is explained by order imbalance. Although they do not test the direct impact of order imbalance on volatility, they find that after filtering the effects of order imbalance on returns, number of trades explain very little of the absolute residuals. They conclude that it is order imbalance, rather than number of trades that drives the volume–volatility relation.

We argue that this conclusion may be premature. First, prior studies, including Jones et al. and Chan and Fong use absolute returns as the measure of daily stock returns volatility. It is well known, however, that absolute returns are a very noisy estimator of the true latent volatility. Since daily absolute returns are computed using only two prices (opening and closing), the computed volatility may be very low if the opening and closing price happens to be very close, even though there might be significant intraday price fluctuations. The fact that absolute returns are measured with substantial noise prompts the following question: would the results of prior studies hold if one uses a more precise estimator of the unobserved volatility?

This paper answers this question by using realized volatility in place of absolute returns as the volatility measure. Following Andersen et al. (2001, 2003), we compute daily realized volatility using intraday returns sampled at 5-min intervals. Andersen et al. (2001) shows that in the limit, sampling at sufficiently high frequency leads to a daily volatility estimate that is indistinguishable from the true latent volatility. Consistent with this prediction, we find that our realized volatility measure is substantially less noisy than the corresponding absolute returns measure. Using realized volatility as the volatility measure, we show that number of trades explains far more of daily stock return fluctuations than has been documented in prior studies. Specifically, over our sample period (1993–2000), number of trades explains about 42% of daily realized volatility for the 30 stocks comprising the Dow Jones Industrial Average index. In contrast, average trade size and absolute order imbalance accounts for only 25% and 27% of realized volatility respectively. Adding average trade size and