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Internet information arrival and volatility of SME PRICE INDEX

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HIGHLIGHTS

- We employ Baidu News as a proxy for information arrival.
- A positive impact of internet information on volatility is found.
- Internet information is a better proxy for information arrival.

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ABSTRACT

This article employs the number of news appeared in Baidu News as a novel proxy for information arrival and investigates the validation of the Mixture of Distribution Hypothesis (MDH) using a sample of SME PRICE INDEX in China. The empirical results reveal a positive impact of internet information on the conditional volatility of stock returns. Compared with the prevailing proxies (trading volume and its adjustments), the volatility persistence is most decreased when this novel proxy is incorporated into the conditional variance equation of the GARCH model. Some tentative explanations are also given to expound the non-disappeared GARCH effects.

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1. Introduction

The volatility of the underlying asset prices has long been the focus of financial economics [1–3], with the ultimate objective to clarify the potential causes and pricing mechanism. In accordance with Fama [4], the efficiency of the capital market is attributable in large part to how rapidly information is fully reflected into asset prices. Recent studies have concentrated on the relationship between the rate of information arrival and volatility by employing the ARCH and GARCH models. The Mixture of Distribution Hypothesis (MDH), which claims that the volatility of returns at a given interval is associated with the rate of information arrival, seems to be an appealing answer to explain why volatility is persistent [5–8]. Several previous studies have confirmed the validation of MDH. Lamoureux and Lastrapes [9] show a significant decrease in volatility persistence when raw trading volume is included in the conditional variance equation as the proxy for information arrival. After this, to avoid the nonstationary properties of the raw trading volume series, some forms of adjusted trading

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volume [10,3] as well as other proxies, including the number of firm-specific announcements [11] and transactions [12] are also applied to explain volatility persistence.

Recent studies have shown evidence that the information provided by the internet is associated with economic activities [13–17]. Among these open source information, search engine query data demonstrate a strong link between searching behavior and stock market performance [18–20]. In this study, unlike previous proxies, we employ the number of news appeared in Baidu News¹ as the direct proxy for information arrival and incorporate this novel variable into the conditional variance equation of the GARCH (1, 1) specification. The rationale for using this proxy is twofold. Firstly, trading volume (including its adjusted form) and transaction may not be the proper proxy for the information arrival. Because they cannot be assumed to be exogenous and trading activity is not solely driven by information [21,22]. Secondly, owing to the internet becoming the primary platform for information gathering,² firm-specific announcement is not a sufficient representative proxy for the information arrival. The empirical results show a substantial reduction of the volatility persistence after the number Baidu News is incorporated into the conditional variance equation. The rest of the article is organized as follows. Section 2 describes the methodology. Section 3 presents the data and empirical results. Section 4 is the concluding remarks.

2. Methodology

2.1. Benchmark model

In order to make comparisons with previous empirical results [3,9,10], we adopt the GARCH model. In financial applications, this model is designed to deal with the volatility persistence, describing the amplitude of returns varies over time [23]. For the specification, we restrict it to GARCH (1, 1) because GARCH (1, 1) model has been shown to be a parsimonious representation of conditional variance that fits many economic time series quite well [24]. The model can be described by the following equations:

$$r_t = \mu + \varepsilon_t, \quad \text{where } \varepsilon_t | \Omega_{t-1} \sim (0, h_t^2) \quad (1)$$

$$h_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}^2 \quad (2)$$

where r_t represents the return at interval t , μ represents a constant, ε_t represents the serially uncorrelated errors and h_t^2 represents the conditional variance of ε_t . The sum of the coefficients $\alpha + \beta$ indicates the degree of volatility persistence.

According to the MDH, the time varying conditional volatility is associated with the rate of information arrival at a given interval. This assumption implies that when a proxy for information arrival is incorporated into Eq. (2), the observed volatility persistence should be decreased. As stated in Section 1, varieties of proxies have been used to test the validation of MDH. To facilitate our study, we employ the number of news appeared in Baidu News as the proxy for information arrival. Admittedly, this novel proxy cannot encompass all available information. To some extent, it should display some explanatory power for volatility. Therefore, the number of Baidu News is set as an exogenous variable and incorporated into Eq. (2) as follows:

$$h_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \lambda \text{News}. \quad (3)$$

If this specification is correct, the volatility persistence, indicated as $\alpha + \beta$ should be substantially reduced in comparison with the estimates from the benchmark model (Eq. (2)).

2.2. Trading volume adjustments

The nonstationary properties of the raw trading volume series is a major issue in empirical investigation of the MDH [7]. For preliminary adjustments in the raw trading volume, natural logarithm and first-order difference are employed to transform the raw trading volume (denoted as Vol₂ and Vol₃ respectively). In line with Wagner and Marsh [10], we also apply Hodrick–Prescott filtering and moving average methods to remove the stochastic trend, which generates two adjusted form of trading volume (denoted as Vol₄ and Vol₅ respectively).³ The de-trending method of Fleming et al. [3] is also performed to derive a new adjusted trading volume (denoted as Vol₆). Besides, in order to make a direct comparison with Lamoureux and Lastrapes [9], the raw trading volume series is also applied (denoted as Vol₁).

¹ Baidu News is a product of the largest search engine (Baidu) in China. According to the IResearch Report in 2011, it has more than 77.7% market share in China.

² The report released by the China Internet Network Information Center shows that search engine has become the main channel for information gathering, with more than 450 million users. For the report, see http://www.cnnic.net.cn/hlwfzyj/hlwzxbg/hlwtjbg/201301/t20130115_38508.htm.

³ The Hodrick–Prescott filtering minimizes the sum of squared deviations between the raw and the smoothed trading volume, a value of 6 812 100 is chosen for the smoothing parameter. The Box–Jenkins model shows a four-order autoregressive moving average.

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