



Forecasting the realized volatility of the Chinese stock market: Do the G7 stock markets help?

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HIGHLIGHTS

- Investigate the impacts of G7 stock markets on the Chinese stock market.
- The kitchen sink model is able to attain better performance in forecasting volatility.
- The kitchen sink strategy outperforms the strategy of the simple combination forecasts.
- The G7 stock markets can indeed contain predictive information to help in forecasting volatility of the Chinese stock market.

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ABSTRACT

In this paper, we use a comprehensive look to investigate whether the G7 stock markets can contain predictive information to help in forecasting the Chinese stock market volatility. Our out-of-sample empirical results indicate the kitchen sink (HAR-RV-SK) model is able to attain better performance than the benchmark model (HAR-RV) and other models, implying that the G7 stock markets can help in predicting the one-day volatility of the Chinese stock market. Moreover, the kitchen sink strategy can beat the strategy of the simple combination forecasts. Finally, the G7 stock markets can indeed contain useful information, which can increase the accuracy forecasts of the Chinese stock market.

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1. Introduction

As we known, volatility is a key input on asset pricing, portfolio allocation, risk management, and other areas. Thus, how to model and forecast market volatility accurately is of interest to many scholars, for example, Poon and Granger [1], Wei et al. [2], Koopman et al. [3], Corsi [4], Andersen et al. [5], and Bollerslev et al. [6], among others. However, a large body of literature focuses on volatility forecasting, while accurate volatility is yet hard to forecast, which is still an extremely difficult issue to be addressed.

It is worth noting that in past decades, the generalized autoregressive conditional heteroskedasticity (GARCH) model proposed by Bollerslev [7] is the main predictive econometric model. To this day, there are many variants based on this model, for example, EGARCH [8], GJR-GARCH [9], FIGARCH [10], and HYGARCH [11], among others. Of course, many studies (see, e.g. [12–16]) are used to model and forecast stock market volatility. However, the GARCH and its extended models are prone to use the daily and monthly low-frequency data compared to the tick-data, which may loss intraday trading

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information [4,17–21]. More importantly, previous studies [3,22,23] find that the models based on high-frequency data generally outperform the GARCH-class models. Thus, in our paper, we focus on the high-frequency volatility model.

With the availability of high-frequency data, modeling and forecasting market volatility is a new tendency to use the high-frequency data to construct the predictive model. In particular, Andersen and Bollerslev [24] propose realized volatility (RV), which is defined as the sum of all available intraday high-frequency squared returns. To this date, a large number of documents on forecasting volatility use realized volatility to model and forecast market volatility, for example, ARFIMA-RV [5]. Nevertheless, Corsi [4] pointed out that the ARFIMA model was just a convenient mathematical trick and lacked a clear economic interpretation. Moreover, the fractional integrated model required a fractional difference filter, which would lead to the loss of a large number of observations and transaction information. Considering the drawbacks of ARFIMA, Corsi [4] proposed a simple Heterogeneous Autoregressive model of Realized Volatility (HAR-RV) based on Heterogeneous Market Hypothesis (HMH). The HAR-RV model not only avoided the complex estimation of the ARFIMA model, but also successfully reproduced some stylized facts of financial returns, such as long memory and fat-tail distribution. Therefore, in this paper, we just use the simple model, HAR-RV, to do our research.

Notably, the China economy is gradually important to the globe economy. The Chinese stock market has grown to one of the most important markets in the world and become integrated over time with foreign stock markets [25–27]. In 2017, China grew into the second largest stock market in the world, surpassing UK and Japan. The total market capitalization has exceeded 8.7 trillion dollars, four times than the value in 2006. Over 3,000 companies are listed in Shanghai and Shenzhen exchange. Existing studies (see, e.g. [28,27,29]) have investigated the relationship of between the Chinese and G7 stock markets. Specifically, Luo and Qi [29] capture the increasing positive correlations between G7 and China market after 2008. To the best of our knowledge, there are rare literature to investigate whether the G7 stock markets have the predictive information to help in forecasting the Chinese stock market volatility. Therefore, in this paper, we use a comprehensive look to investigate the impacts of the G7 stock markets on the Chinese stock market.

In this study, we attain several interesting findings. First, in-sample estimation results indicate that some of G7 stock markets, e.g., Nikkei 225 and S&P/TSX index, have significantly positive impacts on the Chinese stock market. In the kitchen sink strategy, the effects of the G7 stock markets are mixed. Second, the kitchen sink (HAR-RV-SK) model can gain higher forecast accuracy than the benchmark model (HAR-RV) and other models, indicating that the G7 stock markets can help in predicting the one-day volatilities Chinese stock market. Third, the kitchen sink strategy outperforms the strategy of the equally weighted combination forecasts. In conclusion, the G7 stock markets can indeed contain useful information to help in predicting the Chinese stock market volatility.

The remainder of this paper proceeds as follows. Section 2 introduces the volatility models for high-frequency data and their extended models. The data used in our study is described in Section 3. Section 4 is our empirical results, including the in-sample estimated results, out-of-sample evaluated results and some robust tests. Section 5 is the conclusion of this paper.

2. Econometric models

2.1. Realized volatility and realized bi-power variation

Barndorff-Nielsen and Shephard [30], among others, prove that the quadratic variation for the cumulative return process can be satisfied as follows,

$$[r, r]_t = \int_0^t \sigma^2(s)ds + \sum_{0 < s \leq t} \kappa^2(s), \quad (1)$$

where r represents intraday return, integrated variance ($\int_0^t \sigma^2(s)ds$) is continuous component and $\sum_{0 < s \leq t} \kappa^2(s)$ is discontinuous components. As Eq. (1), we find that the variance is unobservable, so it is difficult to forecast and model the actual market volatility. Fortunately, Andersen and Bollerslev [24] propose a new concept that the volatility can be observed and calculated easily, named realized variance (henceforth RV). It is defined as the sum of all available intraday high-frequency squared returns and given by,

$$RV_t = \sum_{j=1}^{1/\Delta} r_{t,j}^2, \quad (2)$$

where we divide the time interval $[0, 1]$ into M subintervals of length $M = 1/\Delta$, Δ is the sampling frequency. When $\Delta \rightarrow 0$, Barndorff-Nielsen and Shephard [30] indicate that the realized bi-power variation (BPV) can be seen as,

$$BPV_t = u_1^{-2} \sum_{j=2}^{1/\Delta} |r_{t,j}| |r_{t,j-1}|, \quad (3)$$

where $u_1 = (2/\pi)^{0.5} \simeq 0.7979$.

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