

Statistical Property of Prices in the Arrowhead Market -Lévy's Stable Distribution Or Else?-

Mieko TANAKA-YAMAWAKI

Institute of Statistical Mathematics, 3-10 Midorimachi, Tachikawa, Tokyo 190-8562 Japan

E-mail: mieko@ism.ac.jp

Keyword: arrowhead market, high frequency price data analysis, Levy's stable distribution

The Arrowhead Trading System (ATS) allows transactions within a millisecond in Tokyo Stock Exchange, Co.(TSE), launched on January 4, 2010, which was upgraded to the arrowhead-2 on September 24, 2015 that allows transactions in 0.5 millisecond. Under such ultrafast trading system, the price time series might have changed its nature significantly. We have analyzed two data sets: (A) price set of 100 companies in TSE per 5 seconds in 2013 (April-December), containing 640,800 data points, and (B) price set of 440 companies in TSE per 1 minute from June 16 to November 4 in 2015, containing 29,386 data points, in order to clarify the difference to the results in Ref.[1] analyzing the American stock index, S&P500 in the period of 1983-1989. Surprisingly enough, we found the best-fit statistical distribution for both A and B is Lévy's stable distribution of index $\alpha = 1.4$, same as in Ref.[1], for at least in the central region of the distribution, as shown in Fig. 1-Fig. 4.

Although plenty of discussions against Lévy's stable distribution exist, such as infinite variance, etc., our result should reveal important information on the central region of the distribution in which most transactions take place.

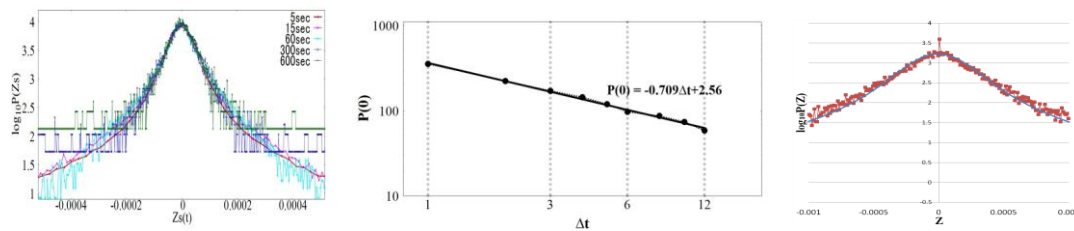


Fig.1 (left) Histograms of log-return Z for $\Delta t=5, \dots, 600$ scale by Lévy distribution of index $\alpha = 1.4$.
(center) The slope 0.709 in the log-log plot of central heights $P(0)$ vs. time interval Δt derives $\alpha = 1.40$.
(right) The central region $|z| < 0.01$ the histogram fits Lévy distribution of index $\alpha = 1.4$ very well.

References

- [1] R.N.Mantegna and H.E. Stanley, Nature Vol. 376, pp46-49, (1995)