

### **Intra-day variability of the stock market activity and stationarity of the financial time series**

Intra-day changes of the activity on stock market is a well-known empirical fact observed all around the world on different types of market. This specific pattern of activity is often called the lunch effect. Observed seasonality suggest non-stationarity of high frequency financial time series, but despite of that estimators of the stationary processes are commonly used (e.g. autocorrelation function estimator). Our aim was to analytically describe this seasonality and use it to transform time and value variables of the time series in such a way to make it stationary. We obtained a strict formula connecting estimator of the autocorrelation functions of non-stationary process and its stationary counterpart. In other words this formula describes the impact of the intra-day activity pattern on the autocorrelation function.

Additionally, the model was applied to stationary Continuous-Time Random Walk model with memory [1,2] to improve its agreement with empirical data from Warsaw Stock Exchange

[1] T. Gubiec, R.Kutner, Two-step memory within Continuous Time Random Walk. Description of double-action market dynamics, arXiv:1305.6797

[2] T. Gubiec, R.Kutner, Backward jump continuous-time random walk: An application to market trading, Phys. Rev. E 82, 046119 (2010)