Intraday correlation structure for high frequency financial data

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Correlation structure of the financial market is a subject that draws attention of both scientists and market practitioners. It is very important in understanding the way market works and may be applied in risk management among other financial issues. Recently, we developed a novel method of estimating correlations when dealing with high frequency data. It is based on the algorithm shown in [1], it does not require evenly spaced series and it can be used with different types of data (jump functions, step functions and other). This method also allows us to calculate correlation in different time-scales what makes it suitable to analyze Epps effect and compare it with other methods, like it was done in [2]. Along with this new estimator, we propose a new filtering method, which allows us to create structured networks out off full correlation matrices. Using both mentioned tools we analyzed the intraday market structure at different time scales similarly to how it was done in [3]. We found some interesting features in recent data which are different from those found in older intraday quotations. These results support the statement that financial markets are getting more and more efficient, especially in high frequency domain. As a next step, we expand our research by analyzing spectral properties of data and we apply Complex Principal Component analysis, which was used before for daily data in [4]. With this methodology, adapted to our correlation algorithms, we were able to determine which forces drive the market most and at which time-scales. Moreover, complex correlations were used in order to find the lead lag relations among stocks and among principal components. Most of our findings seem to be in accordance with economical reasoning but there are some less intuitive results as well. Finally, we show how noise and data aggregation affect all methods used both in our work and in previous papers connected to the subject of financial correlation. As a result, we are able to distinguish between meaningful, robust results and effects which are mainly consequences of increasing noise.

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