Quantifying High-Frequency Financial Market Time Series

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Wild fluctuations in stock prices (*1-5*) continue to have a huge impact on the world economy and the personal fortunes of millions, shedding light on the complex nature of financial and economic systems. For these systems, a truly gargantuan amount of pre-existing precise financial market data (*6-8*) is available for analyses.

We quantified market state-dependent stock price correlations among stocks (*9*) by analysing historical daily closing prices of the $N \equiv 30$ components of the DJIA over 72 years, from 15 March 1939 until 31 December 2010. During these $T \equiv 18596$ trading days, various adjustments of the DJIA occurred. We explicitly consider an adjustment of the index when one of the 30 stocks is removed from the index and replaced by a new stock in order to ensure that we accurately reproduce the index value of the DJIA at each trading day.

The primary goal of this mini-project is to expand on the quantification of stock correlations based on Preis *et al.* (*9*). This includes analysing the same and other quantities as well as specific events such as the "Flash Crash" using a secondly data set of the $N \equiv 30$ components of the DJIA over more than 2.5 years, from 02 January 2008 until 30 July 2010.

Previous preliminary experience in the following three areas is of advantage to complete this mini-project successfully:
> *(1) basic programming skills;*
> *(2) experience with statistical programming packages;*
> *(3) writing reports for an academic audience.*

This mini-project would be suitable as the basis for a PhD project in this area. Possible directions include incorporating historical price time series data on various time scales and developing agent-based models of this complex financial behaviour.

Please do not hesitate to contact us if you have questions about this mini-project.

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