High-Frequency Cross-Correlation Dynamics in US Equity Markets

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The main aim of this paper is to present an analysis of the correlation structure present in high-frequency trades data[1] associated with a number of highly capitalised stocks (mainly S&P100). Cross-correlation matrices based on a covolatility weighted correlation measure[2] are obtained from homogenised time series. The purpose of covolatility weighting is to add robustness to the correlation coefficient computed from series with different data frequencies and gaps. The new correlation measure retains the desirable properties of the standard correlation coefficient (ie. it is scale free, resides in the interval [-1,1] and different measurements are directly comparable).

Bonanno et al[3] use Clustering Analysis and Minimum Spanning Trees (MST) representations for the correlation matrices computed for various time resolutions of returns using the standard correlation measure. The stock transactions datasets used by Bonanno et al were extracted from the TAQ database for the period January 1995 to December 1998. The purpose of our work is to extend and refine this analysis to more recent data (1998-2002) by employing the weighted correlation measure and looking beyond the MST solution to determine the stocks with the most significant connections (ie. highly correlated) and their criticality to the structure of the graph.

A summary of the aspects covered is outlined below:

- Graph structure of weighted correlation of returns, distribution properties of links and how they are affected by changing cut off points
- Correlation of extreme return values during market crashes/rallies
- Correlation dynamics at varying time scales (information aggregation and the "Epps effect") and different periods of the trading day
- Correlations of returns of different sizes through power transforms
- Time evolution of correlation, clustering effects and autocorrelation of correlation

[1] source: NYSE TAQ database

[2] M. Dacorogna et al, An Introduction to High-Frequency Finance (2001), Academic Press

[3] G. Bonanno et al, High-frequency Cross-correlation in a Set of Stocks, Quantitative Finance, 1, 2001, 96-104