Financial Correlations Viewed from Different Time Scales

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Usually, correlations between two assets are quantified in terms of the correlation coefficient calculated from two signals corresponding to the same time scale. In general, construction of a correlation matrix is more useful, as it allows one to identify the global correlation properties in a market and to extract collective effects from noise. In the case of financial data, the largest eigenvalue of such a matrix is typically repelled from the rest of the spectrum whose distribution is consistent with the random matrix theory. We analyze high frequency tick-by-tick data from the NYSE and from the German market. By using returns on various time scales ranging from seconds or minutes up to two days, we compare magnitude of the largest eigenvalue for the same set of securities but for different time scales. For various sets of stocks of different capitalization, we observe a significant elevation of the largest eigenvalue with increasing time scale. For companies with the largest capitalization the largest eigenvalue almost saturates for the time scales larger than tens of minutes. For companies which have smaller capitalization there is no saturation for any of the time scales studied, though in this case we also observe the increase of the eigenvalue with increasing time scale. As the capitalization is positively correlated with the trading frequency of a stock, different behaviour of the largest eigenvalue for different sets of stocks may be related to varying average frequency of transactions.

Our results from the correlation matrix study go in parallel with the so-called Epps effect. There is no unique explanation of this effect and it seems that many different factors play a role here. One of such factors is randomness in transaction moments for different stocks. Another interesting conclusion to be drawn from our results is that in the contemporary markets the emergence of significant correlations occurs on time scales much smaller than in the more distant history.