

Title	統計的手法を用いた株価のクラスタリング ファットテール性を有する株価収益率の相関構造の分析・知識形成
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## Abstract

In this research, we study the correlation structure of fat-tailed asset returns, specifically the Japanese stock returns. A structural analysis of the Japanese stock market with a new data-oriented classification of stocks is the key component, which contributes to the knowledge creation of portfolio investment and risk management. About 1,400 stocks listed on the First Section of the Tokyo Stock Exchange are selected for correlation clustering to find a more data-oriented classification than the standard sector classification. Advanced volatility models are applied to filter the fat-tailed stock returns to avoid the possible distortion of correlation due to volatility fluctuations when estimating the correlation matrix of returns. The correlation matrix is converted to a weighted undirected network. Then, the stock returns are clustered by recursive spectral clustering with a community detection technique developed in the complex networks theory. A new method for controlling the recursive clustering process is proposed there, which is generally applicable to other fat-tailed financial asset returns. The statistical comparison between the clustering result and the standard sector classification reveals some partial linkages between them. It has been proven that portfolio risks are more efficiently controlled with the new grouping by random portfolio simulations. Classification trees are built on the clustering result with various non-price data to explore the group properties; some informative variables are successfully identified. The clustering results are also applied to the analysis of dynamic changes in the correlation matrix. A multivariate volatility model with dynamic correlation is applied to a reduced size of sample portfolios to detect any differences in changing patterns across the market and between groups. It is confirmed that the correlation intensity changes over time; a higher level of correlation is observed during the crisis periods. This study contributes to the further development of knowledge science by proposing a wide range of combinations of analytical techniques in various fields of science to extract information from the complicated high-dimensional financial data.

**Keywords:** stock return, correlation, fat tail, volatility, portfolio, GARCH, copula, network clustering, complex networks, modularity, risk management