

Composition of the first principal component of a stock index — A comparison between SP500 and VNIndex

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Abstract

We analyzed the components of the eigenvector corresponding to the largest eigenvalue of a cross-correlation matrix of stock price change (the 1st eigenvector) using the Principle Components (PCs) analysis method. We found that the components of the 1st eigenvector are not uniformly distributed. In fact, they are proportional to the correlations of individual stocks and the 1st PC, and could be negative if the corresponding stock is "in average" negatively correlated to other stocks. By analyzing data from the world stock index in a developed country (SP500) and an emerging one such as Vietnam (VNIndex) from 2013 to 2017, we found negative components in the 1st eigenvector in the VNIndex (and their distribution is also broader than that of SP500). Furthermore, we found that the largest components correspond to stocks of financial services (brokerage or investment advisory firms) firms in both indices. Those stocks are found to be center hubs in a Minimum Spanning Tree (MST) analysis and play an important role whenever a systemic breakdown happens. Finally, we found a phenomenological linear dependence between the components of the 1st eigenvector and the average stock correlation in both indices, and derived an approximation of this dependency using empirical stylized facts of the data. This result provides an estimation of how the PC1 is composed.