Measuring the Collective Correlation of Stock Markets

Wei-Fang Niu
Shing-Tung Yau Center, National Chiao Tung University

Henry Horng-Shing Lu
Institute of Statistics, National Chiao Tung University

Abstract

It is well accepted that correlations between international stock markets become higher during periods of distress. However, very few articles addressed the same issue for the assets in one market. This paper tries to provide a measure for the collective correlation among the stocks in a market from the viewpoint of network. The market network is constructed by digitizing pairwise correlations. While the number of stocks is very large, the network can be approximated by an exponential random graph model (ERGM) and the sufficient statistics are the numbers of edges, stars and triangles. Thus the transitivity of the market network is a natural candidate for measuring the collective correlation of the stock market. With a sample of S&P 500 components in the period from January 1996 to August 2009, we show that transitivity can be used as alternative risk measure in addition to volatility. Furthermore, investigations on higher order statistics reveals the distinctions in clustering effect between bear markets and bull markets.

Key words: Markov random graph, systematic risk, correlation breakdown.