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Early-warning signals of topological collapse in interbank networks

T. Squartini[1], I. van Lelyveld[2], D. Garlaschelli[1]
[1]University of Leiden
[2]De Nederlandsche Bank

The financial crisis clearly illustrated the importance of characterizing the level of systemic risk associated with an entire credit network, rather than with single institutions. However, the interplay between financial distress and topological changes is still poorly understood. Here we analyze the quarterly interbank exposures among Dutch banks over the period 1998-2008, ending with the global crisis. We find that, after controlling for the link density, many dyadic and triadic structural properties display an abrupt change in 2008, providing a clear (but unpredictable) signature of the crisis. By contrast, if the heterogeneity of banks connectivity is controlled for, the same properties show a gradual transition to the crisis, highlighting a slow build-up phase starting three years in advance and representing an early-warning signal of the upcoming collapse. These results show a dramatic consequence of the heterogeneity of the interbank system. Moreover, we find that the pre-crisis phase is preceded by an earlier period characterized by anomalous unreciprocated debt loops among triples of banks. Given the Over-The-Counter (OTC) nature of interbank transactions, debt loops could have led to the systematic underestimation of counter-party risk. Our results also show that, during the build-up of crises, interbank networks can keep moving away from the expectations derived only from the knowledge of bank-specific properties. In this out-of-equilibrium regime, the local connectivities of banks become less and less informative about the network as a whole. This loss of topological predictability speaks against the use of maximum-entropy techniques aimed at reconstructing the most likely configuration of an (unobserved) interbank network when only local information about the total assets and liabilities of each bank is available. Our results suggest that this technique might yield a realistic guess of the real network only in tranquil times. When the network is under stress, maximum-entropy techniques would instead provide a greatly distorted picture of it. So, by construction, the early-warning signals identified by our approach are completely undetectable if the network is reconstructed from partial bank-specific data, as routinely done. Supervision based only on bank-specific information, and not on the knowledge of the entire network, is thus likely to remain oblivious to warning signals of structural changes in the run-up to the crisis. These considerations show that OTC transactions have the potential to create unintentional but emergent and destabilizing patterns, and feed into the debate on how OTC markets can be monitored and regulated.

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Scaling analysis of time series of stock market indices of transitional economies in the Western Balkans

D. Stratimirović[1], S. Blesić[2], V. Miljković[3], D. Sarvan[3]
[1]Faculty of Dental Medicine, University of Belgrade, Belgrade, Serbia
[2]Institute for Medical Research, University of Belgrade, Belgrade, Serbia
[3]Faculty of Physics, University of Belgrade, Belgrade, Serbia

In this paper we have analyzed scaling properties of time series of stock market indices (SMIs) of developing economies of Western Balkans, and have compared the results we have obtained with the results from more developed economies. We have used three different techniques of data analysis to obtain and verify our findings: Detrended Fluctuation Analysis (DFA) method, Detrended Moving Average (DMA) method, and Wavelet Transformation (WT) analysis.
Following extensive research in the area of econophysics of national and international stock markets, we were interested to contribute to this body of knowledge by analyzing the dynamics of market behavior of transitional economies in the Western Balkans, and to compare data from these emerging economies with data from more economically developed countries. Analyzes of stock market behavior of the emerging economies of South America, or the developing Asian or African markets have shown that the values of scaling exponents, calculated from the time series of stock market indices, could be used to estimate the efficiency of markets in question. With that in mind, by applying the theoretical approach of statistical physics, we aim to offer a new perspective on stock market dynamics in the Western Balkans and contribute to better understanding of the development process in the region's economies.
We have found scaling behavior in all SMI data sets that we have analyzed. Scaling of SMI series changes from long-range correlated to slightly anti-correlated behavior, i.e. the appropriate scaling exponents decrease in value with the increase in growth and/or maturity of the economy the stock market is embedded in. Scaling exponents α, H, and β, corresponding to the DFA, DMA, and WT technique, all cross the 0.5 (and zero) line, marking this alteration.
We also report the presence of effects of potential periodic-like influences on the SMI data that we have analyzed. One such influence is visible in all our SMI series, and appears at a period $T_p \approx 90$ days. We propose that the existence of various periodic-like influences on SMI data may partially explain the observed difference in types of correlated behavior of corresponding scaling functions. The application of time-dependent scaling analysis (tdDMA) proved that these influences are of a complex type, that is, they can not be easily distinguished from a local correlations profile.

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