Analysis of the emergence of log-periodic-power-law in a stock market with a spin model on the network

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By fitting the log-period power law (LPPL) pattern with the price series, Johansen-Ledoit-Sornette (JLS) model [1] has been applied to predict the crashes of various bubbles in financial markets. The effectiveness of such prediction is based on a number of phenomenological studies[2-3], showing that the LPPL pattern had emerged before the stock price crashes realized. Although the mechanism of the formation of LPPL pattern is widely applied in many fields[4], it still needs an insightful explanation on how the LPPL pattern emerges. Meanwhile, agent-based models (ABM) are employed in the financial market to reproduce many stylized facts in real financial markets.

In this study, we employ a zero-intelligence agent-based model, namely a spin model[5] on several social networks including regular lattice, diamond lattice, random graphs, small-world networks and scare-free networks to explore the factors influencing the formation of LPPL patterns on the microscopic scales. In our preliminary study, the emergence of LPPL patterns has been confirmed, which implies that the complex networks as the communication structure among the agents, could be one of the important factors for generating the LPPL patterns. Moreover, by employing various network topologies to fitting the JLS model, we demonstrate that the real social networks of financial market could be a diamond lattices combined with random graphs.

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