

Estimation of sales-change caused by structural change of an interfirm trading network and its verification

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Companies in a social system intricately relates to each other. A breakdown of a tiny part of the system sometimes affects the whole system and it can result in an unexpected destructive disaster.

The company system is usually symbolized as a complex network. Here, a node denotes a company while a link is a trade, an interaction between two companies. We have already reported the interaction intensity between companies, namely the annual amount of money that company A paid to another company B through a trade. The interaction intensity is expected to obey a gravity-like equation with fractional power exponents[1]. We modeled the money transport on an interfirm trading network utilizing this gravity interaction. The steady-state solution of a specified node calculated by the transport equation corresponds to the total amount of sales of a corresponding company. We developed the practical aspect of this proposed model for estimating sales change before- and after the shock to the network system. The method has already been applied to a real case, the 3.11 Tohoku earthquake in 2011[2].

In this research, we check the statistical validity of this method by comparing our simulation results with the real data compiled in 2012. It is confirmed that the simulation results significantly agree in view of the binarized sales change.

References

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- [2] K. Tamura et al. "Money-Transport on a Japanese Inter-firm Networks: Estimating sales from the adjacency matrix", Proceedings of The Asia Pacific Symposium on Intelligent and Evolutionary Systems Kyoto Japan (ISBN978-4-99066920-1) (2012)