Propagation Process of Shock on the Global Banking Network

Kohei AKAHORI[1] and Yu CHEN[2]

[1,2] Department of Human and Engineering Environmental Studies, Graduate School of Frontier Sciences, The University of Tokyo 5-1-5, Kashiwanoha, Kashiwa, Chiba, 277-8561 Japan

E-mail: [1]koh.a9231@gmail.com

Abstract

We proposed a model for the dynamic simulation of shock transmission on the global banking network. From the simulation, two important factors influencing the shock transmission have been found.

Keyword: Fragility, Bank Network, Financial Crisis

1. Introduction

The recent financial shock originated from United States, has spread to other countries and triggered a global scale crisis. As the background, the globalization resulted in dense banking network among different countries. In a previous study, the network was employed in analysis of the shock impact without the consideration of bank-specific fragility [1]. In this paper, we construct a model based on financial condition of an individual bank and reveal the contagious process of shock through a series of dynamic simulations.

2. Model of Shock Transmission

The global banking network consists of country node i which holds assets a_i and liabilities l_i, and the claims c_{ij} of country i for j are represented by weighted directional network links. Assuming that a crisis occurred in country i, it would default its debts c_{ji} by a fraction α. As a result, a_j will be reduced, causing the decline of equity ratio e_j in country j. If e_j becomes lower than a threshold β, i.e.

$$e_j := \frac{(a_j - \alpha c_{ji}) - l_j}{a_j - \alpha c_{ji}} < \beta, \qquad (1)$$

a country j realizes that a crisis has occurred and also defaults its debts in the same way. These procedures are performed iteratively until Eq. (1) is not satisfied in all the countries.

3. Propagation Process of Shock

We construct a hypothetical network and simulate the spread of crisis for $\alpha = 0.10$ and $\beta = 0.08$, as depicted in Fig. 1.

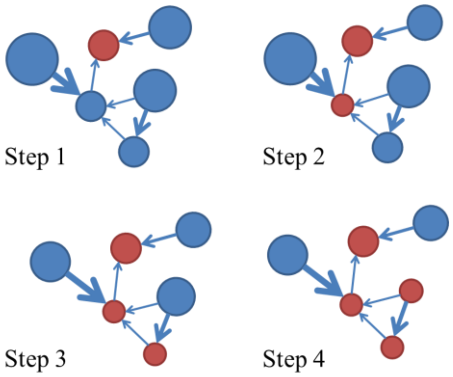

Fig. 1. The contagious process of shocks. Red-colored nodes represent the countries in crisis. The size of a node and the thickness of a link are proportional to the equity ratio and the claims per the assets, respectively.

4. Conclusion

The transmission of crisis is not only affected by bank fragilities, i.e. the equity ratio, the structure of network such as feed-forward-loop is also an important fact.

References

[1] X. Feng, "International transmission of shocks and fragility of a bank network", arXiv:1403.1363v1 (2014).