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# Network theory and its application to banking systems

Abstract

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Since the financial crisis in 2008, understanding the structure of the financial market has become increasingly important. Financial network models have received significant research interest recently. The aim of this thesis is to use network theory to model financial systems and to understand how structure effects the behaviour of the system.

In Chapter 1, we study random graph models, such as the Erdős-Rényi and Barabási-Albert models, and some of their properties. For example degree distribution, rate of the greatest connected component, diameter, etc. Moreover, we illustrate the theoretical results with computer simulations, and in one case we correct an incorrect expression for the diameter of the Erdős-Rényi network.

In Chapter 2 we introduce some basic financial notions, such as the liquidity, solvency, equity, etc. Furthermore, we will demonstrate the unsecured Hungarian interbank transaction network proposed by Berlinger et al.

Chapter 3 is devoted to systemic risk and stability in financial networks. We investigate the theoretical framework proposed by Acemoglu. Hereupon we give a more general solution for the small shock regime, which is more suitable for analysing the connection between any two institutions, not only between an institution and the whole system. We illustrate our results for a networks hit by a shock.

In Chapter 4 we modify a counterparty risk measure which will be the base of our network. Since the financial crisis in 2008, counterparty risk has become one of the most important types of risk, because the shock can spread through counterparty spillovers in the network. This counterparty risk measure is estimated by quantile regression, so we give a short overview on quantile regression. In our network the nodes are financial stocks listed by NASDAQ Stock Market and the weighted connections are given according to the previously mentioned counterparty risk measure modified by us. Moreover, we analyse the properties of this new bank network during and after the crisis. The difference between the two periods is significant in our results for the examined parameters.

In Chapter 5 we arrive at a conclusion and we propose possible future works.