Enterprise Size Distribution in the Financial Network

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Abstract: Due to the increasingly developed supply chain, the financial network has become more and more perfect in recent years. The financial network connects all enterprises, which helps small-scale enterprises get rid of difficulties and promotes the development of the whole industry. This paper studies the influence of enterprises of different scales on the whole financial network. Taking banks as an example, this paper builds a banking system composed of several banks, which are connected by inter-bank links. Then, a model is constructed to simulate different kinds of impacts on financial networks. After the simulation, the results of various situations are analyzed. Finally, it is concluded that large-scale enterprises play a vital role in the financial network. At the same time, this paper also expounds on the disaster that large-scale enterprises will bring to financial networks once they have their own crisis.

Keywords: financial network, enterprise size, banking

1. Introduction

Supply chain plays an increasingly important role in the modern financial system since a large number of supply chains closely link with each other in the financial system, due to which the current world economic system is prone to dramatic collapse. For example, the bankruptcy of one enterprise may lead to many other enterprises' bankruptcy one after another like dominoes. In recent years, under the outbreak of COVID-19, the global supply chain is facing many problems. The situation where upstream enterprises lack supply and downstream enterprises have to stop production is commonly seen. Faced with the inevitable impact brought by the supply chain, different enterprises will suffer different degrees of losses. This paper discusses the impact of enterprises of different sizes on themselves and financial networks. The banking industry is taken as the research object, and the impact of the banking industry is taken as a sample to speculate on the impact that most enterprises will bring. The data obtained from the model in this paper is the evaluation standard to measure the impact. Through the establishment of models and quantitative analysis, the influence of enterprises on themselves and financial networks can be reflected. Because there are not many related research reports at present. The purpose of this paper is to let enterprises make better judgments to deal with the crisis in the face of market shocks with reference to the conclusions of this paper.

2.   Related Literature

2.1.   Theoretical Model

Many economic documents have done a lot of research on the network relationship between banks. The inter-bank market can guarantee each bank in the system against the possible impact that may come and relieve its influence on itself [1]. Allen and Gale's model simply and intuitively shows that the degree of the connection between bank networks will greatly affect the stability of the network [2]. When all banks have only a one-way connection, a small impact on this network may lead to the bankruptcy of all banks. But when all banks are connected with each other, the impact will be distributed to each bank, so that the network will remain stable. But this model also has its defects. First of all, the model only uses four banks as the basis of the model. Too few banks are not conducive to the universality of conclusions. Secondly, the network structure in the model is very simple and not convincing enough to convince people that it is used in the real financial system.

2.2.   Empirical Research

In recent years, the network relationship between banks has been paid more and more attention to. In this context, the number of empirical analyses on the network structure of banks has also surged. These studies use specific data about the banking network, including some interbank risk exposure data. As a salutary lesson, these articles can be regarded as a good reference, such as Austria's Boss et al. [3]. This study is of great significance to the empirical study of inter-bank structure. Finally, the research shows that the banking network conforms to the power law distribution like other networks in reality.

At the same time, it also shows that the network structure of banks is that most banks only have connections with big banks and a few banks of the same level, and there are also connections among a few big banks. However, according to Cont [4], this structure will also lead to a low degree of separation between nodes in the network.

3.   Banking System Model

In order to study, this paper sets up a model to simulate the banking network. According to the previous information, the main connection in banks is the relationship between big banks and small banks. However, there are few connections between big banks and small banks.

3.1.   Construction of a Banking Network

Based on Ebola's theory, each bank is represented by a node in the banking network [5]. Nodes are divided into big nodes and small nodes. Big nodes represent big banks and small nodes represent small banks. The link between the big node and the small node indicates the mutual lending relationship between them with a line without direction. The one-way lending relationship between big nodes and big nodes is represented by directional connection lines. In the model shown in Figure 1, it is assumed that there are four big banks, and each big bank has two-way links with five small banks. Only three of the four big banks have two-way links, and there is no link between one big bank and the other big banks.
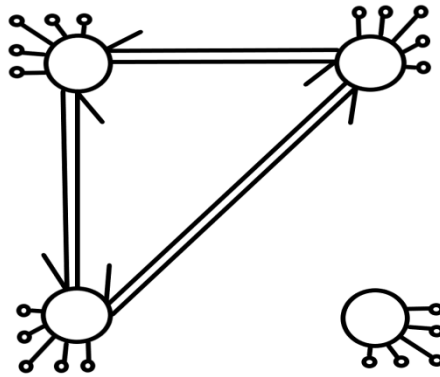
Figure 1: The banking network model.

In this model, the size of the shock is set as m, and the threshold of the maximum shock that the bank can bear alone is set as v. When the impact on a bank is greater than the threshold it can bear, the bank will go bankrupt. In the network model, banks can transfer some of their own shocks to the banks linked to them. Banks of different sizes have different v, and the v of big banks will be much larger than that of small banks.

Because the gap between the v of big banks and the v of small banks is too wide, big banks can generally solve the impact of small banks exceeding the threshold [6]. When a big bank encounters an impact that exceeds the threshold, it will first borrow money from the small banks linked to it on average. If the impact is too great at this time which will lead to all the banks in this small network going bankrupt, the big banks will borrow from other big banks with connections (if there are other big banks with links).

3.2. Simulated Impact

First, the big bank that is not linked with other big banks is simulated. Then, it can be labeled as A. The five small banks linked with it are labeled as b, c, d, e, and f respectively. When faced with a small impact, both big banks and small banks can easily cope. But when the shock gets bigger, the assets of a small bank may not be enough to support it to survive the crisis alone. At this time, it needs loans from big banks to help it tide over the difficulties. However, in the face of a huge impact, even large banks may need help from all small banks, and may even drag down the bankruptcy of all banks in the whole small system. Assuming that every big bank has 10 million assets and its threshold is 5 million, while small banks all have 1 million assets and their threshold is 500 thousand, then, with these conditions, when this small system suffers an impact of more than 7.5 million, all banks will go bankrupt. Ladley [7] said that: the structure of the interbank lending market is considered to have a significant impact on the stability of the financial system. With a small impact, higher connectivity helps to resist infection, but for a larger impact, it has the opposite effect.

Then, the more complicated systems of the other three big banks can be analyzed. In this system, small banks are still linked to only one big bank, so the situation of small banks is roughly the same as that of small banks in the previous small system. The situation of big banks is relatively complicated. When faced with some common shocks, big banks can still tide over the difficulties by themselves and the system of small banks. But when some big shocks come, the interconnection between big banks gives them more chances to survive the crisis. Because of the interconnection between big banks, when a small system is in great danger, big banks can get more funds by asking other big banks for help. Or, supposing that each big bank has 10 million assets and small banks have 1 million assets, and, at the same time, the threshold of big banks is still 5 million, and that of small banks is 500 thousand, then, for a single small system, the upper limit of the impact it can take is 7.5 million. But

for the system of three big banks, the upper limit of the big banks' impact has become 17.5 million, more than twice as much as before. But this is only the theoretical maximum impact threshold. After all, the amount of loans between banks will not be that high.

It should also be known that, with the help of big banks, banks in the whole system can better face the impact on financial networks. But once faced with catastrophe, such close ties will only make the whole financial network collapse faster. Just like what Ozkan described in his paper [8], no system can resist the huge impact of the financial crisis. However, the connection between systems makes the enterprises in the whole system collapse more quickly. Therefore, in a network, large enterprises often play a more critical role, making the enterprises in the whole network survive better. But once big banks have their own crisis, it will bring great crisis to the system. For some small enterprises, it may be a disaster [9].

4. Conclusion

This paper analyzes the influence of an enterprise's scale on the financial network. The perfection of the supply chain makes the financial network more and more developed. Therefore, the importance of the financial network is also worthy of attention. First of all, from the economic literature of inter-bank network relations, it can be known that the degree of the connection between bank networks has a great influence on the stability of the network. And the relationship between the two linked banks is the most stable. Then, through a lot of empirical analyses, it can be found that the nodes in the banking network exist in a power law distribution. At the same time, there is a close relationship between big banks and small banks. The relationship between other banks is not close, and there are occasional connections. Then, the model is established and divided into two categories. One is a large system composed of three big banks with connections to other big banks, and the other is a small system composed of only one big bank. Analysis shows that big banks play a key role in the system and can promote the development of banks in the system. Moreover, the co-existing system of several large banks can better help other banks. But the crisis of big banks may also bring crisis to the whole system.

However, there are still some shortcomings in this paper. The most important one is that, due to the lack of suitable data and related knowledge, the conclusions of the research can not be presented intuitively through data and charts. The conclusion can only be drawn through a plain analysis. And the analysis of this paper can not make full use of the model without the support of data.

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