The evolutionary similarity of the co-shareholder relationship network from institutional and non-institutional shareholder perspectives

Pengli An [a,b], Jinsheng Zhou [a,b,*], Huajiao Li [a,b,*], Bowen Sun [a,b], Yanli Shi [c]

[a] School of Humanities and Economic Management, China University of Geosciences, Beijing 100083, China
[b] Key Laboratory of Carrying Capacity Assessment for Resource and Environment, Ministry of Land and Resources, Beijing 100083, China
[c] Beijing Jiao Tong University Library, Beijing 100044, China

HIGHLIGHTS

- Dividing different sets of shareholders and simulating heterogeneous networks of different shareholders holding listed companies.
- Constructing one-mode derivative co-shareholder relationship networks based on the primitive two-mode network.
- Providing similarity analysis of different co-shareholder relationship networks.
- Providing a new perspective for analyzing relationships among the listed companies.

ARTICLE INFO

ABSTRACT

Shareholders of listed companies can be divided into institutional and non-institutional shareholders. Both groups are important to their listed companies. Many scholars have conducted research on institutional shareholders, some research on non-institutional shareholders, and some scholars have researched similarities of the two shareholder types to reveal co-holding relationships at the shareholder level. However, there are seldom studies of the similarity of the co-shareholder relationship at the listed company level. What are the similarities between the co-shareholder relationships from these two perspectives? In this paper, we apply the complex network theory, which is often used in the financial markets to conduct research, and divide the data of ten major circulating shareholders of the listed companies in China into two parts. We then construct two projected networks that are a common institutional shareholder relationship network and a common non-institutional shareholder relationship network based on the bipartite networks using the decreasing-mode method, in which the shareholders are mediate elements. We analyze the evolutionary similarity of the two co-shareholder relationship networks from three angles, including the contribution rate of the common institutional shareholder relationship network and the common non-institutional shareholder relationship network to the whole network, the behavior intensity of the co-shareholder in the two networks, and the similarity of the two networks. The results indicate that (1) The evolution of the contribution rate of the listed companies with the co-shareholder relationship was influenced by different factors in two projected networks. The evolution of the contribution rate of the co-shareholder relationship in the whole network is consistent with that of the common institutional shareholder relationship network. (2) The intensity of co-shareholder behavior in the common institutional shareholder relationship network

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* Corresponding author at: School of Humanities and Economic Management, China University of Geosciences, Beijing 100083, China.
   E-mail addresses: 13601005388@163.com (J. Zhou), babyproud@126.com (H. Li).

is stronger than that in the common non-institutional shareholder relationship network, and the trend in the whole network is the same as the former. (3) The similarity of the co-shareholder networks is consistent with the change of the co-shareholder relationship and is influenced by the stock market and the difference in the number of co-shareholder relationships. In this paper, we analyze the evolutionary similarity of the co-shareholder relationship between the common institutional shareholder relationship network and the common non-institutional shareholder relationship network and the influence factor of the two networks. This provides a new perspective for analyzing relationships among the listed companies.

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1. Introduction

Listed companies are an important part of financial markets. Scholarly research has examined separate aspects of listed companies, mainly focusing on enterprise performance [1,2], risk management [3,4], stock price fluctuation [5,6], shareholders relationships [7,8] and so on. Shareholders are the owners of the listed companies and can reflect the development status of listed companies from the side [9] and changes in the market [10]. Shareholders of listed companies are classified as institutional shareholders [11] and non-institutional shareholders; in this paper, we regard all shareholders except for institutional shareholders as non-institutional shareholders.

Many scholars have researched the two types of shareholders, focusing on institutional shareholders. Institutional shareholders have vital significance for development of the listed company as a whole, as reflected in enterprise acquisitions [12], the financial distress of listed companies [13] and corporate capital structure [14], etc. Non-institutional shareholders play promoting roles in the development of listed companies, as reflected in profit and loss situation of financial aspect [15]. These two groups of shareholders have significant meaning for listed companies, but what are the similarities and differences between them? Scholars have studied the similarities of the two shareholder groups at the shareholder level [8]. However, they have not considered that at the listed company level, the co-shareholder relationship indicates the same shareholder among listed companies, the comparison of co-shareholder relationship of listed companies between two groups can excavate the principal part which influence the common investment and how to affect the whole co-shareholder relationship network. In this paper, we will analyze the evolutionary similarity of the co-shareholder relationship from the perspectives of institutional and non-institutional shareholders at the listed company level and study the influence factors of two kinds of co-shareholder relationships over time.

Complex network theory provides a method to express information graphically using nodes and the relationships between them. Complex networks are widely used in various fields such as medical science [16,17], biology [18,19] and economics [20,21]. Research perspectives have included the characteristics of the small world [22], the analysis of characteristics of communities [23], topological feature analysis [24,25] and evolution analysis [26,27]. From the start of the 21st century, many scholars have applied the complex network method to aspects of listed companies in the financial markets, such as the fluctuation of stock prices [5] and the Granger causality relationship between listed companies [28]. These researches establish listed companies as the nodes and stock price fluctuations or the Granger relationships as the edges, considering the homogeneous nodes, namely, the listed companies, to establish networks to describe single relationships. However, the financial markets are complex, and the subject of research is not only the listed companies but also the shareholders and executives. Accordingly, scholars use bipartite networks to research shareholder [7] and executive relationships [29], establishing the listed companies, shareholders or executives as the nodes, and the holding relationships of shareholders or company executives as the edges to construct the bipartite network. In this paper, we study co-shareholder relationships among listed companies using the bipartite network and projected network.

In this paper, we divide the data into two parts, specifically, the institutional and non-institutional shareholders of listed companies. We then construct two co-shareholder relationship networks consisting of the common institutional and non-institutional shareholder relationship networks. We construct the undirected weighted homogeneous projected network using the decreasing-mode method [8] (we use the shareholders as the mediate elements) based on the directed unweighted heterogeneous bipartite network. In the bipartite network, since the ten major circulation shareholders are equally important, we only consider the holding relationship between the shareholders and the listed companies. In the projected network, we establish listed companies as nodes and co-shareholder relationships as edges, the number of common shareholder between two listed companies at the same time as weight. We analyze the evolutionary similarity of the two co-shareholder relationship networks based on previous studies from three angles. First, we calculate the contribution rate of the two co-shareholder relationship networks to the whole network, which include both the listed companies with co-shareholder relationships and co-shareholder relationships. We then analyze the co-shareholder behavior intensity, which is the number of co-shareholder relationships of one listed company with other listed companies in the two networks. Finally, we research the similarity of the two co-shareholder relationship networks to reflect the similarities and differences.

We use LI–LI and LNI–LNI as abbreviations to represent the empirical networks, namely common institutional shareholder relationship network of listed companies and the common non-institutional shareholder relationship network of listed companies, respectively, and two networks are both acquired through shareholders as intermediaries.