Credit networks and systemic risk of Chinese local financing platforms: Too central or too big to fail? –based on different credit correlations using hierarchical methods[☆]

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HIGHLIGHTS

- We first studied the Chinese local financing platforms networked structure from below.
- We used the new credit similarity measure to extract the MSTs and HTs.
- The MSTs and HTs based on different credit correlations are heterogeneous.
- The too-big-to-fail and too-central-to-fail policy were compared.
- Key platforms and regions of systemic importance were revealed by the MSTs and HTs.

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ABSTRACT

The accelerating accumulation and risk concentration of Chinese local financing platforms debts have attracted wide attention throughout the world. Due to the network of financial exposures among institutions, the failure of several platforms or regions of systemic importance will probably trigger systemic risk and destabilize the financial system. However, the complex network of credit relationships in Chinese local financing platforms at the state level remains unknown. To fill this gap, we presented the first complex networks and hierarchical cluster analysis of the credit market of Chinese local financing platforms using the "bottom up" method from firm-level data. Based on balance-sheet channel, we analyzed the topology and taxonomy by applying the analysis paradigm of subdominant ultra-metric space to an empirical data in 2013. It is remarked that we chose to extract the network of co-financed financing platforms in order to evaluate the effect of risk contagion from platforms to bank system. We used the new credit similarity measure by combining the factor of connectivity and size, to extract minimal spanning trees (MSTs) and hierarchical trees (HTs). We found that: (1) the degree distributions of credit correlation backbone structure of Chinese local financing platforms are fat tailed, and the structure is unstable with respect to targeted failures; (2) the backbone is highly hierarchical, and largely explained by the geographic region; (3) the credit correlation backbone structure based on connectivity and size is significantly heterogeneous; (4) key platforms and regions of systemic importance, and contagion path of systemic risk are obtained, which are contributed to preventing systemic risk and regional risk of Chinese local financing platforms and preserving financial stability under the framework of macro

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prudential supervision. Our approach of credit similarity measure provides a means of recognizing "systemically important" institutions and regions for a targeted policy with risk minimization which gives a flexible and comprehensive consideration to both aspects of "too big to fail" and "too central to fail".

1. Introduction

The recent economic crisis, which began with the burst of the housing market bubble in the US, has highlighted the networked structure of the economic world [1–3]. The land market bears close relationships with the financial system and plays a crucial role in economies, hence, the collapse of a real-estate bubble usually exerts disastrous consequences of financial crisis and economic recession. As it is increasingly accepted that financial networks play an important role in stability properties of the financial system [4–12], there has been much focus on how network theory can be used to explain financial markets, and better understand and quantify systemic risk of the economic and financial system [13–20]. Due to strong connectivity, catastrophic cascading failure of nodes in networks can happen in case of system shock, especially when shocked nodes represent hubs, or have high centrality measures in the network [21–23]. Scholars have paid main attention on the determination of the so-called "systemically important" financial institutions for discussions of systemic risk, thus leading to the significant question: whether institutions are of systemic importance because they are "too big to fail" or "too central to fail" [24], on which universal agreement has not been reached [7,25,26]. In credit networks describing the complex credit relation between firms and banks, hierarchical methods have been used to detect the backbone of the networked structure and identify institutions of systemic importance [27,28]. However, research achievement on hierarchical structure of credit networks has been limited to the perspective of "too central to fail" due to the correlation measure only considering the connectivity from banks to firms [29].

Recently, the accelerating accumulation and risk concentration of Chinese local financing platforms debts have attracted wide attention throughout the world. Preventing systemic risk and regional risk of Chinese local financing platforms and preserving financial stability is therefore one of the priorities of regulators and central banks in China. It is widely accepted that there is overreliance of financing platforms on land financing; the uncertainty of land income, however, will exert credit risk to local financing platforms [30–32]. With the slowdown of China's economic growth, a crash of the land market will probably induce systemic risk in the local financing platforms, endangering the quality of bank credit assets and the security of financial system [32,33]. In fact, the stability of the financing platforms is strongly related to the underlying structure of credit relationships among its components [34–36]. The failure of a big firm may lead risk contagion occur as a domino effect, and an example of such scenario happened in Japan during the 1990s. The empirical study of the Japan credit network showed that both the degree distributions of firms and banks follow a power law and the hubs are banks, which occupy the central positions in the network [28]. Same conclusion was also drawn from the empirical study of Italy case [27]. Based on the empirical study of the Japan and Italy cases, authors held that the topology of the credit network plays a crucial role in bankruptcy diffusion and that complex credit relationships could possibly trigger the financial systemic risk [27,28,37].

While networks have been widely used to model the interactions among financial institutions, recent progress has been achieved in the research on the correlation based networks. Correlation-based network analysis can reduce complexity of financial dependencies and extract the most important information in the system, which is conducive to understanding and forecasting the dynamics in financial markets [38,39]. There are different methods to construct correlation-based networks; concerning hierarchical methods, Mantegna [40,41] was one of the first to apply the analysis paradigm of subdominant ultra-metric space to financial markets, and introduced a method for finding a hierarchical arrangement for a portfolio of stocks by extracting the minimum spanning tree (MST) from the complete network of correlations of daily closing price returns for US stocks. This type of analysis has been performed afterwards in many different markets, time periods, and market conditions [42–46]. Scholars applied Mantegna's method to the field of the bank–firm credit relationships and have successively analyzed the credit networks of Italy and Japan based on the connectivity from banks to firms [27,28]. Although great attention has been paid to the architecture of credit relationships in Italy and Japan, the complex network of credit relationships in Chinese local financing platforms remains unknown, which makes it difficult for scholars to further explore the systemic risk of local financing platforms. Liu et al. [47] hold that the correlated risk is the latest and the most typical characterization of credit risk in China, but most studies on risks of local financing platforms are not conducted from the perspective of correlated credit risk.

It has been found that correlated credit risk shows a strong geographical characterization. De Masi et al. [28] analyzed Japanese credit relationships based on the network of between firms and banks in 2004 and found that the minimal spanning trees disclose a highly hierarchical backbone and demonstrated a strong geographical characterization. Geographical clusters can be also identified in the Italian market: De Masi and Gallegati [27,37] found that heterogeneity appears among co-financing banks, small banks exert great exposure to risk to the bankruptcy of large banks, and the systemic risk is more probable to happen on a regional scale because of the geographical nature of MST. In China, Ba et al. [48,49] hold that four types of local risks exist in the debts of local financing platforms in terms of regions, and regional concentration risk is the