

Research on Financial Risk Monitoring and Early Warning in China Based on Big Data Analysis

Yizhi Wang

Kansas State University

yizhiw@ksu.edu

Abstract. With the continuous development of China's economy, the financial industry plays a more and more important role in the national economy. At the same time, the financial risk(FR) are increasing and becoming increasingly complex. While sharing the huge benefits brought by financial globalization and financial deepening, China is also faced with greater FR from home and abroad, which greatly increase the possibility of financial crisis in China. In order to enhance the initiative of risk management and ensure the smooth operation of asset quality, we must rely on a powerful system tool, make use of the international advanced risk early warning management concept, and use Internet thinking and data mining technology to dig deep into hidden risk factors, discover hidden risks in advance and deal with them in time, so as to ensure the automatic monitoring ability of credit business. Based on the theoretical research on the generation, accumulation and diffusion of systematic FR, this paper explores the introduction of big data methods into the research on systematic FR in China, comprehensively uses traditional and emerging indicators and models in big data network analysis methods, analyzes the contagion effects of regional systematic FR from multiple perspectives and levels, improves research methods, and enriches research perspectives. The introduction of SIRS model on scale-free network provides a new powerful tool for the study of regional systemic FR.

Keywords: Big data analysis, Financial risk, Monitoring and early warning

1. Introduction

Since the reform and opening up, China's financial industry has seized the opportunity of the times, adopted the gradual financial system reform, expanded the financial openness, strengthened the dirty management of the financial industry, improved the service quality of the financial industry, and achieved great results. The development of the financial industry has played an important role in national economic stability and social stability [1]. Marketization of interest rate is a process of survival of the fittest. If the ability of risk management can't keep up with the requirements of the times, banks may go bankrupt or be eliminated. On the contrary, if a bank is fully prepared, it will be able to seize opportunities and seize market opportunities [2]. These crises not only caused serious harm to the countries where the crises broke out, but also had an immeasurable impact on the global financial market and the development of the world economy. The constant outbreak of FR has plunged the global economy into turmoil, distorted the order of financial activities, and endangered the normal development of society. The trajectory of FR-financial crisis-economic crisis shows more clearly the importance of strengthening FR early warning and financial supervision. Therefore, how to prevent and resolve FR has become an important part of China's financial supervision, and establishing a sound FR early warning system is an important guarantee for preventing and resolving FR [3].

Financial risk estimation refers to the estimation and prediction of the probability of risk occurrence and the extent of loss based on the first stage, through the analysis of a large number of detailed loss data collected, using probability theory and mathematical statistics. This stage is extremely complex and difficult, but it makes the entire FR management based on science and makes risk analysis quantitative, It provides a reliable basis for selecting the best FR management tool [4]. In this case, the multifarious, large-scale and interrelated micro financial data are continuously collected to serve the systematic FR monitoring and early warning, which puts forward higher requirements for economic and FR data management and analysis capabilities [5]. On the other hand,

in recent years, with the rapid development of financial science and technology, the innovation of financial products is emerging one after another, the structural change of the financial system is accelerating, the risks of financial institutions have undergone essential changes, and the concealment, complexity and infectivity of systematic FR are more prominent. The traditional systematic FR monitoring and early warning method is the product of the era of "small data", and the ability to collect and analyze data is limited, Inadequate foresight and accuracy of risk analysis and judgment are likely to lead to narrow vision of financial supervision, late regulatory action, weak regulatory measures and other problems, and it is difficult to effectively prevent systemic FR and respond to the challenges posed by the rapid development of financial technology [6]. Therefore, establishing a FR early warning indicator system, monitoring and analyzing relevant early warning indicators at any time, establishing a FR early warning model suitable for China's national conditions, and taking corresponding measures and formulating corresponding policies in a timely manner according to different situations are of great practical significance for strengthening China's FR resistance, resisting the impact of the international financial crisis, promoting China's economic development and maintaining social stability [7].

Based on the big data method, this paper studies the monitoring and early warning of systemic FR, which has a strong practical significance in the current financial development situation and FR. Its innovation lies in:

(1) Monitoring and early warning of systemic FR is an important aspect of implementing macro-prudential supervision. Applying cutting-edge technologies such as machine learning and deep learning to monitoring and early warning of systemic FR can further improve the means and tools of macro-prudential supervision. (2) Compared with the traditional statistical and econometric models, the big data model has a higher prediction accuracy. Therefore, using big data analysis method can greatly improve the accuracy and effectiveness of systemic FR model prediction.

2. Theoretical Research on Systemic Financial Risk

2.1. Theoretical Basis of Systematic Financial Risk

The research on systemic FR began in the 1980s. Since the outbreak of the international financial crisis that affected the whole world in 2008, systemic FR has increasingly become the focus of attention and discussion by governments and academia. However, there is still no unified view on the accurate definition of systemic FR internationally [8]. Systemic FR not only affect the micro individuals of each financial market, but also impact the smooth operation of the entire financial system and even the macro-economy. It can be considered that systematic FR covers all sectors of the economic system, because its impact affects a wide range of subjects including investors, consumers, financial intermediaries, enterprise departments, regulatory agencies, government departments, etc. At the same time, because financial institutions, residents, enterprises and the government have close financing and lending relationships, and the relationship between various subjects is complex, Therefore, when some financial institutions, especially systemically important institutions, suffer from internal difficulties or external shocks, they will have a chain reaction, leading to the transmission of risks to other financial institutions and other sectors of the economic system, which will have a broad and far-reaching impact [9]. The industrial chain financing platform system has realized taking the relevant enterprises in the production, supply and marketing chain as a whole, setting up financing schemes according to the transaction relationship and industry characteristics, injecting funds into relatively vulnerable SMEs, and providing comprehensive services for large enterprises [10].

The core system mainly provides functions such as general ledger and sub-ledger management of accounting, synchronizes the loan sub-ledger information in related business systems to the core system, and registers the actual debit and credit information in the general ledger in real time or regularly according to various summary accounts, institution codes, debit and credit currencies, amounts incurred, balances, etc., and provides ledger books of various accounting data such as assets,

liabilities, owner's equity, costs, expenses, income and achievements, which are used to generate accounting statements, financial plan management and on-balance sheets. The risk early warning management system can be summarized as: early warning information center+early warning dispatch center, as shown in Figure 1. By building an early warning information center, internal and external risk information can be collected, sorted out and analyzed, and centralized early warning control and joint prevention and control of the whole bank can be realized.

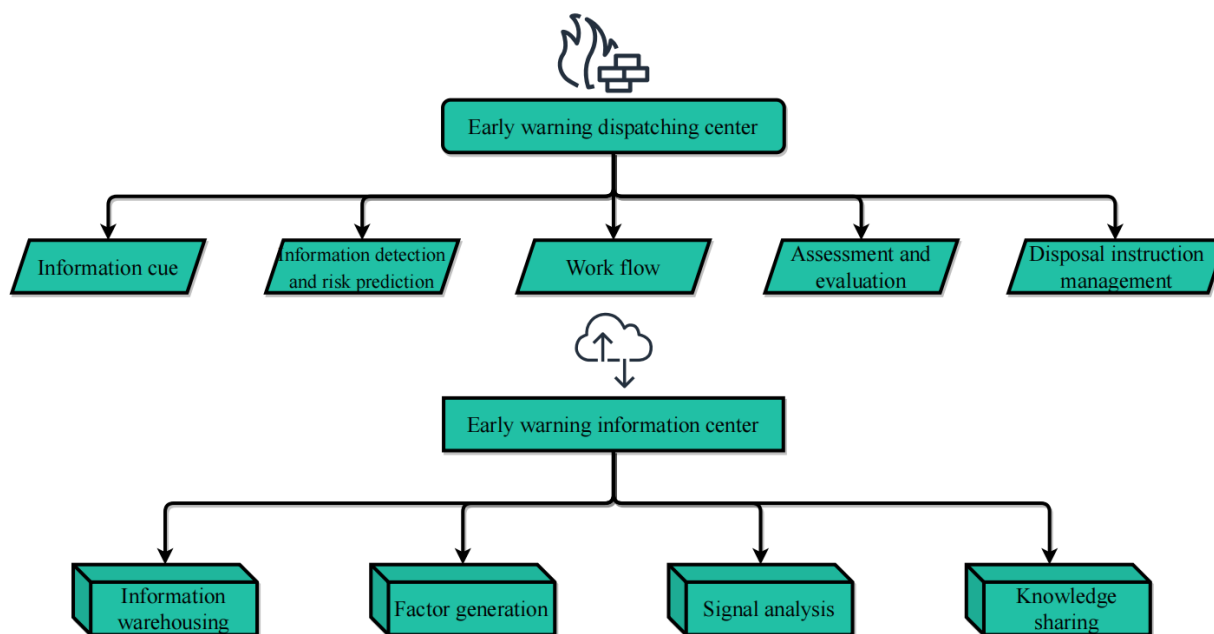


Figure 1. System business architecture

The information platform will plan and design the information framework of each latitude in the risk information management platform, lay a good foundation, standardize the original information, standardize the analysis and processing tools and standardize the information processing results, and ensure the data quality and availability in the platform.

2.2. The Evolutionary Mechanism of Systemic Financial Risk

The financial crisis will have a significant impact on a country's financial system and real economy. Therefore, the identification and early prevention of FR have become the key to ensure the steady operation and sustainable development of national economy. It is necessary for all countries to establish a flexible and effective early warning system to improve their risk prevention ability. In addition to the same advantages of FR model in terms of indicator selection and ease of use, this model also considers country differences, but the conditions are harsh and the indicators are incomplete. Only exchange rate, domestic private loans, international reserves and broad currency ratio are considered. And the dominant idea of the model is to delineate countries that may have a crisis, and it fails to give an accurate prediction of the time of the crisis. The share of the actually sent bad signal (noise) divided by the share of the actually sent good signal is the noise signal ratio, and the threshold is defined as the minimum noise signal ratio. The biggest advantage of this model is that it can use mathematical methods to determine the variables that are significantly related to the occurrence of the currency crisis as the leading indicator of the occurrence of the currency crisis, and calculate the critical value of this indicator to predict the occurrence of the crisis. In order to compare the similarities and differences between the economies and finance of these countries and regions and Mexico, 10 economic and financial indicators are selected. They are: real exchange rate, real GDP growth rate, relative inflation rate, international and domestic interest rate differentials, changes in

international and domestic interest rate differentials, real interest rate, domestic savings rate, international trade balance, current account balance, and the proportion of foreign portfolio investment and foreign direct investment. According to the sampling survey, the proportion of non-performing loans of many trust and investment companies is as high as, while the Interim Measures for the Administration of the Asset Liability Ratio of Financial Trust and Investment Institutions promulgated by the People's Bank of China stipulates that the proportion of overdue loans and the proportion of loans collected shall not exceed and.

A few urban and rural credit cooperatives have irregular management, serious off-balance-sheet operation, high proportion of overdue and sluggish loans, successive losses, declining asset quality year by year, and some of them are insolvent and on the verge of bankruptcy. In addition, some securities companies have engaged in securities repurchase business in violation of regulations, and their funds are occupied on real estate, which in fact cannot be recovered at maturity, resulting in payment difficulties. Although countries all over the world are gradually relaxing the supervision of the market, this does not mean simply canceling the existing regulation. In the long run, in order to adapt to the new social development, new market rules and legal procedures are inevitable, and examples of risks caused by legal changes are common in both financial and non-financial industries. During the period of credit expiration, industrial capitalists are eager to sell their goods in exchange for money, and the pursuit of money has become a common trend. When one payment chain after another and the artificial system to replace payment are broken, the currency crisis occurs. Commodity prices have dropped sharply, stock prices have plummeted, banks have closed down, industrial and commercial enterprises have gone bankrupt one after another, factories have started less and less, output has dropped sharply, and more and more unemployed workers have become unemployed. The crisis of the whole economic system has started to erupt in an all-round way. However, Marx finally believed that although credit promoted and strengthened the crisis process, the root of the crisis was still the basic contradiction of capitalism.

3. Research on Financial Risk Early Warning Model Based on Big Data

3.1. Macroeconomic risk early warning model

Drawing on international experience and integrating the actual situation of our country, we can monitor FR from a macro perspective. The main indicators for monitoring FR are some financial relative indicators closely related to macroeconomic operation. Inflation is a central topic of modern macroeconomic theory. J. Tobin defines inflation as "the general rise in the price of goods and services". Since 1994, the change law of domestic inflation level is more consistent with the theory of economic boom cycle, that is, with the economic warming, the inflation pressure gradually increases, and with the economic slowdown, the inflation pressure decreases. Therefore, inflation can reflect the overall characteristics of macroeconomic changes. Excessive inflation reflects that the economy tends to overheat and macroeconomic risks increase. The purpose of this part is to use the binary choice model to establish a macroeconomic crisis warning model, predict the possibility of a crisis in the next six months, and give a three-month lag period of the crisis, because after the crisis, macroeconomic operation needs a period of adjustment to recover to a more stable state. The real crisis signal curve can be obtained as shown in Figure 2.

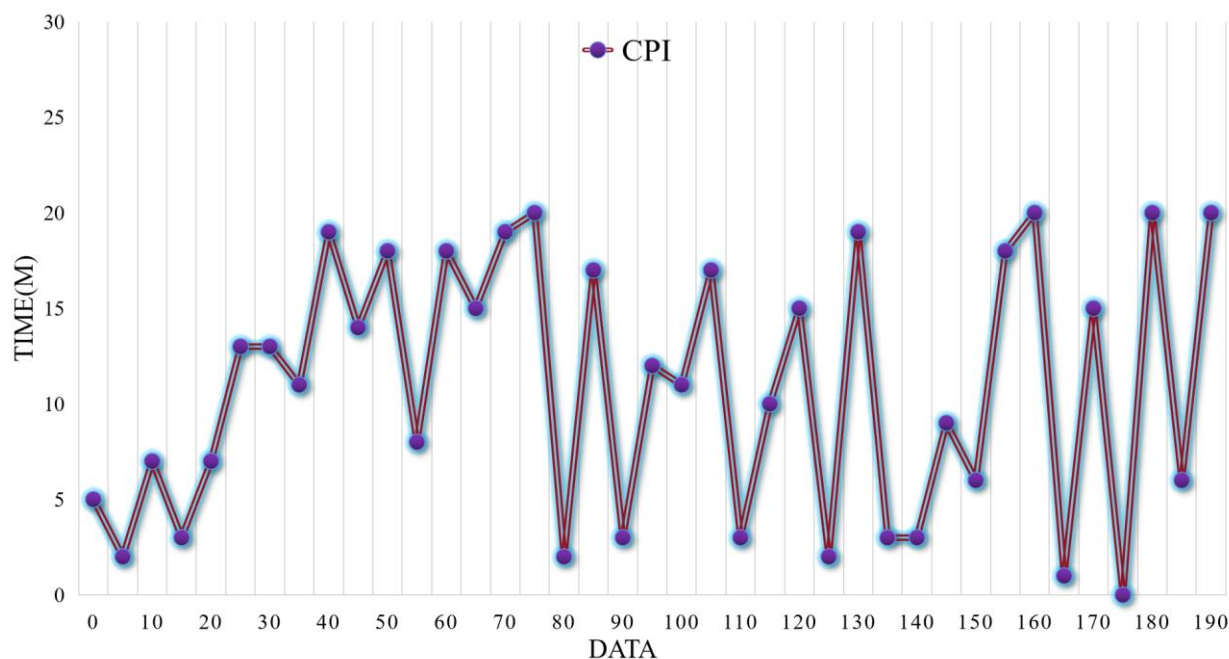


Figure 2. China's macroeconomic crisis index curve

As can be seen from the figure, it is generally believed in academic circles that China's inflation is influenced by many factors, mainly including cost-driven, demand-driven, exchange rate changes and structural factors, etc., and each factor has a significant impact on China's inflation. Excessive inflation will inevitably worsen the economic environment. When the economy is growing at a high speed under severe imbalance, the total demand will greatly exceed the total supply, which will show a high inflation rate, which is a sign of the deterioration of the economic situation. If no control measures are taken, it will surely lead to future "stagflation" (inflation and growth stagnation coexist). We consider selecting indicators with strong representativeness in the changes of macroeconomic operation, and these indicators should be highly sensitive to the occurrence of financial crisis. In order to get the impact of each index on the macro-economy, the Granger causality test between each economic index and CPI was conducted. With China's financial industry opening to the outside world in an all-round way, and facing the influence of financial liberalization and financial globalization, the ability of China's banking industry to resist risks is seriously insufficient. In this case, building an effective early warning system of bank risks and crises is of great significance to China's financial security.

3.2. Experimental results and analysis

In order to better prevent and resolve various FR of Agricultural Bank of China, it is necessary to establish a more perfect FR early warning system on the basis of the risk monitoring index system and the simple FR early warning system. Since systemic FR mainly refers to the possibility of a series of continuous losses in the financial system caused by extreme events, according to the macro impact and micro mechanism of such loss possibility, the existing ways to describe systemic FR can be roughly divided into two categories: from the macro perspective, the possibility of loss will lead to the loss of the basic functions of the financial system. Relevant studies, from the perspective of reflecting the overall functional stability of the financial system, Financial condition index (FCI), financial stability index (FSI), financial stability index (FSCI) and financial vulnerability index (FIX) are proposed to describe systemic FR; From the perspective of micro mechanism, the possibility of loss will also affect the psychology and emotions of economic subjects, thus forming pressure on financial transactions, credit allocation and other behaviors of economic subjects. Therefore, relevant studies use the Financial Stress Index (FSI) to describe systemic FR from the perspective of reflecting the psychology and emotions of economic subjects.

The functional objectives of China Bank's risk early warning system mainly include: First, the early warning function, that is, through a series of risk early warning indicators and the judgment of indicators, the early warning of risks is realized, including measuring the risk status of grass-roots agricultural banks and evaluating the risk level; The second is the real-time monitoring function, which makes a risk assessment on the changes of risks through real-time monitoring of all kinds of risk indicators and capital operation of Agricultural Bank of China; Third, it is the function of risk prediction. According to the calculation of each risk indicator and the record of historical changes, it predicts the changes of future risks, and constantly adjusts the risk monitoring indicators and risk evaluation standards according to the changes of risk status and regulatory requirements. According to the internal structure of the software and the rules of each development stage, all the programs in the software are tested according to the existing test cases and methods, so as to realize the complete test of the software. By doing so, the program errors can be detected as much as possible, the functional defects and errors in each module of the system can be reduced, so that all units in the system can correctly realize their expected functions, and then they can cooperate with each other to ensure the integrity of the overall functions and performance of the system, improve the stability and effectiveness of the software system, and ensure the quality of the software at the same time, so that the final software Whether the threshold value is determined properly has great influence on accurately monitoring the changes of various economic indicators and making a correct judgment on the whole national economy.

When determining the early warning threshold of early warning indicators in China, it should be considered comprehensively according to the past economic changes or economic cycles, the role and nature of various variables in economic activities, the macro-control policies adopted in various periods, and the objectives of future economic development plans. Therefore, regional FR obviously exist, which requires paying attention to the research and establishment of risk monitoring and early warning mechanisms of regional financial institutions and local commercial banks.

4. Conclusions

The real value of big data is like an iceberg floating in the sea. At first sight, only one corner of the iceberg can be seen, and most of them are hidden on the surface. Proceeding from reality, we have classified and identified the FR of Agricultural Bank of China, and made a detailed analysis of the situation of various FR and the corresponding regulatory situation. The monitoring index system and risk evaluation method of commercial banks' FR are studied in depth, and scientific and reasonable index system and evaluation method are selected to establish the evaluation model of commercial banks' FR system and the prediction model of commercial banks' FR system. In this paper, a crisis early warning model which can reflect the reality of our country is preliminarily established, and some meaningful conclusions are obtained, but there are still many shortcomings in this paper. So as to establish a more effective FR early warning system, which is bound to better grasp the economic and financial trends and play a preventive role. The absence of warning signals does not mean that there is really no potential possibility of financial crisis in China in the future. Financial crisis warning is still of great significance to China.

References

- [1] Xia X, Chen Z, Wei W. Research on Monitoring and Prewarning System of Accident in the Coal Mine Based on Big Data[J]. Scientific Programming, 2018, (2018-3-6), 2018, 2018(3):1-10.
- [2] Huang Z, Mao C, Guan S. Simulation research on the deformation safety monitoring and evaluation algorithm of coastal soft foundation pit based on big data[J]. Soft Computing, 2021, 23(3):23-26.
- [3] Li G, Xiao M, Yang X. Research on multiple bubbles in China's multi-level stock market[J]. PLOS ONE, 2021, 16(2):26-28.

- [4] Wei X, School I E, University Y. Software Implementation of Financial Risk Early Warning Analysis[J]. Electronics World, 2018,22(11):6-10.
- [5] Wang D, Ye T, Tian S. Reexamining Spatiotemporal Disparities of Financial Development in China Based on Functional Data Analysis[J]. Mathematical Problems in Engineering, 2021,33(10):6-12.
- [6] Ding Q. Risk early warning management and intelligent real-time system of financial enterprises based on fuzzy theory[J]. Journal of Intelligent and Fuzzy Systems, 2020, 40(6):1-11.
- [7] Zhang C, Zhong H, Hu A. Research on Early Warning of Financial Crisis of Listed Companies Based on Random Forest and Time Series[J]. Mobile Information Systems, 2022, 2022(3):1-7.
- [8] Zhang C, Wang Z, Lv J. Research on early warning of agricultural credit and guarantee risk based on deep learning[J]. Neural Computing and Applications, 2021,26(1):66-68.
- [9] Bao R, Lin J. Research on risk early warning algorithm for asymmetric samples in multifractal financial market[J]. Journal of Intelligent and Fuzzy Systems, 2021,2021(9):1-11.
- [10] Zhu Z, Liu N. Early Warning of Financial Risk Based on K-Means Clustering Algorithm[J]. Complexity, 2021, 2021(24):1-12.