



Construction of Financial Market Risk Early Warning Model Based on Artificial Intelligence Technology

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Abstract. Since the 1980s, world economic integration, the financial industry has become the core of social development, and the accompanying financial risks have become a relatively difficult problem for countries. The complexity and diversity of financial business and the rapid increase of uncertainty factors have led to a significant increase in risks and may lead to financial crisis when accumulated to a certain extent. Once a financial crisis breaks out, it will lead to social and even political crisis in addition to economic recession. Its main purpose is to provide investors with timely information about financial market risks, so that they can make better decisions and thus increase profits.

Keywords: Financial market · Artificial intelligence technology · Risk warning

1 Introduction

As an emerging developing country, China's economy has been basically geared towards good development, and all industries have shown a vigorous and upward trend. However, there are still potential financial risks that cannot be ignored: imperfect financial laws and regulations, lack of strong supervision and management, and market access mechanisms that need to be discussed. After China's entry into WTO, the financial supervision has been gradually relaxed, and the competition among global industries has led to the further expansion of the scope of China's implied financial risks [1]. In addition, due to the large scale growth of China's shadow banks at this stage, and there is a foam in the real estate industry, various signs show that China's finance is facing financial risks that cannot be underestimated. Therefore, it is urgent for China suitable for its own situation, so as to monitor various financial risks in a timely manner.

The existing domestic and foreign literature on financial risk focuses more on some developed countries and countries that have had financial crises. Most of the financial risk prevention strategies are proposed for countries that have experienced financial crisis. The research conclusions have their own shortcomings: the subjectivity is too strong in the empowerment of the indicators of the analytic hierarchy process. so we can not directly use foreign pre-warning models when using financial risk pre-warning models for China. The some of them are still introducing foreign theories and models [2]. The detection process is shown in Fig. 1 below.

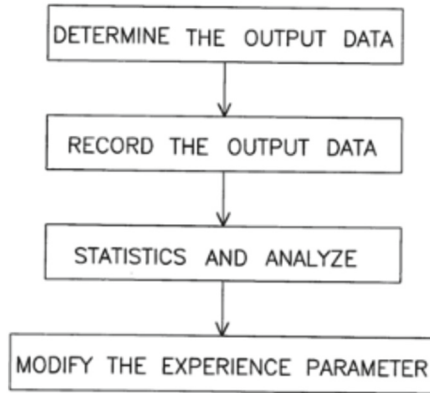


Fig. 1. Detection Process

Chinese scholars still rely on foreign indicator selection systems, and have not conducted research based on China's specific national conditions. In different periods and countries, the influencing factors of financial risks have different characteristics. In recent years, China is an emerging market that has been in the process of reform. Financial risk has its unique characteristics and representativeness. The theoretical analysis of financial risk in China will further enrich the theoretical system of financial risk.

2 Related Work

2.1 Overview of Domestic Research

There were few empirical studies. Most of the methods used were signal methods, supplemented by multivariate statistics and information systems. Chen Songlin (1997y24) combined the internal and external generation mechanism of financial risk, analyzed the systematic risk factors and non systematic risk factors respectively, and built a more perfect financial risk monitoring indicator system. He believed that because some financial risk played a catalytic role, it promoted the continuous spread of financial risk, and finally led to the financial crisis. Based on this, he added other risks that might trigger the crisis to the model, and built A relatively complete risk measurement model [3]. Cao Wenlian and Xu Xiaobo drew on the achievements of foreign research, combined with the actual domestic conditions, and theoretically combined with macro, meso and micro level research, analyzed and constructed the early warning indicator system of financial risk in China. Liu Zhiqiang re established a set of early warning indicator system after learning from foreign research methods on early warning indicators. The system is composed of two parts: one is about the asset quality, profitability, credit growth level and interest rate of domestic financial institutions; Second, indicators such as foreign debt investment and exchange rate [4]. At the same time, he proposed that this set, but there is no necessary explanation on the determination of indicator threshold in his research. The service supply chain is shown in Fig. 2.

He Xiaobo and Zhang Yuhong used KLR signal light display method to build input, calculation and output modules, cluster analysis method, subjective analysis method



Fig. 2. Service supply chain

(analytic hierarchy process) and objective analysis method (entropy method) to build a risk early warning system for commercial banks, and conducted empirical analysis. This method intuitively shows the risk status of banking and financial institutions. Feng Yun and Wu Chongfeng proposed a multi time scale early warning process. By classifying and supplementing the early warning process, they classified it into three levels: long-term, medium-term and short-term. They proposed a method to add multi time scale and supplement indicator sets with changes in financial risk. This method makes the system sensitive to changes in market insight. Zhang Ying sorted out the early warning methods for the currency crisis, predicted the financial crisis in six aspects, and established an early warning indicator system.

Whose research objects are mostly developed countries, does not conform to the special situation of China. However, domestic research on it has just begun, and most of the existing research methods and models abroad are used to study the economic situation of a certain period in China. The existing early warning model research is slightly outdated, and it is urgent to build a risk early warning model suitable for domestic situations.

2.2 Concept Analysis of “Artificial Intelligence”

Since the birth of the name “artificial intelligence”, until now, the field of artificial intelligence has become a hot field of extensive research. Researchers still have not formed a clear and unified view on what is “artificial intelligence”. As for the definition and connotation of AI, Russell’s representative view is that AI is divided into four types of systems: “thinking rationally acting rationally like human beings”. These four definitions point to two dimensions respectively. One is the internal standard of AI, which focuses on thinking or behavior, The second is the realization of artificial intelligence, which is to imitate human beings or to learn independently.

Searle classified AI in terms of the extent to which the development of AI can be achieved, namely weak AI and strong AI. Weak AI means that no matter how intelligent AI is, its essence is still the simulation of human behavior. AI itself does not have the ability to think about behavior and act accordingly; Strong AI means that AI can think and act independently, and its behavior is no different from human behavior. We can think of it as a universal intelligent AI with human intelligence level or even beyond human intelligence level. Searle believes that people can create weak AI, but opposes strong AI. The different dimensions and approaches make the development of AI form different schools and research directions.

3 The Fragility of the Financial System Itself

The financial institutions and the internal fragility caused by the irrational economic activities.

① The fragility of financial markets.

The formation, accumulation and gradual extreme deterioration of financial system risks caused by the sharp fluctuation of asset prices in financial markets (capital markets and foreign exchange markets, etc.). For example, when the interest rate of a country's money market rises, the inflow of foreign funds will probably lead to the rise of asset prices in the market, which will lead to foam. The influx of capital will also lead to the rise of the value of the local currency. If the funds are withdrawn, the asset quality will shrink rapidly and substantially, leading to hidden risks and financial crisis. In addition, more and more homogeneous financial markets will also lead to financial risks. Homogeneous risk refers to the financial risk generated when the financial market gradually moves towards comprehensive operation and internationalization, which makes the thinking mode, professional technology and financial supervision standards among financial markets tend to be the same, and ultimately leads to the consistency of expectations and behaviors. Consistent actions have the same direction of action and cannot offset each other, resulting in sharp fluctuations in asset prices and rising financial risks.

② The Lending Characteristics of Financial Institutions and the Internal Vulnerability of Their Structures

The vulnerability of financial institutions due to their high leverage characteristics, coupled with the problem of principal-agent of financial institutions, has strengthened the risk of financial system. On the one hand, due to the excessive debt scale and the high leverage ratio of the balance sheet of financial institutions, a small decline in asset prices is likely to cause cost losses of financial institutions. On the other hand, the asymmetry between its earnings and the risks and responsibilities it bears, the lack of supervision and the government's assistance have caused financial institutions to ignore the interests of shareholders and depositors, leading them to pursue high profits in high-risk businesses and increasing the risk of investors. Based on the "Financial Vulnerability Hypothesis" put forward by Mins in 1997, he divided enterprises into three types, namely, risk aversion, investment and Ponzi enterprises, according to their increasing risks, and analyzed that commercial banks must experience cyclical crisis and bankruptcy wave due to their inherent characteristics. The risk of a single bank will spread to the entire banking system, and eventually the financial crisis will break out.

③ Irrational Behavior of Financial Market Subjects

In most cases, financial market economic entities are rational in their activities, but a large number of irrational behaviors will eventually lead to the outbreak of financial crisis. The irrational behavior in the financial crisis is divided into three stages: craziness, fear and collapse, describing the different psychological processes of investors. However, there are widespread irrational behaviors. Investors' common irrational expectations have led to "irrational prosperity" and the existence of asset price foam. In the case of relatively flat supply and demand, asset prices must decline sharply after the surge.

4 Model Building

In the 1970s, the American scholar Sadi (a professor at the University of Pittsburgh in the United States) proposed the AHP method. According to the nature of different problems and the overall goal to be achieved, the method decomposed the problem into multiple influencing factors according to the complexity of the problem, and arranged them hierarchically according to the subordination relationship between the factors, thus forming a multi-level structural model. Finally, the comparison method is used to establish the importance order and corresponding weight value of each level and each factor. Since the 1980s, the Analytic Hierarchy Process (AHP) has been introduced into China. Because of its characteristics of combining qualitative and quantitative methods to solve different decision-making factors, it has been widely used in many fields of economic activities in China, such as scientific research evaluation and economic management.

Centering on the overall status of financial risk of AI technology, the hierarchy diagram, as shown in Fig. 3.

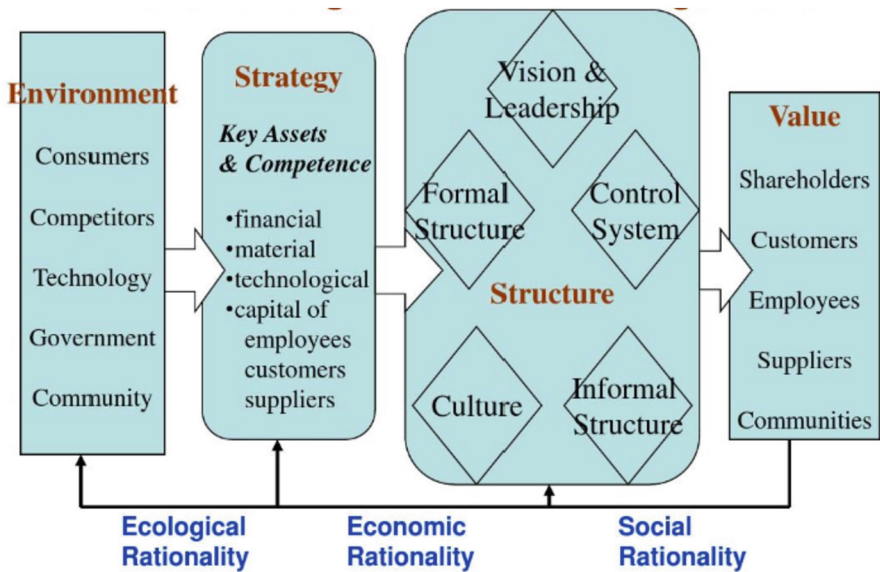


Fig. 3. Hierarchy Chart of Financial Risk Early Warning Indicators

Regression analysis is an effective method to establish risk early warning models. However, because there is usually a linear relationship between economic variables, when using regression methods to establish early warning models, multiple collinearities are usually encountered. Therefore, using the principal component method to solve the collinearity between independent variables becomes a means to deal with the problem of collinearity. This paper constructs the principal component regression model. When collinearity occurs, the regression model constructed by the least squares method will increase the variance of parameters, making the regression equation very unstable, and the regression equation and regression coefficient will not pass the significance test. This paper selects the principal component regression method when studying the risk early warning model, uses the 14 indicators of the signal display model to take the logarithmic variable as the independent variable, and uses the CVaR of the logarithmic return rate of the Shanghai Stock Exchange Index as the substitute variable of financial risk to establish the principal component regression model.

5 Conclusion

At the present stage, China's financial industry has a low level of development and its regulatory system needs to be improved urgently. Therefore, maintaining financial stability and preventing financial risks have become an urgent task. Especially today, when the global economy is gradually becoming synchronized, we should effectively control our own financial risks to prevent the spread of international financial risks. In order to prevent and control financial risks in China, we need to further understand financial risks and their supervision, and strengthen the prediction and control of financial risks in the financial system. On the other hand, on the basis of building a complete and effective early warning indicator system, it is urgent to build the measures that match it. The measures should include efficient laws and regulations, reasonable operation mechanism, complete organizational, we should comprehensively consider the impact of political, cultural and social non economic factors on China's finance.

References

1. Hong, W.: Research on financial crisis early warning mechanism of listed companies based on logistic model and factor analysis. *Ind. Econ. Rev.* (2017)
2. Zhu, M.R., Fang, W., Song, Y.: The research of sme financial crisis warning model based on neural network. *DEStech Trans. Econ. Bus. Manag.* (2016). (iceme-ebm)
3. Xiao, Q., Wang, Y.: Dynamic early warning of cash flow risk of listed companies on the growth enterprise market based on state space model. *Pioneering Sci. Technol. Mon.* (2019)
4. Ma, F., Zhou, Y., Mo, X., et al.: The establishment of a financial crisis early warning system for domestic listed companies based on two neural network models in the context of COVID-19. *Math. Probl. Eng.* **2020** (2020)