

A Review on the Study of Systematic Financial Risk

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Abstract: Financial risk includes systematic financial risk and non-systematic financial risk. Previous studies have focused on non-systematic risk. Since the subprime crisis in the United States has evolved into a global financial crisis, people pay more attention to the systemic financial risk. This paper summarizes and evaluates the existing literature from four aspects: first, the definition and identification of the concept of systemic financial risk; second, the causes of systemic financial risk; third, the measurement of systemic financial risk; fourth, the prevention of systemic financial risk. This paper has a certain reference value for people to fully understand the systemic financial risk.

1. Definition and Identification of the Concept of Systematic Financial Risk

There are great differences in the definition of systemic risk in academic circles. According to Schwarcz (2008), systemic financial risk refers to the risk of a series of negative economic consequences caused by events such as economic turbulence and major corporate mistakes. In serious cases, the domino effect will appear. Benanke (2009) believes that systemic financial risk refers to an event that threatens the whole financial system and the macroeconomic rather than the stability of one or two financial institutions. Hart & Zingales (2009) pointed out that systemic financial risk refers to the risk that the failure of one institution causes the failure of other institutions in the system and has an impact on the real economy. In addition, many scholars focus on a more specific point to define, such as financial imbalances (Cavaliero, 2009), associated risk exposure (Acharya et al., 2010), and the spillover effect on the real economy (G10, 2001). Zhang (2010) pointed out that we should distinguish systematic risk in the micro sense and systematic risk in the macro sense. In the macro sense, "systematicness" has two meanings: one is that an event affects the function of the whole system; the other is that an event causes seemingly unrelated third parties to pay a certain price. According to Ma (2011), systemic financial risk refers to the possibility that the financial system can't continue to operate effectively due to the widespread large-scale impact, which is often manifested in the collapse of a considerable number of financial institutions and payment difficulties, the collapse of the financial market and the failure of price signals, as well as the devaluation of the currency and capital flight, etc.

From the above definitions, we know that although the academic circles have different definitions of the concept of systemic financial risk and different research perspectives, the connotation expressed has many common points, that is, the objects of concern are all or an important part of the financial system, and the spillover effect of risk is considered. These different definitions have the following common points: on the one hand, they focus on all or important parts of the financial system, rather than single institutions; on the other hand, all definitions take into account the spillover effect of risk, that is, the impact on the real economy.

2. The Causes of Systemic Financial Risks

The causes of systemic risk are very complex and difficult to study. Generally speaking, it can be attributed to five aspects:

2.1 The Financial Market Itself Has Defects

Thomas Hoyne, Governor of the Federal Reserve Bank of Kansas, believes that the financial development and innovation in the past 20 years not only failed to solve the problem of information asymmetry, but also worsened it, which is the main reason for the subprime crisis in the United States (Hong, 2008). In addition, the homogenization of financial market also aggravates the systemic risk. To maintain the stability of financial market, a large number of market subjects with different risk preferences should participate. However, in recent years, the characteristics of comprehensive operation, risk transfer and internationalization in the international financial market have led to the convergence of investment concept, risk preference, professional technology and financial regulatory standards of market participants (Eatwell, 2007). The market is prone to the emergence of one-dimensional expectations and behaviors, leading to market shocks and systemic risks. According to Eatwell (2007), systemic risk is caused by the externality of financial market, which can't be managed through the internal procedures of financial institutions, and is not within the scope of market concern.

2.2 Internal Vulnerability of Financial Institutions

Financial institutions have inherent vulnerabilities such as term mismatch and high leverage, and there are serious principal-agent problems in management, which brings risks to the whole financial system. According to Minsky (1992), the inherent characteristics of credit creation institutions and related lenders represented by commercial banks make the financial system inherently unstable, which makes finance itself an important cause of financial crisis. First, excessive use of high leverage directly brings about the vulnerability of financial institutions, limits the ability of the entire financial system to absorb even a small impact, and leads to the rapid spread of systemic risk after the crisis. Second, the serious asymmetry between the income, risk and responsibility of financial institutions, coupled with the government's explicit or implicit assistance to financial institutions, aggravates the principal-agent problem. This will induce financial institutions to engage in high-risk business and sow the seeds of crisis. Third, the market lacks self-discipline. Many financial institutions only take risks in pursuit of profits, and do not care about the rights and interests of shareholders and depositors. In the subprime crisis in the United States, many financial institutions' corporate governance and internal control mechanism failed to play a role of restriction and balance, which exacerbated the failure of risk management.

2.3 Financial Innovation Intensifies Systematic Financial Risks

Chakravort (2009) believes that systemic financial risk comes from the correlation of financial institutions' portfolio positions and the domino effect caused by the exposure of each other's position in the interbank market. Eisenbeis (2009) attributed systematic financial risk to the instability of bank deposits and credit. Acharya (2009) believes that the risk caused by the correlation of bank asset returns is actually a potential systemic financial risk. Some scholars also believe that although the excessive innovation and abuse of financial derivatives have a mechanism to amplify the systemic financial risk, which makes the systemic financial risk evolve into a financial crisis, the formation of risk is closely related to the basic functions of the financial system and the most essential content of financial activities. Gramlich & OET (2011) pointed out that the vulnerability of banks is caused by the correlation between banks and the amplification mechanism brought by linkage. In recent years, the research on "shadow banking" in various countries has fully proved this point of view. Schwarcz (2012) pointed out that shadow banks can generate systemic financial risks from two aspects, one is to increase the possibility of systemic financial risks; the other is to promote the contagion of systemic financial risks. According to Awrey (2011), the decentralization of shadow banks leads to market segmentation, and the opacity of the market makes market participants unable to effectively process information, resulting in the accumulation of risk without attention. Once the market becomes transparent, it will lead to panic in the market.

2.4 Irrationality of Market Subject

According to the latest research of Akerlof & Hiller (2009), although most of the economic behaviors of human beings come from self-supporting economic motives, there are also many economic behaviors dominated by animal spirits, that is, people always have non-economic motives and are not always rational in pursuing economic interests. The causes of irrational behavior mainly include herd mentality (that is herd behavior), the difference of rational degree of different groups and the fallacy of synthesis. Goldberg (2000) divides the whole process of financial crisis into three stages: madness, fear and collapse, which vividly depicts the ups and downs of investors' psychology, and as long as the weakness of human greed and fear are not eliminated, systematic risk cannot be avoided.

3. Measurement of Systemic Financial Risk

Systematic financial risk measurement refers to the qualitative and quantitative analysis and prediction of the probability and loss caused by systematic financial risk based on the analysis of the past systematic financial risk loss data and the current economic and financial situation (Wang, 2011). According to the difference of the existing measurement methods, it can be divided into three categories: the first is the traditional systematic financial risk measurement method, and the representative methods such as KLR Model, matrix method, network analysis method, default intensity model and GARCH model, etc.; the second kind of systematic financial risk measurement based on system importance, such as conditional risk value method; the third kind of comprehensive method of systematic financial risk measurement, such as financial stress index method, etc.

3.1 Traditional Systematic Financial Risk Measurement

The result of the accumulation of systemic financial risk is a financial crisis. If the conditions of financial crisis are found, the possibility of financial crisis, that is, the size of systemic financial risk, can be measured by synthesizing the possibility of these conditions. Therefore, the earlier index empirical analysis method is to use experience to screen indicators, and measure systemic financial risk by empirical difference between actual value and the normal value of indicators. The representative methods include KLR model, FR model, STV model et al. However, this kind of method does not distinguish the systemic financial risks caused by macro shocks from the systemic financial risks caused by contagion. More importantly, this kind of approach fails to grasp the internal structure and interaction between financial sectors, which is the core of systematic financial risk research. However, the later traditional methods have made some progress. This kind of methods focus on the measurement of the risk exposure of traditional inter-bank deposit and loan business. Most of them measure the systemic financial risk by predicting the possibility of a certain number of institutions in the system going bankrupt at the same time. It includes matrix method, network analysis method, default intensity model and GARCH model.

3.2 Systematic Financial Risk Measurement Based on System Importance

One of the assumptions of the traditional systematic financial risk measurement model is that the risks faced by different financial institutions are independent of each other, and the risk transmission path is relatively single. But from the perspective of risk sources, financial institutions often face the homogenization risk. For example, the common financial institutions adopt the same risk management model, accounting practice and investment portfolio. Adrian & Brunnermeie (2008) creatively introduced VaR into the study of systemic financial risk, which caused widespread concern. The IMF (2009) used this method to make an empirical study on the risk contagion among CDs (credit default swap) holders in the US subprime crisis. Empirical research shows that when Citi is at the 95% quantile, that is, at high risk, it will lead to a 135% increase in the Bear Stearns CDs spread and a 103% increase in Lehman's CDs. The CVM is mainly used to measure the spillover effect of a bank's failure on other banks or banking systems, and identify the

financial institutions with systematic and important influence, but it can't sum up the whole systemic financial risk, while the research of Huang et al.(2009) can measure the total systemic financial risk. The method of Huang et al.(2009) is based on the theory of portfolio investment. It takes the conditional expected loss under the condition of systematic events as the measurement of the systematic financial risk of banks. In this way, it measures the expected participation of individual institutions in systematic events. This method can be regarded as a special case of Shapley value.

3.3 A Comprehensive Method of Systematic Financial Risk Measurement

After the outbreak of the international financial crisis in 2008, it has become the focus of research to measure the systemic financial risk from the perspective of the whole system by using the comprehensive method. Among them, the research of Hakkio & Keeton (2009), Hancock & Passmore (2008) and so on has attracted the most attention of the academic community. Illing & Liu (2003), an economist at Bank of Canada, first proposed the concept of financial stress and constructed a comprehensive financial stress index. According to its description, financial pressure is a continuous variable, and its extreme value is called financial crisis. Financial pressure increases with the increase of expected financial loss, risk or uncertainty. The pressure is the result of the combination of a fragile structure and some external shocks. The size and transmission of the shocks within the fragile financial system determine the size of the financial pressure. Hakkio & Keeton (2009) further revealed several main characteristics of the financial system when the financial pressure increased, and constructed the financial pressure index (FSI) according to the characteristics of the financial pressure. This index includes 11 variables. However, the variables selected in the financial stress index constructed by Cardarelli et al. (2009) are relatively refined, and the index system includes 7 variables.. Balakrishnan et al.(2009) constructed the financial stress index of developed economies and emerging markets respectively. The variable selection and construction methods of FSI are the same as those of Cardarelli et al.(2009). FSI chooses five variables, which are captured coefficient of banking sector, stock yield, time-varying stock index return volatility, sovereign debt spread and foreign exchange market pressure index.

Although the above three methods measure systemic financial risk from different perspectives, up to now, there is no recognized and effective model and method for systematic financial risk identification and assessment.

3.4 Prevention of Systematic Financial Risks

With the deepening of the reform of the global financial system, people's awareness of financial risk prevention is increasing. In order to prevent systemic financial risks, researchers put forward their own views from different perspectives (Zhuo & Chang, 2015), which are summarized as follows:

Some researchers put forward the corresponding views from the perspective of financial innovation, monetary policy, financial market relevance and interaction. For example, Ba & Yan (2010) pointed out that financial innovation is an important breakthrough to digest, absorb and resolve financial market risks. Zhuang et al. (2012) believed that the innovation of credit derivatives could reduce the individual risk of banks and increase the risk of the banking system, so they suggested that China should implement "Basel III" while carrying out the innovation of credit derivatives, so as to eliminate the negative externalities of financial innovation and prevent financial risks. Xu & Chen (2012) suggested that the policy authorities should consider the capital adequacy and macro-economic environment of the banking industry, use traditional monetary policy with macro prudential management tools, and improve the effectiveness of monetary policy regulation and financial stability by weakening the impulse of domestic banks to expand credit. Zhang (2013) proposed that since risk will be transmitted and spread among different markets along with capital flow, we should learn from the concept of engineering, and build a financial market risk prevention system from multiple levels such as financial supervision, risk self-discipline and financial infrastructure.

Others put forward corresponding countermeasures and suggestions from the perspective of

micro and macro prudential supervision. For example, Chang (2010) believed that the current financial regulatory system should be reformed to reduce the procyclicality of liquidity management, including the establishment of a dynamic reserve system, the revision of the existing VaR based risk assessment methods, the inclusion of loan to deposit ratio and the proportion of high liquidity assets in bank assets and other indicators into the management of bank asset liquidity, and the targeting of financial institutions. The usage of leverage should establish a quantitative monitoring index and constraint mechanism. Guan et al.(2012) proposed that the People's Bank of China should be endowed with the functions of macro Prudential Management, establish and improve the laws, regulations and systems of macro Prudential Management, build a macro Prudential management framework to effectively prevent systemic risks, build an information sharing mechanism, and strengthen international cooperation to jointly prevent systemic risks. Liu & Miao (2013) believed that the risk reserve could be withdrawn from the current salary of the decision-maker in combination with the project risk level, so as to restrict the short-term risk behavior of the managers of financial institutions during their tenure and prevent future financial risks.

Others emphasize early the warning and prediction of the crisis. For example, Liu & Zhu (2011) established a systematic risk matrix from the perspective of macroeconomic impact, bank's own vulnerability and financial risk contagion and diffusion, which laid a theoretical framework for risk measurement in China's banking industry. Gong (2012) measured China's macro-financial risks in 2000-2008 by using the method of contingent claims analysis, intuitively displayed and analyzed the dynamic evolution of risk exposure in various sectors of the national economy during this period, and then found the specific theory and method to measure and monitor the systemic financial risks. Zhou et al.(2013) combined with previous research results, used MSVAR model to study the early warning of financial risk in China, and suggested that banks should increase the control of loan risk to avoid financial risk caused by bank crisis.

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