

## The Application of System Theory in Economics and Finance

Xiaowei Yang<sup>1, a</sup>, Jianjun Xu<sup>2, b</sup>

<sup>1</sup> Business School, Ningbo City College of Vocational Technology, Ningbo, Zhejiang, 315100, PR. China

<sup>2</sup> Institute of Science and Technology Ningbo University, Ningbo, Zhejiang, 315300, PR. China.

<sup>a</sup> yangxiaowei@nbcc.cn, <sup>b</sup> xu-jj@hotmail.com

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**Abstract:** System theory is the study of general patterns, structure and law of the system. In recent years, system theory has been widely used in economic and financial issues. This paper summarizes the main application of system theory in the field of economy and finance. Among them, the application of the economic field is mainly reflected in the study of the coordinated development of the whole economic system, regional sustainable development, regional integration, economic system reform, technological innovation, and system dynamics; while the application of the financial field is mainly reflected in the financial stability, financial ecosystem, financial system reform, financial institutions, and other financial topics. This study has a strong reference value for people to fully understand the application of system theory in economics and finance.

### 1. An Overview of the Application of System Theory in the Field of Economy and Finance

The system is a whole composed of many elements with specific functions and organic relations. System theory is the knowledge of studying the general pattern, structure and law of systems. It studies the common characteristics of various systems, describes their functions quantitatively with mathematical methods, and seeks and establishes the principles, and mathematical models applied to all systems. System theory uses the concepts of integrity, concentration, hierarchy, finality and logical isomorphism to study the patterns, principles and laws applicable to all integrated systems or subsystems, and tries to describe their structures and functions mathematically. The system emphasizes the organic connection between the whole and the part, the part and the part, the whole and the external environment, which has three basic characteristics of the whole, the dynamic and the purpose. As a guiding ideology, systematology requires that things be examined as a whole or a system, which conforms to the Marxist philosophic principle of universal connection of the material world (Gu et al., 1987).

The achievements of using system theory to study economic problems are as follows: (1) using system theory to study the coordinated development of economic systems (Luo, 1997; Zhao, 1989; Tang, 2009; Zong et al., 2013); (2) using system theory to study regional sustainable development (Chen & Li, 1996; AI, 2004; Li, 2009); (3) using system theory to study regional integration (Gu, 2010; Zhang, 2010); (4) using system theory to study economic system reform (Sun, 1987a, 1987b; Wang & Wang, 2006); (5) using system theory to study on technological innovation (Sun & Lin, 2011).

The achievements of using the system view to study financial problems are as follows: (1) study financial stability based on the system theory (Pang, 2004; Yan & AI, 2007; Zhang, 2013; Chen & Li, 2014); (2) study financial ecosystem based on the system theory (Lin, 2005; Zheng, 2012; Zhang & Ren, 2012; Liang, 2013); (3) research on financial system reform based on system theory (Wu, 1985; Ji & Li, 1987; Xing, 1991; Xiao, 1994, Li, 1996; Peng & Li, 2005; Li, 2005); (4) research on financial mechanism based on system theory (Chen, 2010; Zhou, 2012); (5) research on other financial related issues based on system theory problems (Wei, 1995; Wan, 2008; Fang & Tang, 2011).

## **2. Examples of Application of System Theory in Economic Field**

### **2.1 Using System Theory to Study the Coordinated Development of Economic System**

Zhao (1989) analyzed the coordinated development of the structure of the open economic system. He believed that the diversification of the open economy and the complexity of the economic relations determined that the open economic system must be a large-scale and diversified system. The coordination of open economic system is very complex because it is a complex system structure with multi-level, many related factors interacting, vertical and horizontal interlacing. However, from the macro perspective of the system movement, it can guarantee the relative stability and order, integrity and environmental adaptability of the open economy, and make its functions play an effective role by mainly dealing with the relevant subsystems and subsystems as well as the collaborative relationship with the non-open economy system. Luo (1997) applied the theory of self-organization to analyze the evolution of the Chinese economic system, including the economy of new China, Hong Kong, Macao, Taiwan and overseas Chinese. It is believed that the glorious Chinese economy for thousands of years, the decline of modern times for hundreds of years and the rise of modern times are the result of the comprehensive effect of five major factors, namely, science and technology, population, system, culture and natural geographical conditions. Tang (2009) believed that the harmonious development of economy has inherent systematicness, which is the system development and system paradigm. Zong et al. (2013) borrowed the idea of system evolution in general system theory, established the coordinated development model of logistics industry and economy, and evaluated the coordination of logistics industry and economic development in Inner Mongolia Autonomous Region

### **2.2 Study on Regional Sustainable Development with System Theory**

AI (2004) believed that the sustainable development concept contains rich system thoughts, and analyzed the sustainable development theory from the perspective of system theory and revealed the system essence of the sustainable development concept. Li (2009) believes that the research object of sustainable development is actually a dissipative structure, which can be called a sustainable development system. The system includes five subsystems: government, society, economy, ecology and environment, and depends on the material energy input from the outside world to maintain survival. To achieve sustainable development, we must enhance the stability and improvement of the sustainable development system.

### **2.3 Using System Theory to Study Regional Integration**

Gu (2010) thinks that the development of regional economic integration is a typical complex giant system with system characteristics, and the realization of regional economic integration is also a complex system engineering. From the perspective of system theory, this paper studies the development of regional economic integration in Changsha, Zhuzhou and Xiangtan. Zhang (2010) believed that the establishment of the economic cooperation zone in the Western Triangle is of great significance to the development of the western region and even to the overall development of China. He analyzed the functions and influencing factors of the regional economic cooperation in the Western Triangle from the perspective of system theory, It is considered that the regional economic cooperation in the Western Triangle is a huge and complex system. In order to make the regional economic cooperation in the Western Triangle develop harmoniously, orderly and sustainable, we must study it from the perspective of system theory.

### **2.4 Using System Theory to Study the Reform of Economic System**

Sun (1987) made a detailed and practical study on the general objective, supporting relationship and overall basis of action deployment of China's economic system reform by using the system theory. He believed that it was one-sided to simply take the maximization of enterprise vitality or the idealization of centralized planning as the general objective of economic system reform. We must solve and strengthen the power performance and balance performance at the same time, and

make it Optimization is achieved in mutual constraints. Starting from the order of the elements of the system, the author thinks that it is necessary to combine the three levels of vertical connection (system structure, operation mechanism, system function) and the three subsystems of horizontal connection (micro system, regulation and control system, macro system) in the economic system to carry out the supporting reform. Wang & Wang (2006) thought that the county economy is a multi-level and complex regional economy, which plays an important role in the development of national economy. They introduced the system theory into the study of the county economy, and systematically analyzed the county economy.

## **2.5 Using System Theory to Study Technological Innovation**

Sun & Lin (2011) analyze innovation activities from a systematic perspective, which is becoming a new field for many scholars to study and explore. From the national level, the regional level and the enterprise level, the research results of the application of system theory in the field of innovation are sorted out. It is believed that scholars have carried out more in-depth research in the national innovation system, the regional innovation system and other aspects, and achieved considerable results, but there are still some deficiencies in the research content and methods. For the study of national innovation system, it mainly focuses on the importance of interaction between institutions and elements, the comparison of national innovation system (NIS) differences among countries, and policy suggestions for the construction and improvement of NIS, while the institutional arrangements for improving the performance of system innovation, the interaction of NIS elements, interactive learning and other issues need to be further analyzed. The research on regional innovation system mainly involves the concept, structure, how to build and the influencing factors of efficiency of regional innovation system, while the research on the interaction between different regional innovation systems is relatively lacking, and the research on regional innovation system from the perspective of cluster still needs further study. From the perspective of the scope of application, the current research on RIS is mainly applicable to developed countries or developed regions of developing countries, while less attention is paid to the relatively backward regions.

## **3. Examples of Application of System Theory in Finance Field**

### **3.1 Research on Financial Stability Based on System Theory**

Pang (2004) thinks that the financial system is an organic whole with functions of maintaining economic and financial stability, preventing and resolving systematic risks, providing liquidity and creating investment and financing tools, which is composed of several subsystems that interact, relate and depend on each other. Yan & Ai (2007) think that the financial system is a complex system composed of many subsystems, and the financial system vulnerability risk is composed of two parts: The internal organizational structure and the external vulnerability environment, which can establish a financial system vulnerability structure model including the external environmental input and the internal structure of the system. Zhang (2013), based on the basic thought of system science, constructed the theory of financial system, distinguished the interrelation and quantitative contrast between financial elements, and believed that the financial system is an orderly whole composed of many financial elements in the interrelationship. Financial stability is determined by the stability of financial structure and reflects the stability of financial function, which is embodied in financial services. As for the continuity of business, the driving force for the financial system to stay away from equilibrium and maintain the existing structure and acquire new structure is collective behavior. Because financial stability has both the attributes of public goods and public resources, if it is provided and maintained through collective behaviour of the private sector, the financial stability will be under supplied and over consumed; While the financial management department is responsible for providing and maintaining financial stability, it is necessary to reduce the organizational cost of the collective behaviour of the private sector, strengthen the incentive of the private sector to provide and maintain financial stability through collective behaviour, and limit the tendentious behaviour of the private sector that excessively consumes financial stability. Chen

and Li (2014) believed that the stability of the system doesn't only depends on the internal factors of the system, but also closely related to the external factors. Therefore, the construction of the financial system stability framework should examine all factors affecting the operation of the financial system, and then formulate corresponding measures to maintain financial stability.

### **3.2 Research on Financial Ecosystem Based on System Theory**

Lin (2005) used the system theory to analyze the relationship between the subsystems in the financial ecosystem and the various deep-seated elements that determine the financial ecosystem in China. In order to promote the harmonious coexistence, and balanced development of the subsystems, it is imperative to establish the system theory concept of the financial ecosystem construction, improve the financial, legal environment, and strive to realize the transformation from regulatory finance to ecological finance. Zhang & Ren (2012) think that the function of rural financial, ecological regulation is weak, which leads to the imbalance of system ecology. Whether to realize the ecological balance of rural finance is related to the sustainable development of rural economy. By analyzing the causes of the systematic deficiency and ecological imbalance of rural financial ecology in Zhejiang Province, this paper puts forward the optimized path of regulating the ecological balance and orderly development of rural finance. Liang (2013) applied the viewpoint of system theory and the principle of ecology, systematically analyzed the integrity, dynamic, openness, complexity and regional differences of rural financial ecosystem, and diagnosed the defect of rural financial ecosystem.

### **3.3 Research on Financial System Reform Based on System Theory**

Wu (1985) believed that the financial system is the parent system and the financial system is the subsystem compared with its economic system. Ji & Li (1987) thought about the reform of the financial system from the perspective of system theory. They believed that integrity and relevance is the basic foothold of financial system reform, purposefulness and dynamism are the direction of financial system reform, and environmental adaptability is the guarantee of the success of financial system reform. Xing (1991) also believed that it was necessary to use the principle of system integration to study the overall goal of the financial system, the principle of element order to study the supporting relationship of various financial reforms, and the principle of element correlation to study various financial reforms and action plans. Wang (1994) believed that we should use the theory of system theory to analyze and guide the financial work so as to better serve the socialist market economy. Li (1996) thinks that the financial market is an organic aggregation, and the development of the financial market has formed its own system, which is composed of the monetary market system, the capital market system, the foreign exchange market system and other subsystems. Peng & Li (2005) think that the crisis event manager of commercial banks should build a complex control system, and the particularity of crisis event prevention of commercial banks determines the high difficulty and complexity of this risk management work. Li (2005) builds a dynamic model of East Asian monetary cooperation by using system theory and dissipative structure theory and which is used to analyze the influence of two important variables on East Asian monetary cooperation; he finds the tension factors that impede monetary cooperation in East Asia.

### **3.4 Research on Financial Institutions Based on System Theory**

Chen (2010) regards the new rural financial institution system as a complete system with integrity, independence, relevance and dynamic, and studies the constituent elements, overall structure and external environment of the new rural financial institution system, and analyzes the functional effect of the new rural financial institution system, and combines the system evolution Theory, and puts forward to build a new rural financial institution system with perfect elements, reasonable structure, effective supervision and full play of functions. Zhou (2012) analyzed the functional characteristics of the "three rural" financial institution system based on the viewpoint of system structure and function, and examined the current practical functions of different types of financial institutions one by one. He believed that the function of policy financial institutions was reduced from the earlier extensive policy supporting function to the development supporting

function, with obvious profit-making orientation.

### **3.5 Research on Other Financial Related Issues Based on System Theory**

Wan (2008) constructed a research framework of petroleum financial system with the thought of system theory, and analyzed the current situation of Petroleum Finance in China from traditional petroleum finance and modern petroleum finance, and analyzed the problems in the development of Petroleum Finance in China through the comparison with international petroleum finance, and qualitative analysis of the root causes, combined with the actual situation of petroleum economy and financial market in China. Fang & Tang (2011) analyzed the reform and practice of higher vocational education personnel training mode from the perspective of systematology, and believed that the reform of higher vocational education personnel training mode from the perspective of systematology needs to deal with the relationship between commonness and individuality, between work and study, and between inside and outside the school.

## **4. Conclusion and Enlightenment**

System theory is the knowledge of studying the general pattern, structure and law of systems. It studies the common characteristics of various systems, describes their functions quantitatively with mathematical methods, and seeks and establishes the principles, and mathematical models applied to all systems. The core idea of system theory is the concept of the system as a whole. In recent years, system theory has been widely used in economic and financial issues. This paper summarizes the main application of system theory in the field of economy and finance. Among them, the application in the economic field is mainly reflected in the study of the coordinated development of the whole economic system, regional sustainable development, regional integration, economic system reform, marine and tourism economy, technological innovation, industrial clusters, etc.; while the application in the financial field is mainly reflected in the financial stability, financial ecosystem, financial system reform, financial institutions and other financial themes.

The existing research results have shown that the ideas and methods of systematology can be widely used in the relevant research of economic and financial problems, but the achievements applied to the research of economic and financial problems in the 20th century are obviously more than those in recent years, which in a sense shows that the ideas and methods of systematology seem not to be widely used in the research of economic and financial disciplines. The reasons are as follows: There are some differences in the mainstream analytical paradigms of different disciplines, but as long as they are popularized, their application scope will be wider and wider, and their innovative achievements will be more and more, which need us to promote and apply the ideas and methods of system theory.

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