

Qualitative and Quantitative Evaluation for Chinese Financial Industry

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Abstract. In order to objectively measure the security degree for Chinese financial industry, a security evaluation system is proposed. The proposed system includes 15 carefully selected indexes which are designed basing on economic environment, policy environment, credit environment, financial operation, security control. Entropy weight method is used to obtain the index's weight. Linear comprehensive model is adopted and nonlinear comprehensive evaluation model is proposed to aggregate the indexes together. To demonstrate the validity of the proposed system, the evaluation of the security degree for Chinese financial industry from 2001 to 2011 has been conducted. Results have shown that the system can effectively reflect the security status.

Keywords: financial industry; index; industrial security degree; linear model;

1. Introduction

The financial industry is not a virtual economy, but a compound system of organization, it is generally made up of the banking, securities and insurance, and other professional departments. The connotation of the financial industry security refers to a country's financial industry in the process of its development can reduce and control risk, avoid and prevent crises, to maintain the normal operation and development; and have the face of foreign threats and invades, to ensure that its financial system, financial sovereignty from harm (Shen,2007; Cheng,2010).

Finance is the core of modern economy, financial security is the core of the

national economic security, is the important component of the national industrial security. In recent years, the frequent financial crises in the world, especially the outbreak of the "subprime crisis of the United States " warning, if a country is lack of recognition on guarding against the financial crisis, financial risk and financial crisis occurs, threatening their economic security, and even national security(Zhucui,2012;Menggang,2010) Therefore, how to scientifically evaluate China's financial industry running has extremely important significance.

Researching about financial security on foreign is much earlier than the domestic. American economist Irving Fisher (1933) first researches the financial security problems from the level of the economic fundamentals after analyzing the previous economic and financial crisis. American economist Crockett (1997) in his article 《Theory and Practice of Financial Stability》, first defines the risk of the financial system in the macro sense.

Since the end of the 20th century, with the acceleration of global financial integration, domestic scholars begin to research financial security using different methods from various aspects, which can be roughly divided into banking, capital markets and the real economy. First, scholars Wang Yuanlong (1998), Liang Yong (1999), Zhang Youwen (1999), Dai Xiaoping (2000), Zhang Jikang, Tang Guoqing (2002), Liu Kaixuan (2005), research the definition of financial security .

Overseas for financial security evaluation index system research mainly focus on banking and currency crisis. The earliest studies dating back to the 1960s, professor F • T • Han Eritrea of the American Business Environment Risk Intelligence Research Institute (BERI) designed risk prediction index, also known as Flanders ingdex. With the deepening of the research of financial crisis, Paul Krugman of Stanford university is constructed financial crisis evaluation framework basing on the real exchange rate, trade and current account balance, the real wage rate and the domestic interest rates and other forward-looking indicators. Graciela Kaminsky, Saul Lizondo and Carmen M.Reinhart follow the trajectory of his research and make a beneficial supplement to the framework using the "signal". At present, the international representative financial security index system was the financial stability index (FSI) organized by the international monetary fund (IMF) and world bank (WB). Indicator set of the evaluation system include the core index set and encourage index set to measure the risk of the entire financial system.

Before the Asian financial crisis , Domestic scholars generally investigated little on China's financial security index system . After the Asian financial crisis,

some scholars began to study the financial security system. Earlier research on financial security index in our country, is Liu Zunyi (1995) has been proposed for southeast Asia's financial crisis prediction. After the Asian financial crisis, some scholars have begun to focus on the issue of financial security and establish the early warning model to measure the current financial risk. Chen Xiuying (1998) constructed a set of relatively simple and easy, strong operational early warning index system after analyzing the causes and its influence of the financial crisis . At present there are three commonly used methods of constructing index system, the first one is from the financial functions to deconstruct the financial risk and build financial security index system, index system is divided into the macro, medium and micro level respectively. For example, Gao HongZhen(2005),Gu Haibing, Xiameng (2011), and He jianxiong (2001), Chen songlin (2002), LiuXiLiang, JingZhuCui , Li Menggang (2012) etc , these scholars adopt to construct index system in this way.

The second common method is divided index system into macro economic index system, financial security subsystem, external shock subsystem, this method was more typical commonly used, Zhang Yuanping, Sun gang (2003), Shen Yue, Zhang Zhen (2007), Jiang Hai, Su Liwei(2009), Tangling Xiao (2009) use this method to classify indexes. There are many scholars build financial security evaluation system on the cause of financial risks . Such as Chen liming, Zhuo sijun (2003), Han Bing (2006).

Overseas research for financial security evaluation model is more focused on financial crisis for early warning. For example, Frankel and Rose (1996) proposed FR probability model. Andrew Berg and Catherine Pattilo validate the predictive ability of the model. Kumar, Moorthy and Perraudin (2003) put forward Simple Logit model based on macroeconomic and financial data.

About the research on the domestic financial industry security evaluation model, Wang Shuoping (2000) earlier study systematically financial risk. Lin Boqiang (2002) use multivariate cumulative and MCS model to evaluate China's foreign debt financial security, think that China's economic and financial situation has problem at the end of 1992. Chen songlin (2002) set up a "financial safety monitoring and early warning system structure module". Xu Dianqing (2003) concludes a financial safety index to measure the safety degree of the financial system. Gao Hongzhen (2005) use "factor analysis" to evaluate our country's financial security. Luo Huiying, Nan Xuguang (2007) use catastrophe theory to research the evaluation model. Shen yue, Wang Xiaoxia, Zhang Zhen (2008) applies AHP (the analytic hierarchy process) to the

evaluation of financial security. Han Bing (2008) on the basis of AHP (analytic hierarchy process) empowerment, to final output of the efficacy coefficient method is in the comprehensive evaluation method, the results more convincing.

2. The Evaluation Index System and the Weights of Index System of Financial Industry

2.1 The evaluation index system

According to the design method of the evaluation index system, we select and determine the economic environment, policy environment, credit environment, financial operation, security control , the following evaluation indexes are eventually screened, see Table 1.

Table 1. China's financial industry security evaluation index system and their values

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
GDP growth rate	0.083	0.091	0.100	0.101	0.113	0.127	0.142	0.096	0.092	0.103	0.092
The rate of change of total fixed asset investment in the whole society	0.131	0.169	0.277	0.268	0.260	0.239	0.248	0.259	0.300	0.238	0.118
World economic growth	0.017	0.020	0.027	0.041	0.036	0.041	0.040	0.014	-0.023	0.042	0.028
The increase rate of financial industry practitioners	0.028	0.012	0.039	0.008	0.009	0.023	0.061	0.071	0.075	0.047	0.048
The rate of change in total fixed assets investment of financial industry	0.070	-0.210	-0.100	0.508	-0.195	0.109	0.298	0.654	0.382	0.359	0.284
Capital adequacy ratio	0.056	0.062	0.067	0.045	0.074	0.065	0.096	0.105	0.114	0.122	0.127
Foreign banks accounted for the proportion of total bank assets	0.008	0.011	0.015	0.018	0.019	0.021	0.024	0.022	0.017	0.019	0.019
The proportion of foreign premium income	0.008	0.011	0.015	0.018	0.019	0.021	0.024	0.022	0.041	0.044	0.031
Commercial banks non-performing loan ratio	0.254	0.236	0.196	0.132	0.086	0.071	0.062	0.024	0.016	0.011	0.010
Index change rate of the real effective exchange rate	0.054	-0.023	-0.070	-0.030	-0.010	0.018	0.042	0.089	0.041	0.039	0.043
Price Earnings Ratio	0.377	0.344	0.365	0.242	0.163	0.333	0.592	0.149	0.287	0.216	0.134
The increase rate of monetary supply	0.154	0.167	0.200	0.162	0.162	0.167	0.175	0.166	0.265	0.206	0.156
M1 year-on-year growth	0.127	0.184	0.187	0.141	0.118	0.175	0.210	0.090	0.324	0.212	0.079
Inflation rate	0.007	-0.008	0.012	0.039	0.018	0.015	0.048	0.059	-0.007	0.054	0.049
Inflation rate / The increase rate of monetary supply	0.045	-0.048	0.060	0.241	0.111	0.090	0.274	0.356	-0.026	0.262	0.314

2.2 The weights of index system

The definition of the indicators entropy is:

$$H_j = -K \sum_{i=1}^n f_{ij} \ln f_{ij} (j=1,2,\dots,n) \quad (1)$$

Where $f_{ij} = \frac{r'_{ij}}{\sum_i^n r'_{ij}}$, $K = 1 / \ln n$, when $f_{ij} = 0$, $f_{ij} \ln f_{ij} = 0$.

According to the formula (1), The calculation results is shown in Table 2.

Table2 The results of indicators entropy

GDP growth rate	0.08
The rate of change of total fixed asset investment in the whole society	0.13
World economic growth (A3)	0.02
The increase rate of financial industry practitioners	0.03
The rate of change in total fixed assets investment of financial industry	0.07
Capital adequacy ratio	0.06
Foreign banks accounted for the proportion of total bank assets	0.01
The proportion of foreign premium income	0.01
Commercial banks non-performing loan ratio	0.25
Index change rate of the real effective exchange rate	0.05
Price Earnings Ratio	0.38
The increase rate of monetary supply	0.15
M1 year-on-year growth	0.13
Inflation rate	0.01
Inflation rate / The increase rate of monetary supply	0.05

(3) the calculation of index weight

The entropy weight of indicators are as follows:

$$w_j = \frac{1 - H_j}{m - \sum_{j=1}^m H_j} \tag{2}$$

According to the formula (2), the weight of each index calculated results are shown in Table 3.

Table 3 The results of indicators weight

GDP growth rate	0.07
The rate of change of total fixed asset investment in the whole society	0.08
World economic growth (A3)	0.09
The increase rate of financial industry practitioners	0.07
The rate of change in total fixed assets investment of financial industry	0.06
Capital adequacy ratio	0.04
Foreign banks accounted for the proportion of total bank assets	0.07
The proportion of foreign premium income	0.08
Commercial banks non-performing loan ratio	0.08
Index change rate of the real effective exchange rate	0.05
Price Earnings Ratio	0.07
The increase rate of monetary supply	0.09
M1 year-on-year growth	0.06
Inflation rate	0.05
Inflation rate / The increase rate of monetary supply	0.04

3. Comprehensive Evaluation

3.1 Use Linear Comprehensive Evaluation Model to Evaluate the Security Degree of Chinese Financial Industry

The following linear comprehensive evaluation model are used to estimate the security degree of the financial industry,

$$S = a_1x_1 + a_2x_2 + \dots + a_{15}x_{15} \tag{3}$$

Where S denoting the security degree of financial industry, x_1, x_2, \dots, x_{15} denoting financial industry index, a_1, a_2, \dots, a_{15} denoting indicators weight .

The result of security degree are shown in Table 4, according to equation (3)

. Table 4 2001-2011 year security degree of financial industry

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Security	0.68	0.70	0.80	0.80	0.81	0.85	0.75	0.72	0.59	0.77	0.74

3.2 Use NonLinear Comprehensive Evaluation Model to Evaluate the Security Degree of Chinese Financial Industry

We use Nonlinear Comprehensive Evaluation Model to Evaluate the Security Degree of Chinese financial industry . The following nonlinear comprehensive evaluation model are used to estimate the security degree of the financial industry,

$$S = 10.85 * x_1^{a_1} * x_2^{a_2} \dots x_{15}^{a_{15}} \tag{4}$$

Where S denoting the security degree of financial industry, x_1, x_2, \dots, x_{15} denoting financial industry index. a_1, a_2, \dots, a_{15} denoting indicators weight .

The result of first level indexes and security degree are shown in Table 5, according to equation (4) .

Table5 2001-2011 year security degree of financial industry

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Security	0.57	0.62	0.8	0.81	0.82	0.83	0.75	0.83	0.78	0.88	0.68

According to Tables 4 and 5, the 2001-2011 security degree chart is shown in Figure 1.

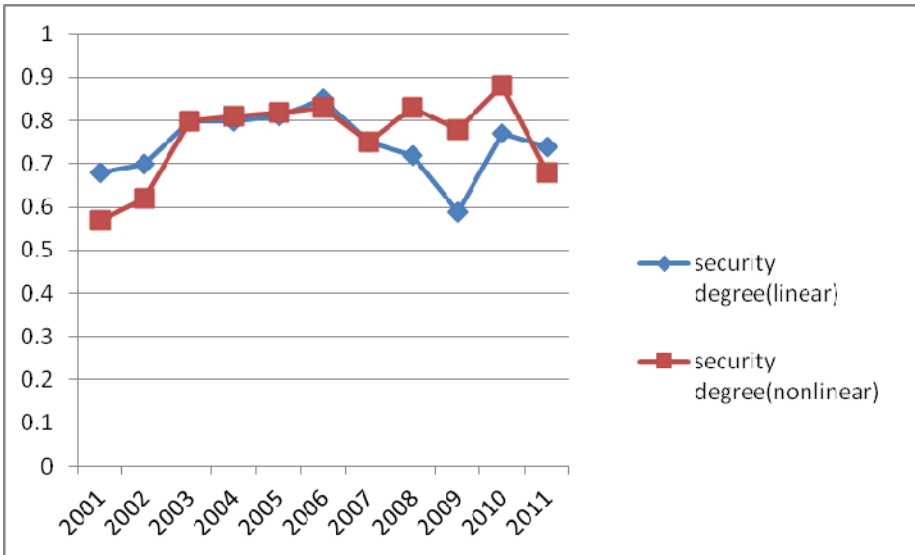


Fig. 1. Variables of the x-axis denote the year. The data from 2001 to 2011 has been collected. Variables of the y-axis denote security degree. The evaluation values of linear model and nonlinear model have been compared.

Linear comprehensive evaluation model can highlight the value of the greater index or indexes weights, while, nonlinear comprehensive evaluation model is more sensitive to the index value in dramatic changes. Observed from Figure 1, the security trend calculated based on linear and nonlinear comprehensive evaluation model is generally consistent. According to Figure 1, the security degree of Chinese financial industry from 2001 to 2011 is in the interval [51.87, 65.39]. We conclude that it is basic security.

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