

The Construction of Regional Financial Stability Index

Bo Zhang

School of economy and management
Xi'an University of Technology , XAUT
Xi'an, China
e-mail: zhangbo197407@163.com

Bijun Li

School of economic and management
Xi'an University of Technology , XAUT
Xi'an, China
e-mail: 402024464@qq.com

Yanping Li

School of economic and management
Xi'an University of Technology , XAUT
Xi'an, China
e-mail:1012711728@qq.com

Abstract—This paper takes the regional financial stability of China as the research object, aims to establish the index system of regional financial stability in China, so as to better understand the regional financial stability. Based on previous studies on the financial stability system and the existing characteristics, this paper establishes a new financial stability index system. Different points of this paper from other researches is that it is based on the weighted index using is entropy method instead of analytic hierarchy process (AHP). In this paper, we take Chinese as samples, selects the 2008-2012 macro data of these 5 years, and the index system was built for the assignment by entropy method. We can use this measure the regional financial stability, and then compare the stability index of different regions.

Keywords- *Regional financial stability; Stability index system; Entropy method; internal factors; external factors*

I. INTRODUCTION

Regional financial stability is a hot research in recent years, studies on regional financial are varied. Some studies are based on the world financial economy[1], such as the Asian regional financial research, European regional finance research[2-3]. And other studies based on the domestic financial perspective, while they pay attention to eastern, western and central part of the China[4-5]. Some scholars make a province as the research object to study the regional financial stability. The paper is with the stability of Shaanxi Province to establish a regional financial stability indicator. In order to better know regional financial stability, we must understand what the regional financial stability is. Chen Rui (2010) pointed out that the essence of regional financial stability has two characteristics[6]: First, the financial system of a region is running stably, orderly and standardized financial system in the region must also have a certain degree of resolve and resilience to external shocks; Second, the region's financial system

could be able to guide the rational allocation of funds and improve the quality and efficiency of region's industrial and economic development in this state. On the basis of the above-mentioned, Regional Financial Stability refers to an area of financial institutions and financial markets are in a stable state, That is to say the financial system in the region can effectively play its key function. As China's economy continues to develop, the financial sector is drawn more and more attention, especially that our country is now in economic transition phase, we pay more attention to the regional finance. Regional financial risk once exposed, it will hinder the stability of regional economic growth. If handled properly, it will lead the risk spread and may even drag on long-term stable growth of the regional economy. This article is in this context, we identify factors which influence regional finance and build regional financial stability indicators.

II. REGIONAL FINANCIAL STABILITY FACTORS

Regional financial instability is the opposite of regional financial stability, and regional financial instability is caused by internal factors and external factors, internal factors mainly include the endogenous shocks of financial system and the poor of financial ecological environment, which has a direct impact on the operation of the financial system; external factors mainly include the exogenous shocks to the real economy, which indirect impact the operation of the financial system. These two kinds of factors often interact with each other to threaten the financial environment.

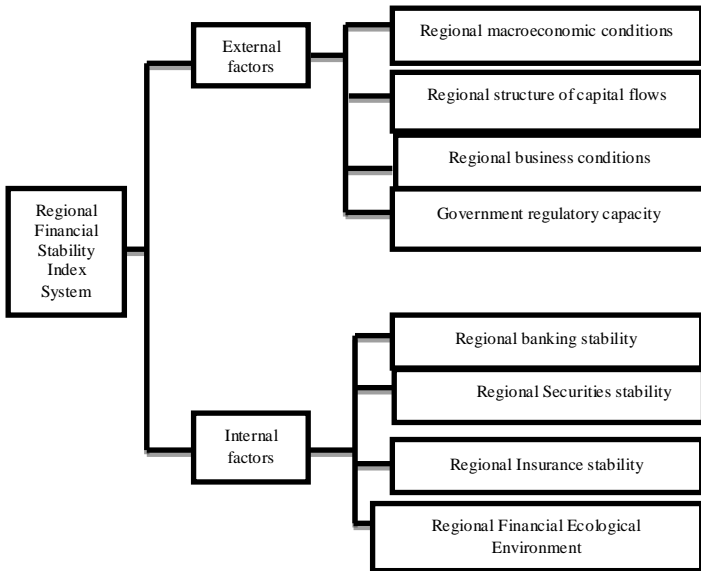


Figure 1. Factors Influence Regional Financial Stability

A. External Factors

The smooth functioning of the financial system is inseparable from the basic stability of the macro economy. Macroeconomic operation occur dramatic changes, Which will directly or indirectly affect the capital allocation, upset the normal operation of financial enterprises, and bring serious influence to the financial stability.

The external factors that affect the regional financial stability include the macro economic situation of the region, the regional capital flow, the enterprise management status and the regional government regulation ability. Generally speaking, regional macroeconomic showing a positive development trend, such as GDP growth in the moderate range, the inflation rate is in the range of reasonable range, the impact of regional financial stability is positive. Secondly, regional capital flow will also have an impact on regional financial stability, if most of the funds flow in real estate, which is easy to cause real estate boom and result in the real estate bubble, once the bubble burst, it will cause instability. In addition, when a large number of capital flows on the coal industry, it will cause serious pollution to the local environment and illegal mining of coal. There are many people are even to join the coal mining boom in the way of using usury to raise funds which have greatly contributed to regional financial stability. The financial situation of enterprises in the region will also affect the stability of regional finance, business poorly will make the enterprise accounts receivable difficult to recover and may even turn into bad debts, which affects the regional financial stability. A regional financial development is inseparable from the reasonable regulation and control of government departments, the higher government revenue indicates that government efforts to the higher regulate and control, which is more conducive to the development of regional finance. In order to realize the regional common prosperity, reduce regional income gap, government expenditure should be increased, it will be conducive to regional financial stability.

B. Internal Factors

Regional financial system structure and development are the most direct factors that affect regional financial stability. Whether history or late regional financial system operation results, the formed the regional financial structure and development determines the regional financial stability, and reflects the changes that will occur in the future regional financial stability.

The internal influencing factors of regional financial stability include the regional financial institution and the development as well as the financial environment. For the regional financial institutions, regional banks are more vulnerable sector. Regional banking vulnerability can lead to regional financial instability, which will lead to the waste of regional financial resources and unreasonable allocation. We use regional banks non-performing loan rate and the deposit loan ratio to consider regional bank stability investigation .Non-performing loan ratio rise means that the regional bank cash flow, net income and solvency deterioration. High loan to deposit ratio on the one hand make commercial banks face liquidity risk, on the other hand it will the shocks to the central bank's financial macro-control because bank issued the loan funds are mostly from the central bank loans. The price of stock market is the barometer of economy, which reflects the running of macro economy. But for the regional securities industry, especially in Shaanxi, the securities industry organizations are business department, there is no legal institution. For the regional securities, operating income growth rate is high, the regional securities market transactions active degree is high, and the securities market developed faster. With the continuous improvement of Shaanxi Province economy rapid development, the insurance industry in the economic development of Shaanxi Province status improved significantly. But for the regional insurance industry, most of them are branches. We can investigate the robustness of its operations from its income and expenditure. The rate of premium growth is higher, the stronger profitability in regional insurance, the more conducive to regional financial stability. The higher the simple payment rate is, the weaker the payment capacity. The regional ecological environment also has the effect on the regional financial stability, and the research of the regional environment is mainly concentrated on the private financing. On the one hand, folk financing can promote the development of regional financial sustainable development and promote the efficient allocation of financial resources; on the other hand, private financing has risk. Because in our current laws, there is no clear specification on private financing, it is difficult to control private financing risk.

III. REGIONAL FINANCIAL RISK INDEX SYSTEM REVIEW

Yi Chuanhe (2005) set up five categories of 19 core indicators. He studies adequate safety, liquidity and profitability of the financial institutions capital from microcosmic area[7]. Zhou Caiyun(2006) selected 25 indicators to build a regional financial safety warning index system from the macro and micro-prudential indicator[8]. Song Zhengwei(2008) build a stable regional financial security early warning indicator system by 26 indicators from the area of macroeconomic stability index and the area of financial stability and micro-prudential indicators[9]. Lai Xian (2009) draw on the world's financial risk prevention

experience, combined with the risk of the truth of China's financial sector, took Jiangsu Province as an example from the four aspects to construct the pre-warning indicator system to the regional financial risks: regional indicators in the external economic environment, regional banks risk early warning index, regional securities risk early warning index, regional insurance industry risk early warning indicators[10]. Peng June (2008) build a regional financial security early warning indicators from regional banks, the regional insurance, regional securities industry and regional economic environment[11].

Table 1 Research Situation of Domestic Financial Stability Evaluation Index System

Research \ Author	Yi Chuanhe	Zhou Caiyun	Lai Xian	Song Zhengwei	Peng June
the Macroeconomic and Financial Performance Indicators					
Economic Growth	√	√	√	√	√
Inflation rate		√	√	√	√
Propensity to save				√	
Revenue ratio	√	√	√	√	√
Financial expenditure ratio	√	√	√		
Return on assets	√				
ROE	√				
Regional enterprise loss rate	√		√		
Public debt		√			
Fixed asset investment growth rate			√		√
Real estate investment growth rate			√		√
Regional Neutral Stability and Micro Prudential Stability Index					
Bank stability assessment index		√	√	√	√
Regional foreign exchange market stability evaluation index				√	
Stability evaluation index of regional securities industry			√	√	√
Stability evaluation index of regional insurance industry			√	√	√
Capital	√				
Asset quality	√				
Profitability	√				
Mobility	√				
Management ability	√				

Table 2 General Situation of the Research on the Neutral Stability and the Micro Prudential Stability in China

Research	Author	Song Zhengwei	Lai Xian	Peng June
Regional Banking Stability Assessment Indicators				
Excess reserve ratio		√	√	
Deposit and loan ratio		√	√	√
Liquidity ratio		√	√	√
Capital adequacy ratio		√	√	√
Non-performing loan ratio		√	√	√
Single group customer credit concentration		√		
Asset profit margin		√		√
Capital profit ratio		√		
Regional Securities Industry Stability Evaluation Index				
Commission income growth rate		√	√	
Cost income ratio		√	√	
Illegal case rate		√	√	
Net capital and net assets ratio				√
Ratio of net capital to debt				√
Ratio of net assets and liabilities				√
Flow rate				√
Long-term assets accounted for the proportion of total assets				√
Regional Insurance Industry Stability Evaluation Index				
Insurance depth		√	√	
Premium growth rate		√	√	
Simple payout ratio		√	√	
Solvency adequacy ratio				√
Recognized asset liability ratio				√
Asset recognition rate				√

The above analysis of the establishment of regional financial stability index is by the domestic scholars, we discover that for setting up regional financial stability index is basically divided into two categories: Macro economic and financial operation index and regional neutral contact stability and micro Prudential stability index. Macro indicators include some external factors that affect regional finance, such as economic growth rate, inflation rate, financial income ratio, etc. For neutral contact stability and micro prudential stability index selection is based on the internal factors which influence regional financial. In neutral contact stability and micro prudential stability, domestic scholars mainly investigate from the banking, securities, insurance and foreign exchange market. The banking industry is the most important part of the study of regional financial stability, some of

the research and even selects the banking industry as a representative of the neutral stability and micro prudential stability. On the stability of the banking industry, there are many scholars analyze from the profitability, safety and mobility. But this paper is focused on the research of Shaanxi Province regional financial stability, some data from the breakdown of these three aspects are difficult to collect even there is no specific statistics, which affected the index system established. so we select the banking stability index whose data can be collected and that can reflect the Shaanxi Province special factors. Although the stock market is a barometer of the economy, but China's securities industry started late, the overall development is not very mature. Most of the securities companies in Shaanxi Province are business department. There is no independent legal entity. So in the evaluation of its

stability can observe through the size, personnel quantity, and the commission income growth rate. On the stability of the insurance industry, we took the same indicators as Song Zhengwei, Lai Xian. Shaanxi Province in the foreign exchange market are not developed enough, foreign exchange trading of Shaanxi Province regional stability influence degree of smaller. so in the construction of the regional financial stability index system will not be considered for stability in the foreign exchange market..

IV. REGIONAL FINANCIAL RISK INDEX SYSTEMS

A. Construction Principle

When we created regional financial stability index, there are quite a number of variables can be used as the selected index. When selecting the variables, we should have a certain understanding of the types of risk. We need to select the indicators that can identify the risk of financial operations, and will not pass the wrong signal. Therefore, the following principles should be followed in the selection of regional financial risk indicators:

Normative principle. Early warning indicators should be as far as possible with the international practice standards, international monitoring index is used to select, and keep basic consistent with the New Basel Capital Accord and reflect the basic requirements of " the core principle of the effective banking supervision "; as far as possible with the people's Bank

B. Index System

of China formulated the" the people's Bank of China Financial Supervision Regulations "requirements, In order to facilitate the people's Bank at all levels to monitor the risk of regional banking industry is easy to implement and measure.

Scientific principle. According to the relationship of Finance and economy, the early warning indicators should be comprehensively reflected between the two related degrees, should follow the objective economic law, in line with the scientific theory and evidence, the early warning indicators require both representative but also have progressiveness, can basically reflect the economic and financial risk of the latest developments.

Precautionary principle. The establishment of the index system is an important part of the early warning process. The early warning function is an important function of the index system. This requires that the choice of indicators and risk is closely related, it can reflect the extent of the risk of regional finance.

Full range design principle. The design of regional financial stability assessment index to reflect the integration of foreign currency, and balance banking, securities and insurance industries, prominent banking in order to achieve on regional financial risks of full coverage and comprehensive analysis, discriminant analysis and early warning. At the same time, to set the background of macroeconomic indicators and take macroeconomic risks into consideration.

Table 3 Regional Financial Stability Index System

	First level indicator	Two stage index	Three stage index	Index attribute
Regional financial stability index system	Regional neutral stability and micro Prudential stability index	Banking internal index	Bank employee growth rate	Positive index
			Deposit and loan ratio	Negative index
			Non-performing loan ratio	Negative index
		Internal index of securities industry	Cost income ratio	Negative index
			Operating income growth rate	Positive index
		Internal index of insurance industry	Insurance employment growth rate	Positive index
			Premium growth rate	Positive index
			Simple payout ratio	Negative index
			Insurance depth	Positive index
		Regional financial ecological environment	Private financing accounted for	Moderate index
	Private financing growth		Moderate index	
	the macroeconomic and financial performance indicators	Regional macroeconomic situation	Regional GDP growth rate	Moderate index
			Regional inflation rate	Moderate index
			Propensity to save	Positive index
		Regional capital flow structure	Real estate investment proportion	Moderate index
			Resource investment ratio	Moderate index
			Agricultural investment accounting	Positive index
		Regional enterprise management	Asset profit margin	Positive index
			Enterprise loss rate	Negative index
		Government regulation ability	Financial income ratio	Positive index
			Fiscal expenditure to the regional GDP ratio	Positive index

C. The Concept of Entropy Method

The weight of the index system is an important link in the comprehensive measurement. The measurement method of the index system can be divided into two categories: subjective and objective. Subjective method mainly includes the analytic hierarchy process (AHP) and scoring method and its characteristics are according to the subjective importance of the attribute index to weight; objective method is according to the index contains information to determine the weights the entropy method is more commonly used.

Entropy method is based on the concept and the properties of entropy, to quantify information of various indicators, and a method of index weight coefficient is obtained. According to the information is passed by information theory point of view, that is to measure the role of an indicator in the indicator system, we must measure the degree of variation of indicators, index variability more, corresponding to the index of the greater the amount of information, and the differential effect is bigger also. While the amount of information can be measured from the entropy measure, reduction in the amount of information means entropy increase.

D. Entropy Mechanism and Results

If there are m index, n observation value;
First, construct the evaluation matrix

$$T_{ij} = \begin{bmatrix} x_{11} & x_{12} & x_{13} & \dots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \dots & x_{2n} \\ x_{31} & x_{32} & x_{33} & \dots & x_{3n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & x_{m3} & \dots & x_{mn} \end{bmatrix} \quad (1)$$

Second, the uniform dimension of the index

In the indicators to be measured, some indicators is positive, which means numerical bigger and more favorable. Some index is negative to the index, that is to say, the smaller the value, the better. There are some indicators are appropriate indicators, said the best in a certain range. Therefore we need to standardize indicator values. In order to remove the non-total amount which presence of dimensions and dimensional units. We should be first to unify dimensional processing before using entropy to determine the weights of indicators.

For positive indicators:

$$x_{ij} = \frac{x_{ij} - \min(x_{1j}, x_{2j}, \dots, x_{nj})}{\max(x_{1j}, x_{2j}, \dots, x_{nj}) - \min(x_{1j}, x_{2j}, \dots, x_{nj})} \quad (2)$$

For the reverse index:

$$x_{ij} = \frac{\max(x_{1j}, x_{2j}, \dots, x_{nj}) - x_{ij}}{\max(x_{1j}, x_{2j}, \dots, x_{nj}) - \min(x_{1j}, x_{2j}, \dots, x_{nj})} \quad (3)$$

For moderate indicators,

When $x_{ij} < L_{1j}$

$$Y_{ij} = 1 - \frac{L_{1j} - x_{ij}}{\max[L_{1j} - \min(x_{1j}, \dots, x_{mj}), \max(x_{1j}, \dots, x_{mj}) - L_{2j}]} \quad (4)$$

When $x_{ij} > L_{2j}$

$$Y_{ij} = 1 - \frac{x_{ij} - L_{2j}}{\max[L_{1j} - \min(x_{1j}, \dots, x_{mj}), \max(x_{1j}, \dots, x_{mj}) - L_{2j}]} \quad (5)$$

When $L_{1j} \leq x_{ij} \leq L_{2j}$, $Y_{ij} = 1$

$[L_{1j}, L_{2j}]$ means the appropriate range of appropriate indicators.

So as to get a new matrix:

$$R_y = \begin{bmatrix} y_{11} & y_{12} & \dots & y_{1n} \\ y_{21} & y_{22} & \dots & y_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ y_{m1} & y_{m2} & \dots & y_{mn} \end{bmatrix} \quad (6)$$

Third, calculate the probability of Y in all the observed values.

$$P_{ij} = \frac{y_{ij}}{\sum_{i=1}^m y_{ij}} \quad \begin{matrix} i = 1, 2, \dots, m \\ j = 1, 2, \dots, n \end{matrix} \quad (7)$$

Fourth, calculate the information entropy of the index of J

$$e_j = \left(-\frac{1}{n}\right) \sum_{i=1}^m P_{ij} \ln(P_{ij}) \quad (8)$$

Fifth, define the difference coefficient

$$g_j = 1 - e_j \quad j = 1, 2, \dots, n \quad (9)$$

Obviously, the greater of g_i is, the bigger difference of the index, and the greater impact on the whole subsystem.

Sixth, the weight of the index of j

$$w_j = \frac{(1-e_j)}{\sum_{i=1}^n (1-e_i)} \quad (10)$$

According to the mechanism of the entropy weight method, we can discover that the greater of the weights of the index is, the greater of the index of the constructed subsystem, the greater steady of the

constructed index finance is; on the contrary, if the index weight is small, smaller index, finance is less robust. Through calculating the entropy method, we can not only determine the weights of indicators in the index system, but also describe the measurement of the stability of the financial system by the index system.

We take China as samples, through collecting the 2008-2012 five-year data to determine the weights of each index by entropy method, empowerment results in the following table shows:

Table 4 the Weight of Regional Financial Indicators

First level indicator	Two stage index	Three stage index	e_j	g_j	w_j
the Macroeconomic and Financial Performance Indicators (0.477)	Macroeconomic situation regional (0.1372)	Regional GDP growth rate	0.277259	0.722741	0.0449
		Regional inflation rate	0.249793	0.750207	0.0467
		Propensity to save	0.26705	0.73295	0.0456
	Regional capital flow structure (0.1409)	Real estate investment accounted for	0.264286	0.735714	0.0458
		Resource investment ratio	0.202105	0.797895	0.0496
		Agricultural investment accounting	0.268443	0.731557	0.0455
	Regional enterprise management (0.1011)	Asset profit margin	0.10047	0.89953	0.0559
		Enterprise loss rate	0.273541	0.726459	0.0452
	Government regulation ability (0.0978)	Financial income ratio	0.2	0.8	0.0498
		Fiscal expenditure to the regional GDP ratio	0.227578	0.772422	0.048
Regional Neutral Stability and Micro Prudential Stability Index (0.523)	Banking internal index (0.1399)	Bank employee growth rate	0.248362	0.751638	0.0467
		Deposit and loan ratio	0.239899	0.760101	0.0473
		Non-performing loan ratio	0.262326	0.737674	0.0459
	Internal index of securities industry (0.0929)	Cost income ratio	0.254669	0.745331	0.0464
		Operating income growth rate	0.251754	0.748246	0.0465
	Internal index of insurance industry (0.1923)	Insurance employment growth rate	0.243521	0.756479	0.047
		Premium growth rate	0.253446	0.746554	0.0464
		Simple payout ratio	0.184973	0.815027	0.0507
		Insurance depth	0.22636	0.77364	0.0481
	Regional financial ecological environment (0.0979)	Private financing accounted for	0.172495	0.827505	0.0515
Private financing growth		0.253427	0.746573	0.0464	

V. CONCLUSIONS

Based on previous studies on the financial stability system and the existing characteristics, this paper establishes a new financial stability index system. In the calculation of the index weight, this paper chooses the method of entropy weighting, which is the

biggest innovation point. Previous scholars adopt mostly analytic hierarchy process (AHP), in which people's subjectivity is too strong, information cannot be amount of fully reflect to the weight. In this paper, we put to use entropy method to decide the attribute weights according to the degree of connection between the attributes or the attributes of the size of the

information, and the results are more reliable. We can measure the regional financial stability, and then compare the stability index of different regions.

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