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Equity holders, assets changes and listed Bank of China, the contagion analysis effect of systemic risk

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ABSTRACT

The effective measure of bank systemic risk to financial market stability plays an important role. Minimum difference entropy analysis and stress testing method changed in this article uses both scholars and build systemic risk of infection matrix norm theory by combining innovative matrix theory norm with rows and columns norm to do precisely this issue metrics. And listed on the Shanghai Stock Exchange has all the assets related to equity holders and changes in the inter-bank and systemic risk situation empirical analysis for the study. The results show that the systematic risk of the size and influence of the banks in the industry with a difference, so the establishment of "bankruptcy as the core" of financial institutions exit mechanism, in essence, is to get rid of "financial security at the end, " the habit of thinking, while effectively reduce and prevent systemic risks in the financial operation of the capital markets and deepen the reform of the banking system to create better conditions.

KEYWORDS

Banking system; Systemic risk; Norm; Contagion effect; Equity holders.

INTRODUCTION

In the past few years, there has been an upsurge of research into the banking systematic risk and contagion effects .Just like Kaufiaaan G and E.R.davis et al.pointed out in this study area.Some international organizations and the relevant financial regulatory authorities also begin to realize the importance of the banking systemic risk and crisis prevention issues at the same time and shows great interest.However, In terms of the current research progress and status, it is only a new branch school in the theory of the borderline to the financial crisis , its theoretical framework is just in an early form. They have not formed a complete scientific theoretical interpretation in the conduction mechanism of the formation factors, risk prediction and prevention, etc of the bank systemic risk. At present, although a lot of experts and scholars and managers to study on this question, and their point of view is wide, it is far from forming a complete system.

THE THEORETICAL ANALYSIS AND APPLICATION OF BANKS' RISK

At present, the research of Chinese Banks' risk transmission characteristics is still lack of systemic measure. In the existing research, Li zong-yi and Li yu-hai(2005)has carried on the empirical research to the Chinese inter bank loan market risk transmission characteristic. Wu Qing-quan and Wang Jinyun (2005), Jiang xuhuai and Wu Fujia (2006) has carried on the empirical research between the inter bank market and capital market ‘contagion risk; Fan Xiao-yun and Cao Yuntao (2005, 2006) are discussed the measure of Banks' contagion risk and analyzed the characteristics of China's inter bank market risk transmission. The study found that inside the Chinese banking system, The probability of contagion risk is very low, at the same time, the probability of its leading to the losses are in the declining; there is no obvious influence on the change of the Inter bank lending rates to the stock market and bond market, their index can cause inter bank lending rates change in the opposite direction, but this influence is weak; Bank loan system memory channels and capital markets contagion effect is limited. Systemic risk is also called market risk or undiversifiable risk, it will impact all assets and the risk cannot be eliminated by portfolio. This part of the risk is caused by that affect the entire market risk, such as: war, regime change, natural disasters, economic cycle, inflation, energy crisis, the macroeconomic policy adjustment, etc. Single item assets, securities portfolio and different companies affected by varies systemic risk, its size is usually measured by the beta coefficient (β coefficient). Systematic risk refers to when there is the risk of failure or collapse of the whole system. System risk in the financial sector is called the financial system unstable; the reason is that some special events causing the situation deteriorating and ends up with disastrous results.

To definition of the bank systemic risk, more representative view is as follows: the IMF officer of Hermosillo argues that , systemic risk is the externalities to make the economic losses of some other extraneous economies , the externality shows as of infectious and risk of overflow.Kaufman , professor of economics at the university of Chicago, argues that systemic risk is an event in a series of institutional and market structure system causes the possibility of a series of consecutive losses.The banking systemic risk refers to a participant's failure due to the other participants to default, causing a chain reaction and lead to the possibility of a wide range of financial difficulties. Nikotay argues that systemic risk is the possibility of a banking systemic crisis, and it refers to the serious damage to the financial markets harmed the basic function of the market, which makes huge damage to the economy, and the injury is extended to other countries.

Domestic study of inter bank market contagion risk started relatively late, the literature is also less.Ma Jun Lu applied 2003 data to estimate the risk of transmission of bilateral banking system, derived inter-bank lending market structure with Bank of China and China Construction Bank as the center.Guo Chen, Song qing-hua simulated the contagion effects of macroeconomic variables, not considering the economic crisis shrinking market liquidity and Banks' assets sale (fire sale) caused by the capital loss and contagion effect further enlarged.In addition, the domestic research has not involved in the different distribution of the inter bank market influence to contagion risk, and on the data selection, Ma used the data before banks reforming and listing in 2003, cannot reflect the characteristics of the current banking systemic risk, and Guo chen’s research only considers the time-series data of 6 listed bank, the sample is small, so it is difficult to guarantee the conclusion of robustness.So far, there is no domestic research directly to the inter bank market on the effects of structure and the liquidity risk of contagion effect, also had no systemically empirical research to the important and infected microscopic characteristics Banks.

CONSTRUCTION OF RISK CONTAGION EFFECT’S MEASURE UNDER CHANGES BETWEEN BANK ASSET HOLDINGS

A single failure of bank assets held risk contagion

Step 1: The object of study for N Banks. x_{ij} Stands for asset holding of bank i to bank j. θ Stands for Bank risk lead to external assets loss rate. $\theta \in [0,1]$. c Stands for the determination of parameters of can pay off the last remaining of the total amount of capital σ .Setting $\sigma_i = \frac{c_i - \theta x_{ij}}{c_i}$ for the parameters of the i bank's risk coefficient, the parameter nearly on

the basis of the definition about the bank's risk in "Basel ". ω is a standard value for bank risk. According to the definition about the bank's risk in "Basel " to get accurate price. If $\sigma > \omega$, it's on behalf of the bank's risk arise.

Step 2:In the first round, If the bank j had a risk, because bank i holding bank j ' s volume assets x_{ij}, when $\sigma_i = \frac{c_i - \theta x_{ij}}{c_i} > \omega$, bank i had a risk, too. In the second round, if bank k holding bank i and bank j 's volume assets are x_{ki} and x_{kj} respectively. As a result, when bank of i and j have a risk together, meet the condition $\sigma_k = \frac{c_k - \theta(x_{ki} + x_{kj})}{c_k} > \omega$, bank k will have a risk followed.....

Step 3: θ have no difference in varies number of infecting, means its value is basically fixed. Namely, contagion affects almost nothing.

Contagion effect under condition of asset liquidity risk

Under the condition of the financial crisis, a sharp deterioration in liquidity of the money market and capital market, Banking institutions cannot often from bust Banks borrow all the money to refinance, For recovering poising of the balance sheet, Banks usually need to sell part of financial assets, and resulting in the impairment of assets for sale. In this case, the fragility of a banking institutions is not only comes from direct exposure to other Banks, but also comes from it will not able to display of all or part of its money in the inter bank market. Existing research often neglects the influence of the liquidity risk of contagion effects and underestimates the scope of the impact of systemic risk and loss.

Assume banking institutions i in the financial crisis can't refinance from the asset losses bank j of borrowed all of the funds x_{ij}, and resulting in the impairment of assets for sale. Assume that Bank i can only reset $(1-\rho)$ proportion of funds borrowed from the bank j, and its assets trading at a discount (that is, the market value is less than the book value), so the bank i was forced to sell the book value of assets $(1+\delta)\rho x_{ij}$, δ represents the degree of assets, assume that the impairment of assets for sale due to a loss of assets $\delta\rho x_{ij}$ which absorbed by the Bank i' capital funds. When external factors lead to bank j in a risk, under the liquidity risk $\theta x_{ij} + \delta\rho x_{ij} > c_i$, bank i collapse, liquidity risk reduces the threshold of a banking collapse.

The numerical estimate analysis of assets holding market structure of inter bank

Due to a relative lack of relevant data, commercial Banks, in the process of this study, the author using the Shanghai stock exchange listed bank equity data (equity), as part of the research data. According to the reference by the scholars both domestic and abroad before , assumed that the structure of the inter bank market for full market structure, asset holdings ratio between Banks are independent of each other, and its distribution scattered as much as possible, the bank asset holdings relationship between can be represented with a matrix x $N \times N$:

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1j} & \cdots & x_{1N} \\ \vdots & & \vdots & & \vdots \\ x_{i1} & \cdots & x_{ij} & \cdots & x_{iN} \\ \vdots & & \vdots & & \vdots \\ x_{N1} & \cdots & x_{Nj} & \cdots & x_{NN} \end{bmatrix} \begin{matrix} a_1 \\ \vdots \\ a_i \\ \vdots \\ a_N \end{matrix} \quad \text{(Formula 1)}$$

$$b_1 \quad \cdots \quad b_j \quad \cdots \quad b_N$$

In this formula, a_i stand for bank i to all the other banks assets. b_i Stands for all the other banks holding in j bank's total asset.

$$\vec{c}_N = \begin{bmatrix} c_1 \\ \vdots \\ c_i \\ \vdots \\ c_N \end{bmatrix}$$ in this formula, c_i stands for i bank can pay off the remaining total capital at last.

$$\rho(N,j)=\frac{\vec{c}_N-\theta\vec{b}_j}{c_i}\overset{\Delta}{=}\begin{bmatrix}\frac{c_1-\theta x_{1j}}{c_1}=\sigma_1\\ \vdots\\ \frac{c_i-\theta x_{ij}}{c_i}=\sigma_i\\ \vdots\\ \frac{c_N-\theta x_{Nj}}{c_N}=\sigma_N\end{bmatrix} \quad (N=1, 2, \ldots, 3)\text{(Formula 2)}$$

Define $\rho(N,j)$ function as an excessive function, mainly for the following discussion, the meaning is: after j bank has a risk, the values of other Banks risk parameter forms a column matrix function.

Hypothesis 4: Banks collapse one by one

And obtained for the first round of the affected Banks risk parameter matrix σ can be expressed in matrix κ, m in κ_m stands for the number of rounds in a systemic contagion risk. Namely in which round of contagion risk, the bank produces risk.

$$\kappa_1=\sum_{j=1}^{N}\rho(N,j)=\begin{bmatrix}\sigma_{11} & \cdots & \sigma_{1j} & \cdots & \sigma_{1N}\\ \vdots & & \vdots & & \vdots\\ \sigma_{i1} & \cdots & \sigma_{ij} & \cdots & \sigma_{iN}\\ \vdots & & \vdots & & \vdots\\ \sigma_{N1} & \cdots & \sigma_{Nj} & \cdots & \sigma_{NN}\end{bmatrix} \text{(Formula 3)}$$

In this formula, σ_{ij} represents after j bank produce a risk, i bank's risk parameter σ_i.

Most of the articles in the next steps, will continue to consider a second, a third round, until the number of m round of systemic risk of the bank transfer , the innovation of this article is based on the risk of the first round here parameter matrix κ_1 conducting matrix norm studies.

$$\kappa_1=\begin{bmatrix}\sigma_{11} & \cdots & \sigma_{1j} & \cdots & \sigma_{1N}\\ \vdots & & \vdots & & \vdots\\ \sigma_{i1} & \cdots & \sigma_{ij} & \cdots & \sigma_{iN}\\ \vdots & & \vdots & & \vdots\\ \sigma_{N1} & \cdots & \sigma_{Nj} & \cdots & \sigma_{NN}\end{bmatrix}\begin{matrix}\vec{\alpha}_1\\ \vdots\\ \vec{\alpha}i\\ \vdots\\ \vec{\alpha}_N\end{matrix} \quad \text{(Formula 4)}$$

$$\vec{\beta}_1 \quad \cdots \quad \vec{\beta}_j \quad \cdots \quad \vec{\beta}_N$$

In this formula, $\vec{\alpha}_i$ represents i bank's risk lead to other bank's σ line matrix of risk parameters.

$\vec{\beta}_j$ Represents the σ columns matrix of the j bank's risk parameters affected by banks' risk

For $\vec{\alpha}_i$, N norm $\left\|\vec{\alpha}_i\right\|=(\sum_{j=1}^{N}\left|\sigma_{ij}\right|^{N})^{\frac{1}{N}}\ (i=1,2,\cdots,N)$ and $\vec{\beta}_j$, N norm $\left\|\vec{\beta}_j\right\|=(\sum_{i=1}^{N}\left|\sigma_{ij}\right|^{N})^{\frac{1}{N}}\ (j=1,2,\cdots,N)$ respectively.

Based on the definition of known as the matrix norm, that is, to avoid the next second, the third round, until the m round of bank risk contagion discussion, so as to define a new systemic risk measure parameter vector of the bank $\vec{\xi}$.

$$\vec{\xi}(i)=\left[\left\|\vec{\alpha}_i\right\| \quad \left\|\vec{\beta}_i\right\|\right](i=1,2,\cdots,N) \quad \text{(Formula 5)}$$

Bank i specific measure of systemic risk can be used 2 -norm of $\vec{\xi}(i)$ (Euclidean norm) to do quantitative. that is , If the systemic risk of Banks measure parameters as a parameter η ,

$$\eta(i) = \left\|\vec{\xi}(i)\right\|_2 = \left\|\left[\left\|\vec{\alpha}_i\right\| \quad \left\|\vec{\beta}_i\right\|\right]\right\|_2 = \sqrt{\left\|\vec{\alpha}_i\right\|^2 + \left\|\vec{\beta}_i\right\|^2} \quad \text{(Formula 6)}$$

At this point, the value of banks systemic risk measurement can be determined.

DATA DESCRIPTION AND CALCULATED RESULTS

Due to lack of relative data, most Banks can only be retrieved in the Wind consulting database of the top 10 shareholders equity holdings, many commercial Banks ' equity holdings data is only the first five shareholder's equity holdings. For continuing to study, this paper use the data again in table 1, the sum $\bar{x}_i = \sum_{j=1}^{N} \sigma_{ij}$ of average value $\bar{x}_i$ in a list as a model for i bank to other Banks to the risk of parameter σ_i of lines, in the same way, the data in table 2 the sum $\bar{y}_j = \sum_{i=1}^{N} \sigma_{ij}$ of average $\bar{y}_j$ of a list as a model for other banks on bank j risk parameters σ_j

According to the formula mentioned, with 16 sample bank data into it can get formula 7.

$$\kappa_1 = \begin{bmatrix} \sigma_{11} & \cdots & \sigma_{1j} & \cdots & \sigma_{1\,16} \\ \vdots & & \vdots & & \vdots \\ \sigma_{i1} & \cdots & \sigma_{ij} & \cdots & \sigma_{i\,16} \\ \vdots & & \vdots & & \vdots \\ \sigma_{16\,1} & \cdots & \sigma_{16\,j} & \cdots & \sigma_{16\,16} \end{bmatrix} \begin{matrix} \vec{\alpha}_1 \\ \vdots \\ \vec{\alpha} i \\ \vdots \\ \vec{\alpha}_{16} \end{matrix} \quad \text{(Formula 7)}$$

$$\vec{\beta}_1 \quad \cdots \quad \vec{\beta}_j \quad \cdots \quad \vec{\beta}_{16}$$

In it, $\bar{x}_i = \sum_{j=1}^{16} \sigma_{ij}$, $\bar{y}_j = \sum_{i=1}^{16} \sigma_{ij}$

So for $\vec{\alpha}_i$ '1 norm, get $\left\|\vec{\alpha}_i\right\| = (\sum_{j=1}^{16} \left|\sigma_{ij}\right|^1)^1 = \bar{x}_i$ (Formula 8)

For $\vec{\beta}_j$ '1 norm, get $\left\|\vec{\beta}_j\right\| = (\sum_{i=1}^{16} \left|\sigma_{ij}\right|^1)^1 = \bar{y}_j$ (Formula 9)

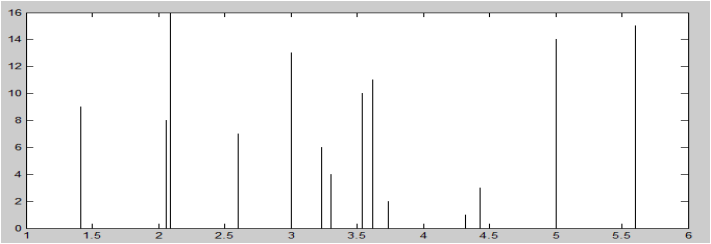
According to the formula 8, 2-6, 9, we can get the table 1

TABLE 1 : 16 samples of the banking systemic risk measurement $\eta(i)$ calculation table

i		$\left\|\vec{\alpha}_i\right\|$	$\left\|\vec{\beta}_j\right\|$	$\eta(i)$
1	SDB Bank	1	4.2	4.32
2	Bank of NingBo	1	3.6	3.74
3	SPDB	1.4	4.2	4.43
4	HXB	0.8	3.2	3.30
5	CMSB	1	3.4	3.54

6	CMBC	1.2	3	3.23
7	Bank of NanJing	1	2.4	2.60
8	Industrial Bank	1	1.8	2.06
9	Bank of BeiJing	1	1	1.41
10	Agricultural Bank	3.5	0.5	3.54
11	Bank of Communications	3.6	0.4	3.62
12	ICBC	5.6	0	5.60
13	CEB	0	3	3.00
14	CCB	5	0.2	5.00
15	Bank of China	5.6	0.2	5.60
16	CITIC Bank	0.6	2	2.09

In order to facilitate the results, using the Matlab drawing below chart 1



Fagure 1 : 16 samples of the banking systemic risk measurement Analysis diagram

CONCLUSION AND SUGGESTION

The establishment of a well-functioning, filled with the unity between rights and responsibility and effective deposit insurance system, which not only can timely collect and check risk information, to promote the formation of market-oriented risk management mechanism, but also can prevent the damage of the interests of investors caused by small and medium-sized banks bankruptcy and avoid bank runs effectively, eventually defuse regional financial risks of the small and medium-sized joint-stock commercial banks, to achieve the purpose of maintaining financial stability.

Financial institution bankruptcy legal system which is suitable for our country's specific situations should be set up to standardize financial institutions' quit procedures from the market. Besides, deposit insurance system should implement priority compensation and differential cost rate mechanism based on risk; linking cost rate to bank's risk level, which means imposing corresponding high cost rates on high-risk bearing institutions such as joint-stock commercial banks, as well as establishing accumulated funds in advance. Moreover, early risk intervention and prompt treatment towards unhealthy banks will serve to restrain potential moral hazard and minimize deposit insurance fund loss, resolving risk through "early detection, early treatment", which will not only radically prevent the risk accumulation of financial system, but also restrict depositors' capital loss from the very beginning.

Although it should withdraw from the market when financing institutions fell into insolvency in modern market economy countries, there are still some difficulties to put large state-owned banks into this system due to the concrete national conditions of China. If financing institutions are involved in systemic risk, the Central Bank can relief them by the aid of reloaning when the withdrawing system is ruled. However, when they deal with systemic risk, the administrating authority has to provide financial support, which may lead some ethical risk problems inevitably. When facing state-owned banks' systemic risk, there should be a separation of providing the last resort lender, as well as give aiding targets punitive interests to get over the risk steadily, and help people to have more confidence to the financial system.

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