Identification of China's Systemically Important Financial Industry based on CoES model

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Abstract

Introducing the Expected Shortfall (ES) into CoVaR framework, the paper establishes the dynamic CoES model to measure the systemic risk undertaken by the various financial industries in China and identify the systemic importance of China's financial industry. The results show that CoES is able to reflect the time variability of risk in China's financial system and the scale characteristics of the China's financial industry. An observation to the mean level shows that when the China's financial system is under the high-risk pressure, the China's banking industry will shoulder the largest risk, followed by the insurance industry, securities industry, real estate industry and diversified financial industries. Among them, the Chinese insurance industry will undertake higher risk compared to its market scale, and the risk undertaken by Chinese insurance industry is significantly larger than the risk spillover. During the global financial crisis, the risk undertaken by each industry in China was higher than the mean value in the sample, which fell to around the mean value after the crisis. In the 'money shortage' period of Chinese banking industry in 2013, the risk undertaken by each financial industry in China changed largely in the short term, especially for the banking industry. During the "stock market crash" and "8.11 exchange reform" in 2015, the risk undertaken by the financial industries in China increased significantly and lasted for a long time.

Keywords: Systemic Importance, Systemic Risk, Risk Spillover, CoES Model

1. Introduction

Since the international financial crisis from 2007 to 2009, the supervision authorities in different countries started to attach great importance to the macro prudential supervision. When focusing on the individual risk of financial institutions, they paid special attentions to the supervisions on the cross-institution, cross-industry, cross-market or even the cross-border financial systemic risk. While the "money shortage" event happened to Chinese banking industry in 2013 and the "stock market crash" event in Chinese stock market in 2015 warned the Chinese supervision authorities, the academic circle and the industry to pay special attention to the macro prudential supervision. On Dec. 29, 2015, the Central Bank of China declared to upgrade the current "dynamic adjustment of differential preparation fund" and "consensual loan management mechanism" to "macro prudential assessment, briefed as MPA" from the year 2016. MPA holds that the stability of single financial institution or the financial market doesn't mean the stability of the entire financial system. What's emerging with this is the identification for the systemic importance of the financial institution in the financial system. The concept of systemic importance was put forward in 2009 by the International Monetary Foundation (IMF) in the investigations for the "systemic importance" expanded among over 30 countries and regions with the main body of G20.

If the shutdown or crisis of a certain financial institution would damage the entire financial system, bring large-scale difficulties in operation within the system and pose significant effects on the financial service-providing abilities in the entire financial system, this institution, then, is regarded as the systematically important financial institution. Researches universally hold that it may define the systemic importance through the influence value of single financial institution for the financial system.

Systematic influence for the financial institution to the financial system is correlated to two aspects. One is that the more contribution of a single institution for the systemic risk under certain risk background shows that this financial institution is the systematically important one. On the other hand, when the entire financial system is under the background of crisis, the larger capital loss of the single financial institution in the financial system shows that this financial institution has a larger contribution to the crisis, which is, the systematically important financial institution, and this is similar to pressure test. However, there are no literatures in China about systemic importance in industry where financial institutions belong, which means there are no researches yet on the systemic risk undertaking and contribution in the various financial industries with the unit of the various financial industries.

2. Literature Review

Looking around in the research status home and abroad, there are those who measure the systemic importance of the Chinese financial institution from the first aspect, for example Adrian and Brunnermeier (2016) proposed the $\Delta \mathrm{CoVaR}$ model to measure systemic risk of financial institutions. To be more specific, when the financial institution is under high risk, the conditional value at risk of the financial system is CoVaR^a; when the financial institution is under normal risk, the conditional value at risk of the financial system is CoVaR^b. Therefore, the absolute value of the difference oftwo conditional value at risk is viewed as marginal contribution of the financial institution to the financial system and used to reflect systemic importance of the various financial institutions. The CoVaR has provided a new method to measure the systemic risk by which to evaluate the systemic importance of financial institutions. So many scholars home and abroad have carried out the application researches after this method is proposed. For example, López-Espinosa et al. (2012), by considering the asymmetric tail connection between a single bank and the banking system, promoted CoVaR the model to the asymmetric state. Reboredo et al (2015), by taking the advantages that the Copula function could effectively fit the financial data, established the Copula-CoVaR Model to measure the systemic risk for different countries before and after the European debt crisis. As for the research status in the country, LiuXiaoxing, Duan Bin and XieFuzuo (2011), considering the importance of the extreme situations in the financial market, combined the Extreme Value Theory (EVT), Copula function and CoVaR, and established the EVT-Copula-CoVaR Model to research the risk spillover among stock markets. BaiXuemei, ShiDalong (2014), ChenShoudong,Wang Yan (2014) utilized the $\Delta \mathrm{CoVaR}$ model to measure marginal contributions of various Chinese listed financial institutions to the financial system, and the results show that the financial systemic risk in Chinese banking industry is the highest. ChenJianqing, Wang Qing, XuShaohui (2015), XuYingmei, Xu Lu (2015) categorized the financial institutions according to the industries they belong to in order to measure the systemic risk spillovers among Chinese financial industries, and the results show that there is non-asymmetry for financial systemic risk spillover effect among financial industries. And the documents written by Wang Yongqiao, Hu Hao (2012), Zhou Tianyun, Yang Zihui, Yu Jieyi, et al (2014), Liu Xiangli and GuShuting (2014) all employed the CoVaR measuring method to carry out empirical research on the systemic risk of Chinese financial market. The literatures above, starting from the different perspectives and with the employment of different improved CoVaR models, researched the systemic importance of the financial institutions, and obtained the similar results: the systemic risk generally would be reflected into the ‘too big to fail’ financial institutions, which means the systematically important financial institutions are usually those with large scales.

However, the Chiness scholar Jia Yandong (2011), who carried out research on the systemic importance of the financial institutions based on the perspective of financial network, pointing out that there are ‘external effect’ existing in the financial institutions and stressed the ‘too big to fail’’ must be systematically important, while the systematically important financial institutions would not necessarily reach the degree of ‘too big to fail’’. For example, in the recent financial crisis, Bear Stearns and Lehman Brothers shut down successively, however the JP Morgan was only slightly affected in the financial crisis. And the similar situation happens in Europe.

There are literatures home and abroad which measure the systemic importance of financial institutions in China, for example, Acharya (2010) stressed that under the background of the breakout of the systemic risk, compared the capital shortage degree of the entire financial system, the single financial institution, on the basis of the Expected Shortfall (ES), should establish the MES method to measure the values of the expected loss faced by the various financial institutions when the entire financial system’s benefits rates decline, measuring the systemic importance of this institution by calculating the comprehensive capital shortage degree of the single financial institutions in contrast to the financial system. Acharya, Engle and Richardson (2012) took the factors as the bank's scale, leverage and interior connection into consideration for the expected capital shortage to measure the capital shortage of the various banks when the banks are in the crisis background. Brownlees and Engle (2017) proposed questions for the key hypothesis made by Acharya (2010), that is, when a financial institution is facing the capital shortage, it may be acquired and merged, or it may collect new capital or face bankruptcy. The financial service gap that it leaves will be filled by other financial institutions, and therefore, the single financial institution has little impacts on the entire financial system. However, when the hypothesis conditions couldn't be met, which means when the single financial institution's capital shortage event happens at the time when the entire financial system is capital-restrained and the normal compensation couldn't be made, it will seriously weaken the financial intermediary service functions of the financial department. On this basis, Brownlees and Engle (2017) proposed the Systemic Risk Indicators (SRISK). Different from MES, SRISK refers to the expected capital gap of the single financial institution when the systemic financial crisis happens in the future. What it stresses is to identify the systematically important financial institution based on the long-term capital shortage. Banulescu and Dumitrescu (2015), on the basis of MES, introduced the market weight of the financial institution into it and established the Component Expected Shortfall (CES) method to explain the characteristics of 'too connected to fall' and 'too big to fall' in China.

Other literatures that measure the systemic importance of the Chinese financial industry from the second aspect include works of Guo Weidong (2013), Song Qinghua, and Jiang Yudong (2014) respectively who employ the MES model and DCC-GARCH-MES model to measure 14 listed commercial banks' contributions to the marginal risk of the financial system. Liu Lu and Wang Chunhui (2016), with the DCC-GARCH-MES model, measured the systemic risk of Chinese insurance system. Fan Xiaoyun, Wang Daoping, Fang Yi (2011), Zhou Qiang, Yang Liuyong (2014) and Bu Lin, LI Zheng (2015) made comparisons among the methods as CoVaR, MES and CES. SU Mingzheng, Zhang Qingjun, Zhao Jinwen (2013) and Zhang Tianding, Zhang Yu (2016) measured the systemic importance of the China's financial institution with CES Model. Liang Qi, Liang Zheng and Hao Xiangchao, based on SRISK method, calculated the capital shortage degree for 34 listed banks, insurance companies and securities companies, making evaluations for their systemic importance, and found out that the financial institutions with large scales are ranking among the top ones in the systemic importance.

In conclusion, the various systemic importance-researching methods have their edges. Among them, the nature of CoVaR is to describe the market risk of the financial system in the correspondent situation by solving the VaR of the financial institutions under two special conditions, and representing the contribution of the financial institutions for the risk in the financial system with the differences of the VaR under these two conditions. Looking from the perspective of risk measurement, the nature of CoVaR is to describe the market risk of the financial institutions with VaR.

The first VaR-based risk measurement model was established in 1994 by JP Morgan. VaR as being simple and understandable, is widely applied, but is also questioned for its own defects. One of its defects is that it couldn't take into consideration of the tail extreme loss of the random variable, having no sufficient description for the tail loss, while the little possibility and big losses are especially important to the financial market. Another defect is that VaR couldn't meet with the sub-additivity, which means it couldn't meet with the consistency requirements of the risk measurement. Then, Acerbi and Tasche (2002) proposed the new risk measurement indicators, which meet with the consistency measurements requirements, that is, the Expected Shortfall (ES). Therefore, this text took in the edges of the above methods, introducing ES into CoVaR research framework to propose the dynamic CoES model, which starting from the comprehensive crisis of the financial system, measures the systemic importance in China's banking industry, insurance industry, securities industry, real estate industry and diversified financial industry from the dimensions of time and space.

3. Model Introduction

$\Delta\mathrm{CoES}$ is an improvement of $\Delta\mathrm{CoVaR}$. So we firstly illustrate the CoVaR measurement method:(1) System-$\Delta\mathrm{CoVaR}$ is able to measure systemic risk contribution of single financial institution to financial system s through calculating $\Delta\mathrm{CoVaR}^{s|i}$; (2) Exposure-$\Delta\mathrm{CoVaR}$ similar to pressure test is able to measure assets of financial system s to single financial institutioni exposed system impact by calculating $\Delta\mathrm{CoVaR}^{i|s}$, which means the more assets exposed in system impact, the more contributions made to systemicrisk; (3) Network-$\Delta\mathrm{CoVaR}$ can apply this method into research on risk spillover effect of the entire network by calculating $\Delta\mathrm{CoVaR}^{j|i}$, for instance, when institution i at risk pressure, the changed CoVaR of institutionj; (4) CoVaRcan be further promoted into the other risk measure method with excellent properties, such as conditional expected loss (CoES), however, there are no papers where ΔCoES is adopted to measure Chinese systemicrisk.Based on the static CoES model, this paper proposes a dynamic CoES model. The market data are used to capture the impact to the expected losses of financial industry when the entire financial system under risk pressureor the impact to expected losses of financial system when some financial industry under risk pressure.

3.1 Static CoES model

CoES refers to the expected loss (ES) of the financial industry j when the financial system s is under extreme risk pressures:

$$CoES_q^{j|s} = E(X^j \le CoVaR_q^{j|C(X^s)} \mid C(X^s)) \quad (1)$$

The CoES of financial industry j conditional on the financial system s is under extreme risk pressure minus the CoES of financial industry j conditional on the financial system s is under the normal risk pressure.

$$\Delta CoES_q^{j|s} = CoES_q^{j|x^s=VaR_q^s} - CoES_q^{j|x^s=VaR_{0.5}^s}$$

$$=E(X^j \le CoVaR_q^{j|C(X^s)} \mid C(X^s)) - E(X^j \le CoVaR_{0.5}^{j|C(X^s)} \mid C(X^s)) \quad (2)$$

Where, the CoVaR can be defined as

$$\Pr(X^j \le CoVaR_q^{j|C(X^i)} \mid C(X^i)) = q \quad (3)$$

Where, the CoVaR refers to VaR of industry j when the financial system s is under risk pressure; $C(X^i)$ refers to state of financial system s under extreme risk X. The risk spillover of financial system s to industry j is:

$$\Delta CoVaR_q^{j|s} = CoVaR_q^{j|x^s=VaR_q^s} - CoVaR_q^{j|x^s=VaR_{0.5}^s} \quad (4)$$

It means the risk spillover of financial system s to industry j refers to difference of value at risk from industry j when financial system s is under qquantile and 0.5quantile. Since we focus on the loss which is corresponding to the left-tail distribution of random variables, the value of q is generally small, and it is 0.1, 0.05, or 0.01 in literatures. However, one needs to notice that CoVaR is not the consistent risk measurement as a result of its failure to meet sub-additivity. But sub-additivity is a property which must be met by any risk measure.It describes the risk diversification principle in modern investment portfolio theory and which is a basic condition for portfolio decision.

3.2 Dynamic CoES model

Considering the time dimension and spatial dimension of risk, this paper further builds dynamic CoES model based on dynamic VaR model where the data generation process of X^s and X^j is set as follows:

$$X_t^s = \alpha^s + \gamma^s M_{t-1} + \varepsilon_t^s \quad (5)$$

$$X_t^j = \alpha^{j|s} + \beta^{j|s} X_t^s + \gamma^{j|s} M_{t-1} + \varepsilon_t^{j|s} \quad (6)$$

Here, the M_{t-1} refers to the lagged state variable vector. The quantile regression coefficients of (5) and (6) are obtained by quantile regression, and then the time-varying VaR and CoVaR are obtained:

$$VaR_{q,t}^s = \hat{\alpha}_q^s + \hat{\gamma}_q^s M_{t-1} \quad (7)$$

$$CoVaR_{q,t}^{j|s} = \hat{\alpha}_q^{j|s} + \hat{\beta}_q^{j|s} VaR_{q,t}^s + \hat{\gamma}_q^{j|s} M_{t-1} \quad (8)$$

The time-varying ΔCoES can be obtained according to the (7) and (8):

$$\Delta CoES_{q,t}^{j|s} = CoES_{q,t}^{j|x^s=VaR_q^s} - CoES_{0.5,t}^{j|x^s=VaR_{0.5}^s}$$

$$=E(\hat{X}^j \le \hat{\alpha}_q^{j|s} + \hat{\beta}_q^{j|s} VaR_{q,t}^s + \hat{\gamma}_q^{j|s} M_{t-1}) - E(\hat{X}^j \le \hat{\alpha}_q^{j|s} + \hat{\beta}_q^{j|s} VaR_{0.5,t}^s + \hat{\gamma}_q^{j|s} M_{t-1}) \quad (9)$$

3.3 ΔCoES model expansion

First, Exposure-$\Delta \mathrm{CoES}^{j|s}$ is able to measure the changes of expected loss in financial industry j when financial system is under high-risk state; Secondly, the Network-$\Delta \mathrm{CoES}^{j|i}$ is able to measure the changes of expected loss in financial individual j caused by high-risk state of any financial individual so as to measure changes in risk taking caused by high-risk state of the entire financial network or other financial individuals; Thirdly, System- $\Delta CoES^{s|i}$ is able to measure the changes of expected loss in the entire financial system s caused by financial individuals, which means the marginal contribution made by financial institution i to systemic risk.

4. Empirical analysis

4.1 Data selection and description

The second-level industry index of Shenyin Wanguo Securities refers to second-level industry stock price index compiled based on industry classification standards by China Securities Regulatory Commission, which is widely used by domestic scholars. Therefore, the paper also selects the second-level industry index of Shenyin Wanguo Securities including the banking, insurance, diversified finance, securities and real estate industry from January 18, 2007 to February 8,2017. Excluding the data of inconsistent business dates, 2323 sets of valid data are obtained by adopting formula $r_t = 100 \times \ln(p_t / p_{t-1})$

which includes price series in the banking, insurance, diversified finance, securities and real estate industries; r_t refers to the corresponding yield data after conversion, and the yield rate of the financial system is obtained through weighting of daily yield rate all financial sub-sectors with calculation formula of $r_t^s = \sum_i \frac{\omega^i}{\sum_j \omega^j} r_t^i$.

The weighting of most literatures is calculated according to general capital. However, due to the actual situation of China circulation stock accounting for relatively low rate of general capital, the utilization of capital stock in circulation is able to precisely reflect the real situation of China's financial industry. Therefore, the weight in the paper adopts the proportion that capital stock in circulation of all indexes accounts for general capital stock in circulation of the entire financial system. The data in this article are derived from the Wind database.

Table 1 shows the proportion of capital stock in circulation in all financial sectors and general capital stock in circulation of the entire financial industry. According to the calculation results show that the banking industry is the largest proportion among the second-level China's financial sub-industry with weight of 0.7433, a figure which is greatly larger than weight of other financial industries. The second largest financial industry refers to the real estate industry with the weight of 0.1348 followed by the securities industry, insurance industry and diversified finance industry. The sequence representing yield rate of the entire financial system can be obtained according to the proportion of all financial sectors in Table 1 and the daily yield rate data in all financial industries.

Table 1: The weight of financial industries accounts for the financial system

	bank	real estate	securities	insurance	diversified finance
Circulating share capital (100 million yuan)	10401.9700	1886.1940	1098.6270	410.0722	196.6271
weight	0.7433	0.1348	0.0785	0.0293	0.0141
order	1	2	3	4	5

Table 2 describes the basic characteristics of the banking, insurance, diversified finance, securities, real estate and financial system yield rate. It shows that the standard deviation of the securities industry in the sample range is 2.9831 which is higher than that of other industries, indicating that the largest fluctuation in the securities industry within the sample range. The average yield rate in the sample range shows that the maximum average yield is diversified finance sector with 0.0463 yield rate, and the real estate industry is the second largest financial industry with average yield of 0.0417 followed by the banking and securities industry. The insurance industry is the minimum average yield of all financial industries where it is below 0 and that of others is greater than 0. Meanwhile, the largest yield is made in diversified finance industry, and however, the corresponding volatility is also larger, which meets the characteristic of financial market of high risk with high income. As for the yield in all sectors, the larger variation range of yield are securities industry and insurance industry, while it is slight in the real estate industry.

The kurtosis of yield in each sector is greater than 3 and is characterized by sharp peak and heavy tail. The yield in all financial industries is in left avertence, and the P-value tested by the Jarque-Bera of the yield sequence is close to zero, the original hypothesis is rejected, which means the yield sequence is against normal distribution. This paper calculates model parameters by adopting the quantile regression and it does not require that the sequence must comply with the normal distribution.

The P-value of stationary test statistic is close to zero, and the original hypothesis that the unit root is existed is rejected, which means the yield sequence is in a stationary sequence.

In this paper, the state variables from January 18, 2007 to February 8, 2017 are selected; the state variables and their methods of calculation are as follows: Shanghai-Shenzhen 300 index volatility, the standard deviation obtained from the 22-day rolling yield represents the market volatility; trend variables of interest rate can be represented by changes of bond rate with 3 months. The short-term liquidity trend variables indicate short-term liquidity tightening degree of the financial market, which is represented by the difference of the interbank interest rate of 3 months and treasury bond rate of 3 months; The CSI 300 index yield represents market returns; US yield curve represents changes in world business cycle is expressed by the difference of US treasury bond interest of 10 years and 3 months; The Chinese yield curve represents the changes in the Chinese business cycle is expressed by the difference of Chinese treasury bond interest of 10 years and 3 months.

Table 2: Descriptive statistics of yield data

statistics	diversified finance	bank	securities	insurance	real estate	financial system
mean	0.0463	0.0238	0.0213	-0.0069	0.0417	0.0254
max	11.0125	9.5507	15.5909	12.8579	9.3925	9.5044
min	-11.6225	-12.4412	-17.3323	-20.2730	-14.5848	-13.2688
std	2.6499	2.1106	2.9831	2.5398	2.4280	2.0626
skewness	-0.5158	-0.1090	-0.1194	-0.1712	-0.4973	-0.2556
kurtosis	5.3976	7.0075	5.9167	7.0374	5.3508	6.8914
JB-test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ADF-test	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

4.2 Static empirical results

This paper calculates the impact of financial industry when the financial market encounters systemic risk by adopting quantile regression and historical simulation method according to Formula (1) - (2). Table 3 shows the influence suffered by expected loss conditions of financial systems in Chinese banking, real estate, securities, insurance and diversified finance when the entire financial system is under high-risk state. Table 3 shows that when the entire financial system is under high-risk state, China's securities industry will suffer the greatest impact followed by banking, insurance, the real estate and diversified finance. There is a gap between the results and the order of each industry's market size. Particularly, the circulation stock of China's securities industry accounts for a smaller proportion of the entire financial system than that of China's banking industry which, however, suffers less impact from the financial system than the former. The impact suffered by China's insurance industry is significantly larger than that ordered according to size. This may be related to two situations: first, what described in Table 3 refers to static situation which is unable to give explanation about dynamic market of the securities industry; second, according to Chen Jianqing, Wang Qing and Xu Shaohui (2015), China's securities industry refers to the industry where low risk spill and high risk overflow as a whole. Therefore, this paper further explores the systemic risk spillovers of China's securities industry and insurance to other industries, and that of other industries to securities industry and insurance industry. The results are shown in Table 4.

Table 3: Influence of financial systemic risk on ΔCoES in all financial industries

financial industry	Bank	real estate	securities	insurance	diversified finance
Static ΔCoES	6.6395	5.0820	9.1323	5.4971	3.6107

Table 4: Influence of expected loss caused by securities and insurance industry on financial industry

Direction	ΔCoES	Direction	ΔCoES
from securities to diversified finance	4.0952	from diversified finance to securities	9.3363
from securities to insurance	8.2550	from insurance to securities	8.5941
from securities to bank	3.5814	from bank to securities	8.2052
from securities to real estate	7.5486	from real estate to securities	9.1851
Direction	ΔCoES	Direction	ΔCoES
from insurance to diversified finance	3.5264	from diversified finance to insurance	7.6255
from insurance to securities	8.5941	from securities to insurance	8.2550
from insurance to bank	4.2403	from bank to insurance	4.9797
from insurance to real estate	5.1623	from real estate to insurance	12.5342

The results in Table 4 are consistent with the conclusions given by Chen Jianqing, Wang Qing and Xu Shaohui (2015) that the systemic risk spillovers of China's securities industry to any other financial industries are smaller than those of corresponding financial industries to China's securities industry; especially for banking and diversified finance industries, the risk spillover of securities industry to banking is 3.5814 significantly less than 8.2052 which refers to the systemic risk spillover of the banking to securities industry; the risk spillover of securities industry to diversified finance is 4.0952 significantly less than 9.3363 which refers to risk spillover of diversified finance to securities. Therefore, the Chinese securities industry is characterized by high risk overflow and low risk spillover. Table 4 also shows the risk spillovers of China's insurance industry in other financial industries, and the results show that the risk spillovers of China's insurance industry and other industries are those of overflow to other financial industries, which are smaller than those of other financial industries to the insurance industry in addition to the securities industry. Particularly, as for the diversified finance and real estate industry, the systemic risk spillover of insurance industry to diversified finance is 3.5264 significantly less than 7.6255 which refers to risk spillovers of diversified finance to insurance industry; the systemic risk spillover of insurance industry to real estate is 5.1623 significantly less than 12.5342 which refers to risk spillovers of real estate to insurance industry.

4.3 Dynamic empirical results

This paper considers the changing environment at home and abroad in financial industry, and selects measurement samples ranges from January 18, 2007 to February 8, 2017. In this decade, China's financial industry had witnessed important periods such as the global financial crisis, the European sovereign debt crisis, the domestic "money shortage", "stock market crash", "8.11 exchange reform" and RMB's participation in SDR on October 1, 2016. So this paper measures impact on different financial industries by financial system at different periods according to formula (5) - (9).Table 5 shows basic description statistics of the variable sequence with time varying influence of expected loss in all financial industries when China's financial system is under high- risk state in different periods.

It can be seen from the mean value of the ΔCoES sequence, the paper finds that ordering of the dynamic impact on financial industry from financial systems is similar to ordering of their sizes. However, the general trend is corresponding to maximum marginal risk of Chinese banking industry to the entire financial system whose high risk impacts the banking industry, which is related to the huge proportion of the banking industry accounting for the entire financial system. The China's insurance industry is affected deeper by the financial system than the real estate and securities whose market sizes are larger than that of the insurance industry; relatively speaking, the real estate industry ranks No. 2 in financial industry and it suffers less impact than securities and insurance industries do with relative smaller scale when the financial system is under high-risk state, which is related to the characteristic of high-yield and low risk in China's real estate industry.

The diversified finance industry is lightly affected by high risk of entire financial system as a result of smaller market share of diversified finance industry and superficial business operation.

Table 5: Descriptive statistics of ΔCoES sequence

ΔCoES	Bank	real estate	securities	insurance	diversified finance
mean	4.7978	2.2041	2.2376	2.4390	1.9578
max	7.3362	2.5989	2.4005	3.0632	2.0996
min	2.3403	1.8960	2.1004	1.9753	1.8361
std	0.4225	0.0651	0.0288	0.0993	0.0195

Figure 1-3 describes the dynamic sequence chart of the impact of China's financial systemic risk on various financial industries at different times where Figure 1-3 describes China's banking, real estate, securities, insurance and diversified industries, and concludes that variation trend of five industries is consistent after influence of financial systemic risk under the condition of China's financial systemic risk impact, which also reflects the variation trend of China's financial systemic risk. Generally speaking, because China's financial system faces higher risk as a whole during periods of financial crisis and the outbreak of European debt crisis, the change trend of expected loss in all industries is significantly higher than the corresponding mean value level, and lasts for longer time; during the "money shortage" event period, China's financial systemic risk increasingly impacts all financial industries, and the banking industry suffers a lot during this period. The year 2015 saw overall fluctuation in China's financial market during periods of "stock market crash", "8.11 exchange reform" and RMB's participation in SDR which exerted increasingly impact on all financial industries. It shows that the CoES model is not only able to capture the time-varying financial systemic risk in China's financial system, but also reflect the sizes of all financial industries.

Figure 1: The impact of financial systemic risk on the banking and real estate industry

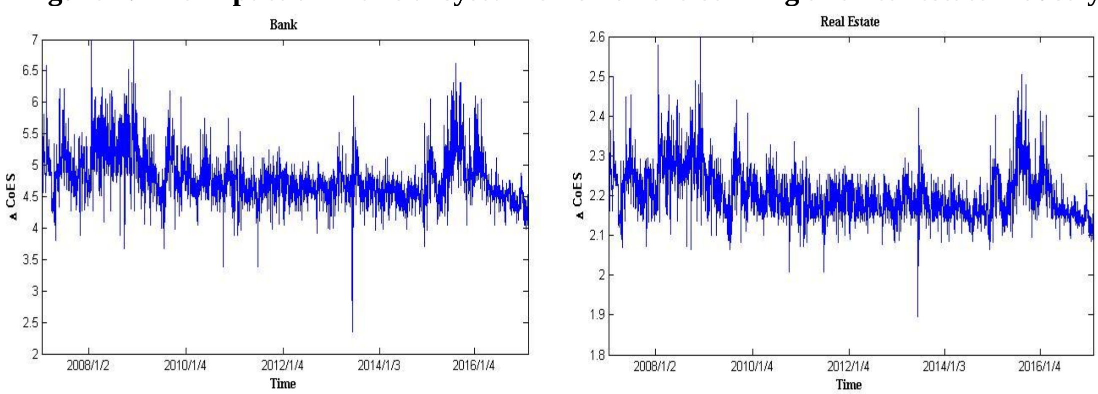


Figure 2: The impact of financial systemic risk on securities and insurance industry

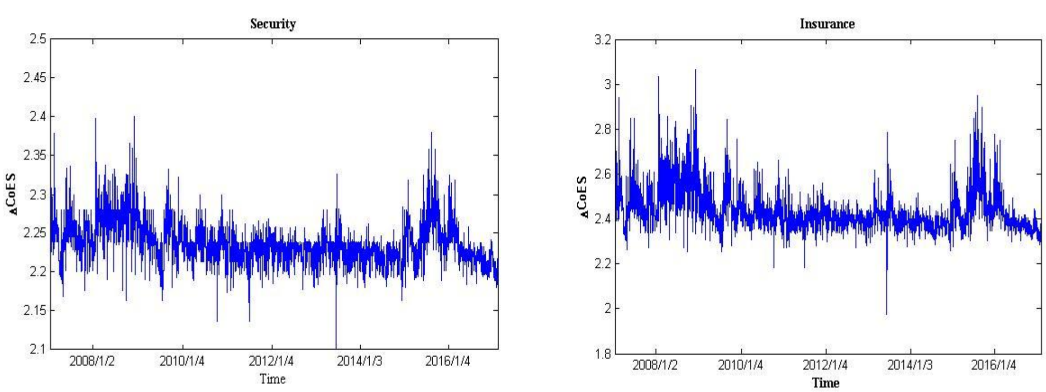
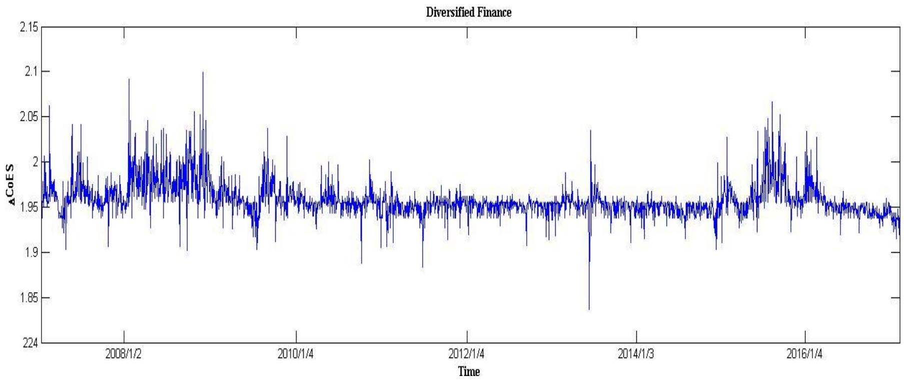


Figure 3: The impact of financial systemic risk on diversified finance industry



5. Conclusions

Rather than assessing importance of financial institutions according to contributions made by single financial institution in systemic risk, the paper starts from overall financial systemic risk to study the influence of expected loss in all financial industries so as to reflect important financial industries in China's financial system when the entire financial system is in a high- risk state. This paper combines the expected loss (ES) of the risk measurement and the CoVaR framework, applies dynamic CoES to describe the expected loss in financial industries when the financial system is in the high -risk state and the normal risk state, and measures the influence of high risk of system on expected loss in all financial industries by utilizing difference of both CoES, which is ΔCoES .Considering the time dimension and spatial dimension of systemic risk, the paper discusses dynamic influence on expected loss of all financial industries when China's financial system is in high-risk state by using dynamic ΔCoES.

The results show that, different from what has been achieved in many literatures, there is the positive correlation between financial risk assumed by various industries and the market sizes, but it is not consistent completely. For instance, China's circulation stock in insurance industry accounts for 0.0293 of that in market financial industry and among all second-level financial industry in China, it is ranked fourth according to the size ordering of the circulation stock. When the risk of financial system are higher, China's insurance industry is ranked No. 2 in assuming risk and bears more risk than securities and real estate industries do with relatively larger scales. It indicates through further verification that there is an asymmetry for systemic risk spillovers in China's insurance industry and other financial industries, which means the risk spillovers of insurance industry to other financial industries are larger than those of the latter to the former. In the past decade, there is significant time-varying characteristic in China's financial market systemic risk, and during the global financial crisis, China's financial system is also in a high-risk state, and risk assumed by all financial industries increase at the same time.

With the weakening of financial crisis, the possibility to bear risk for all financial industries falls back to the mean value; although the "money shortage" event has affected China's financial system temporarily, it has impacted China's financial industries, and the banking industry in particular. The year 2015 had witnessed higher systemic risk in China's financial market as a whole during the periods of "stock market crash" and "8.11 exchange reform", and at the same time, risk assumed by all financial industries in China had increased significantly which were similar to those assumed by them during the financial crisis.

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