The Influence of Foreign Stock Markets on Chinese Stock Markets during the period of Subprime Crisis in 2008

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Abstract - In this paper, several major composite indices from Chinese stock markets and some developed countries are researched. The developed countries belong to the countries who had been highly influenced by the subprime crisis in 2008, including Australia, German, French, Japan, United states of American, United kingdom. Our research shows the Chinese stock markets in mainland have been highly influenced by the stock markets in American, Australia, Japan and Hong Kong. We find that the four countries and region are just the countries who have closed trade relations with China mainland. It also denotes the trade relationship is a major way of financial crisis spreading.

Index Terms - subprime crisis, stock price index, granger causality test, VAR (Vector Auto-regression Mode)

1. Introduction

Reviewing the financial crisis in past 20th century, the crash of stock markets is the signal of crisis coming. The stock markets in China mainland are becoming more and more vulnerable to be influenced by the crisis in financial field from other countries. For example, Around 1990s, the Japanese asset price bubble collapsed because of the greatly inflation of real estate and stock prices. The US subprime mortgage crisis in 2007 triggered the worldwide financial crisis[1], which make a large partition of markets value of the domestic stock markets have been evaporated in short time. Thus, it is important to research the influence of foreign stock markets on Chinese stock markets in emergence period.

If we can completely master the transmission mechanism of economic crisis from the origin country to the other countries and exactly predict the economic crisis, it is possible that the government take steps to nip the crisis in the bud. Ye Wuyi and Liu Xiaoquan have investigated the financial contagion during the subprime crisis between the US S&P 500 index and five Asian markets, namely China, japan, Korea, Hong Kong and Taiwan. They find that a statistically significant change point exists in the dependence between the US market and all Asian stock markets except Taiwan[2]. Song have researched the financial linkage relations among the stock markets in China mainland, American, Hong Kong during the worldwide crisis. However, they have ignored some other developed countries who have been highly influenced by the subprime crisis, which affect Chinese economics because of the closed trade relationships. Just as Garas proposed that a crisis that originates in a large country, such as the USA, has the potential to spread globally[3]. Meanwhile, these research also show that countries with a much lower GDP, such as Belgium, are able to initiate a global crisis. Thus, we should pay attention to that the countries suffering large loss may highly affect our economics.

For that reason, in this paper, we will research the influence of the several developed countries' stock markets on Chinese stock markets during the period of worldwide economic cirri's around 2008.

2. Data

The origin of the worldwide crisis is coming from subprime housing credit problems in American in July 2007, the worldwide stock markets have suffered a large fluctuation at the end of July to early August. On September 15, 2008, the 158-year-old fourth-largest U.S. investment bank, Lehman Brothers, declared bankruptcy, the U.S. subprime mortgage crisis quickly turned into a ferocious financial storm. As a symbol, the most serious global financial crisis and economic recession after the second world war was coming. Thus, the period from January 1, 2007 to December 31, 2009 was selected as the sample period. Every six month is a sample period.

The stock composite indices in serial developed countries, including Australia, German, French, Japan, United states of American, United kingdom, are studied. All the data used in this paper are extracted from the RESSET Financial Research Database (http://www.resset.cn/). The data used in this paper was collected on July 20, 2014

We choose the composite index which can reflect the whole trend of the stock markets in the countries mentioned above. The detailed indices and its short names in this paper listed in Table 1.

For the purpose of keeping the sample data integrity and consistency in data processing, the Occam Razor method is used. It means that the empty data of a certain day will be instead by the data of the previous day.

TABLE 1 The kinds of stock price indices and its short name in this paper

Country or name of stock market	Name of composite index	Index code	Short name in this paper
United states of American	Nasdaq composite index	I05031	US
United kingdom	London's FTSE 100 index	I03001	GB
German	Deutscher Aktien Index	I03051	DE
French	Cotation Assisté en Continu 40	I03021	FR
Japan	Nikkei 225 index	I01021	JP
Australia	Australia's composite index	I06001	AU
Hong Kong exchange	Hang Seng Index	HSI	HSI
Shanghai Stock Exchange	Shanghai Composite Index（new）	000017	SHI
Shenzhen Stock Exchange	Shenzhen stock composite prices index	399106	SZI

3. Empirical Study

A. Judgment of time series data stability

The relationships of the closing price of the composite indices in stock markets along with the date during the period from January 1, 2007 to December 31, 2009 are listed in Fig. 1. It is worth to mentioned that the coordinate of Y-axis is logarithmic coordinate.

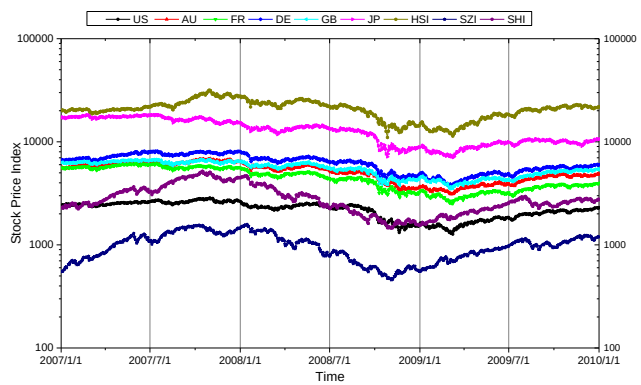

Fig. 1 The fluctuation of 9 kinds of stock price indices in single logarithmic coordinate

As shown in fig. 1, the mean value and variance of the time series indices changes along with the date, the time series data have a random distribution and do not obey a certain probability distribution function. In order to avoid the phenomenon of spurious regression, the method of Unite Root Test is used to judge the time series data stability[4].

We find that the starting point of these curves are not the origin of coordinates, meanwhile the curves haven't the obviously increasing trends or decreasing trends. Therefore, the interceptor item should be included in test equation, but the trend item shouldn't be included. The Augmented Dickey-Fuller (ADF) method is used to test the indices stability for unit in level and 1st difference. The mode can be expressed by equation (1).

$$\Delta y_t = \alpha + \gamma\, y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + u_i$$
$$H_0 : \gamma = 0 \qquad H_1 : \gamma < 0 \tag{1}$$

Where, Each six month as a sample set; the lag length in the test model is obtained according to the Akaike Info Criterion (AIC); the maximum lags is 12. We find that the 9 kinds of indices haven't the characteristics of stability when test for unit root in level, but they have obviously characteristics of stability in 1st difference, I.e. $I(1)$. The results of t-Statistic in unit root test are plotted in table. 2.

TABLE 2 The results of unit root test in 1st difference

Time		2007-1	2007-2	2008-1	2008-2	2009-1	2009-2
number		124	127	125	128	124	128
t-Statistic (ADF test)	SZI	-10.96	-11.68	-11.54	-10.58	-10.27	-10.58
	SHI	-12.68	-11.65	-13.26	-11.16	-11.41	-11.16
	HSI	-6.85	-5.50	-14.61	-4.574	-10.75	-12.20
	GB	-10.37	-13.35	-13.00	-5.96	-11.14	-12.42
	DE	-10.01	-7.01	-11.62	-9.65	-11.11	-11.67
	US	-11.51	-12.32	-12.38	-10.49	-13.08	-10.55
	FR	-6.57	-12.74	-12.40	-6.17	-11.45	-6.98
	RP	-6.70	-5.54	-5.43	-9.39	-12.23	-7.01
	AU	-6.53	-5.75	-8.15	-7.83	-11.25	-6.74

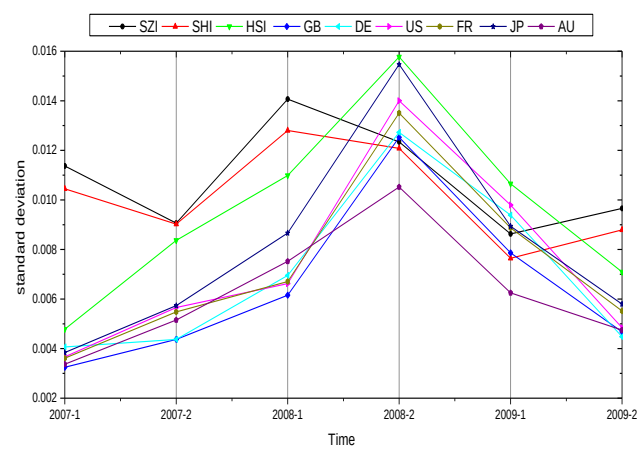

Fig. 2 The standard deviation under the condition of $I(1)$

As shown in Fig. 2, the standard deviation of SZI and SHI have a relatively high value from 2007 to the first half year of 2008. The reason just as I have pointed in reference [5]. It is mainly due to new listed companies frequently listed on the stock markets. There are 140 new companies listed in stock markets in 2007, which make the total assets of the stock markets suddenly increase. The stock markets need time to adopt and digest the changes.

Fig. 2 seems to show that all the stock price indices in developed stock markets have the same trend with US stock markets. The Hong Kong stock market have a large fluctuation because it is a highly opening stock market.

B. Established the VAR Mode (Vector Auto-regression)

In order to master the dynamic relationships among the 9 kinds of indices, the VAR model is used after conforming the data have the 1st difference stability[6]. It is an econometric model used to capture the linear interdependencies among multiple time series. A VAR model describes the evolution of a set of k variables (called endogenous variables) over the same sample period ($t = 1, ..., T$) as a linear function of only their past values, A *p-th* order VAR, denoted VAR(p), is

$$y_t = A_1 y_{t-1} + \cdots + a_p y_{t-p} + Hx_t + \varepsilon_t \qquad t = 1, 2, \cdots, T \tag{2}$$

Where, y_t is an $k \times 1$ vector of time series endogenous variables; x_t is an $d \times 1$ vector of time series exogenous variables; p is the lag order; T is the number of sample data; H is the coefficient matrix.

According to the criterion that the variables can be defined as exogenous variables if there are no causality relationships between the variables and the variables being explained, or else the variables should be viewed as endogenous variables. In this paper, we mainly investigate mutual influence among the indices. Thus, there is no exogenous variables in the model; all the variables are viewed as endogenous variables. According to the Akaike Info Criterion(AIC)[7], we get the maximum lag is 6. In order to test whether the VAR model is correct, the AR root graph and the AR table are obtained. We find that the model is effective only when the remaining variables are US, AU, JP, HIS, SHI, SZI. That is to say, all the modules of the Roots of Characteristic Polynomial is less than 1; all the inverse Roots of AR Characteristic Polynomial lay in the unit circle, as shown in Fig. 3.

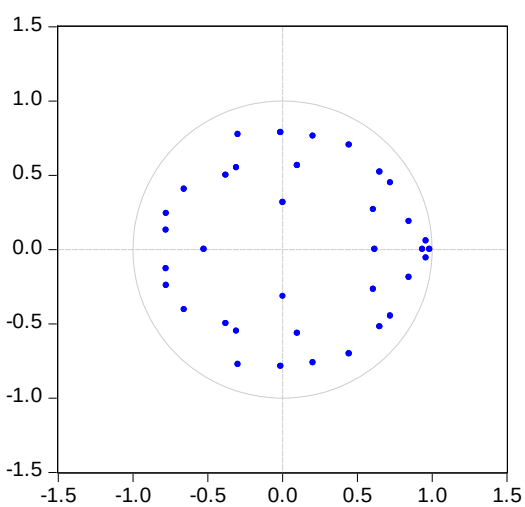

Fig. 3 Inverse Roots of AR Characteristic Polynomial

The phenomenon of spurious regression is excluded through the previous test. Therefore, the remaining variables have mutual relationships. In order to investigate the causality among the variables, the granger causality test is used[8]. The test results is listed in Table 3.

TABLE 3 The results of Granger Causality Test

Time	HIS	SHI	SZI
2007-1	US→HIS(0.000) AU→HIS(0.0991)	JP→SHI(0.0732)	AU→SZI(0.0318)
2007-2	US→HIS(0.000) JP→HIS(0.0889)	-	-
2008-1	US→HIS(0.0024)	AU→SHI(0.0471) HSI→SHI(0.0922) US→SHI(0.0171) SZI→SHI(0.0533)	AU→SZI(0.0827) SHI→SZI(0.0344)
2008-2	US→HIS(0.000) JP→HIS(0.0822) SZI→HIS(0.0090)	AU→SHI(0.0408)	AU→SZI(0.0405)
2009-1	US→HIS(0.000)	US→SHI(0.0471)	
2009-2	US→HIS(0.000) AU→HIS(0.0777) SHI→HIS(0.0422)	-	JP→SZI(0.0725)

From table 3, no matter before the worldwide economic crisis or after the crisis, the American stock markets have highly inflected the Hong Kong stock markets. The stock markets in China mainland have highly influenced by foreign stock markets In the first half of 2008, this condition was changed to some extent in the second half of 2008. In the worst period of the crisis, there is bidirectional causality between Shanghai Stock Exchange and Shenzhen Stock Exchange. I.e., they interact with each other. After we carefully investigate the import and export trade data of China, we find that the US, AU and JP just are the 3 mostly trading partners of China. It denotes that trade is a major channel for financial crisis spreading.

3. Conclusion

We mainly discuss the influence of foreign stock markets on Chinese stock markets during the period of subprime crisis in 2008. The stock markets in Australia, German, French, Japan, United states of American and United kingdom are selected for our research because they have been highly influenced by the subprime crisis. The granger causality test, analysis of VAR, stability test and some other methods are used. Our research shows the Chinese stock markets in mainland have been highly influenced by the stock markets in American, Australia, Japan and Hong Kong, who just the countries or regions have closed trade relations with China mainland. In this paper, our research also that the trade relationships is a major way of financial crisis spreading.

Acknowledgment

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