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Study on the Dynamic Impact Effect of Unconventional Emergencies on Stock and Bond Markets

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Abstract
The research of the impact of unconventional emergency on the stock market and bond market is one of the important concern of academia. This paper uses the VAR model to do the empirical analysis on the dynamic impact effect of unconventional emergencies on Chinese stock market, Treasury bond market and enterprise bond market. The empirical results show that it had a significant impact on the stock market, Treasury bond market and enterprise bond market when unconventional emergencies happened. On this basis, this paper constructs the impulse response functions of the impact of unconventional emergency on the stock market, Treasury bond market and enterprise bond market. Impulse response function display that the impact of unconventional emergencies on the stock market, treasury bond market and enterprise bond market is a dynamic process.

Key words: Unconventional emergencies; Stock market; Bond market; VAR model; Impulse response function

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INTRODUCTION
In recent years, unconventional emergencies occur frequently. They have a huge impact on financial markets when unconventional emergencies hanpen. Due to the impact of the unconventional emergencies, the volatility and risk in financial markets are increasing. Compared with other events, unconventional emergencies have more obvious and longer-time impact of unconventional emergencies on stock market and bond market. The research of the dynamic impact effect of unconventional emergencies on stock market and bond market is conducive to intuitively reflect the impact process of unconventional emergencies on stock market and bond market, reveal the risk transmission path of unconventional emergency, and raise investors' risk awareness.

1. LITERATURE REVIEW
The research results of scholars in China and abroad on the impact of unconventional emergencies on the financial market on are relatively rich. In the research of foreign scholars, by using the multivariate regression model method, Carter and Simkins (2004) tested the effect of "9.11 incident" on the airline stocks. The test results show that the reaction of all airlines stocks is not the same. After the "9.11 event", the Air Transport Security System Stability Bill is good for the larger airlines. The research of Cashell and Labonte (2005) display that the hurricane caused severe damage to oil facilities in the southern region and the gulf of Mexico, decrease in the supply of oil market, cause psychological trauma to the people of the United States, bring pessimistic expectations on the economy, and lead to international oil market volatility. Straetmans et al (2008) referenced extreme value analysis method to assess whether the "9.11" event significantly changed tail risks of U.S. industry stock index or not. Using the time when "9.11" incident occurred as a midpoint, the results found that, after the "9.11" incident, tail β significantly increased. Kaplanski and Levy (2010) examined the aviation disaster impact on stock prices, and found that each airline disaster loss to the company was

more than $6 billion. This led to a significant negative impact on company's stock. At the same time, the impact of the aviation disaster on small firms and higher risk stock is bigger. In the research methods of unconventional emergency, event study is a kind of commonly used methods. Brounen and Derwall (2010) used the event study to study the impact of "9.11 event" on the stock market index of major countries in the world such as The United States, Britain, Spain, Japan and Egypt. The results showed that the terrorist attacks had a negative and strong impact on the price, but rapidly return to normal levels. Using the event study, Festl et al (2012) examined impact of Japan's Fukushima nuclear plant accident on stock prices of nuclear power and alternative energy companies in Germany, France, Japan and the United States. The results show that the Japanese nuclear power companies' stock price had significant abnormal returns in a week's time window and the next four weeks after the event window. German and French nuclear power and alternative energy company stock prices had significant abnormal returns during the event window.

The scholars in China also did in-depth study on the impact of unconventional emergencies on financial markets and made some beneficial research results. Wu Qifang (2003) used the event study to analyze the SARS event's impact on China's securities investment funds. The analysis results showed that the impact of SARS event on closed-end funds and open-end funds is limited and short-lived, and no statistically significant. Zhang Xun, et al (2009) used structural breakpoints inspection and standard events analysis method, and studied the impact of the Iranian revolution, the gulf war and the Iraq war and other events on oil prices. The research results showed that the three incidents significantly affected the price of crude oil, and impact patterns on oil prices met crisis model. Xu Chenghong et al (2010) examined the impact of Wenchuan earthquake on real estate market. Test results showed that when the cost of self protection could be expected, individual risk preference did not play a major role in the purchase decision. When the cost of self protection could not be expected, the risk preference of different populations would emerge. Liu Qingfu et al (2011) used the event study to analyze the impact effect of Wenchuan earthquake on China's stock market. They found that the impact of Wenchuan earthquake on the return and risk of various industries were different and significant. The impact effect of earthquake on the stock market increased. Shan Liwei (2011) also analyzed the impact of the Wenchuan earthquake on China's capital market. The results showed that the closer the company to the epicenter, the lower the return of the stock. The Wenchuan earthquake's impact on the capital market cannot be explained by the actual economic loss caused by the earthquake. The Wenchuan earthquake's impact on capital market is mainly through the negative sentiment of investors. Ma Ji (2011) and He Qiang (2011) analyzed Japan's Fukushima earthquake's impact on international financial markets, and emphatically analyzed the impact of Fukushima earthquake on the stock market, foreign exchange market and international commodity prices.

It can be seen from the above scholars' study, scholars in China and abroad studied the influence of unconventional emergency on the financial markets. All the results show that, unconventional emergencies have a significant impact on financial markets. However, previous researches have not studied the dynamic impact of unconventional emergencies on the financial market, and have not yet intuitively reflected the dynamic impact process of unconventional emergencies. Therefore, taking the stock and bond markets as the research objects, this paper constructs a vector autoregressive (VAR) model, studies the dynamic impact of unconventional emergencies on stock market and bond market, and reveals the dynamic impact process of unconventional emergency.

2. EMPIRICAL ANALYSIS

2.1 The establishing of Model

In order to research the dynamic impact process of unconventional emergencies on stock market and bond market, first of all, based on the duration of the unconventional emergencies impact on stock and bond market, the unconventional emergencies are divided into three types: terraced events, pulse events and gradual change events. In order to describe the different types of unconventional emergencies, this paper builds virtual variable to indicate as follows:

$$d_{1t}=\begin{cases}1, & t\geq u\\ 0, & t<u\end{cases}, d_{2t}=\begin{cases}1, & t=u\\ 0, & t\neq u\end{cases},$$

$$d_{3t}=\begin{cases}\dfrac{1}{t^2}, & t\geq u\\ 0, & t<u\end{cases} \quad (1)$$

Where, d_{1t}, d_{2t} and d_{3t} represent the terraced events, pulse events and gradual change events respectively. The t is represent time. The u is on behalf of the moment unconventional emergencies happen. The influence of terraced events will continue for a period of time, and the influence will not become weak or strong over time, like these unconventional emergencies: hurricane, war or nuclear leak events. So, when $t \geq u$, assign it a value of 1. The impact may be regarded as persistent impact. The influence of impulse event only affects the financial markets when the events happen, and the duration is very short, such as terrorist attacks. So, when $t = u$, assign it a value of 1. The impact may be regarded as instant impact. Gradual change event presents a weakening trend. The impact of these events becomes gradual weak, such as

earthquake, followed by numerous after shocks, etc. So, when $t \geq u$, assign it a value of $\frac{1}{t^2}$. This impact may be regarded as weakening trend impact.

Second, this paper constructs a model of VAR (p) as follows to intuitively reflect the impact process of unconventional emergency:

$$\begin{bmatrix} r_{s,t} \\ r_{b,t} \\ r_{c,t} \end{bmatrix} = \Phi_1 \begin{bmatrix} r_{s,t-1} \\ r_{b,t-1} \\ r_{c,t-1} \end{bmatrix} + \cdots + \Phi_p \begin{bmatrix} r_{s,t-p} \\ r_{b,t-p} \\ r_{c,t-p} \end{bmatrix} + H \begin{bmatrix} d_{1,t} \\ d_{2,t} \\ d_{3,t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix},$$

$$t=1,2,\cdots, T \qquad (2)$$

Among them, $r_{s,t}$, $r_{b,t}$ and $r_{c,t}$ respectively represent the stock market return ,Treasury bond market return, enterprise bond market return. d_{1t},d_{2t} and d_{3t} $r_{c,t}$ respectively represent terraced events, pulse events and gradual change events. $\Phi_1,\cdots,\Phi_p$ and H are coefficient matrix to be estimated; ε_t is the disturbance vector with k-dimension. The matrix H reflects the effects of unconventional emergencies on stock market, Treasury bond market and enterprise bond market. Based on the VAR model, we can construct impulse response function to reflect the dynamic shock process of unconventional emergencies.

In the empirical analysis of this article, Japan's Fukushima nuclear leak was selected as terraced events. The Boston terrorist attack was selected as pulse events. The Wenchuan earthquake was selected as gradual change events.

2.2 Data Sources

This article selects the Shanghai index return, Shanghai bond index return and Shanghai index return to represent the stock market return, Treasury bond market return and enterprise bond market return in China. Data range from On January 1, 2008 to May 31, 2013. The data of stock market return, Treasury bond market return and enterprise bond market return is from RESSET financial research database. This article uses the analysis software Eviews6.0.

2.3 Descriptive statistics

Doing descriptive statistics for the Shanghai index return, Shanghai bond index return and Shanghai index return, the results are shown in Table 1. Table 1 indicates that, in the time interval this paper selected, the average return of Shanghai stock index is -0.0006, Shanghai Treasury bond index is 0.0169, and Shanghai enterprise bond index is 0.0285. The average return of the stock market is negative, the average return of Treasury bond market and enterprise market is positive. This indicated that, the happening of unconventional emergencies lead to stock market declines and the bond market rally and enterprise bond market rally. The skewness value and kurtosis value indicates that it was left-skewed and fat-tail distribution in the stock market, and left-skewed and fat-tail distribution in the Treasury bond market and enterprise bond market. JB statistics and probability indicate that all return of three markets don't obey the normal distribution.

Table 1
Descriptive Statistics Results

	RS	RB	RC
Mean	-0.0006	0.0169	0.0285
Median	0.0003	0.0149	0.0206
Maximum	0.0946	0.7476	1.6871
Minimum	-0.0773	-0.5362	-0.9869
Std. Dev.	0.0184	0.0780	0.1358
Skewness	-0.0042	1.3717	2.9016
Kurtosis	6.2600	24.2055	40.7243
Jarque-Bera	520.7484	22364.5900	71261.9300
Probability	0.0000	0.0000	0.0000

2.4 The Unit Root Test

If the time series is not stationary, building the model for the time series may lead to a "spurious regression" phenomenon. In order to avoid "spurious regression" phenomenon, in this paper, we do the unit root test of return sequence. This paper uses the commonly used methods of unit testing: ADF test and PP test. Test results are shown in Table 2. From Table 2, results of ADF test and PP test all show that, the Shanghai index return, Shanghai bond index return and Shanghai index return are stationary time series.when building the model, "spurious regression" phenomenon won't appear.

Table 2
Unit Root Test

	ADF		PP	
	t-statistics	Prob	t-statistics	Prob
rs	-34.4618	0.0000	-34.4619	0.0000
rb	-28.4989	0.0000	-28.6443	0.0000
rc	-7.3537	0.0000	-24.8306	0.0000

2.5 Empirical Result Analysis

2.5.1 The Results VAR Estimate

Using Eviews6.0 software, we estimate the parameters for the VAR model. The estimation results are shown in Table 3. The results in Table 3 indicate that, the influences of D1、D2 and D3 on the return of Shanghai stock index, Shanghai Treasury bond index and the Shanghai enterprise bond index are significant. It suggests that the influence of unconventional emergencies on Chinese stock market, Treasury bond market and enterprise bond market are significant.

Table 3
The VAR Model Estimation Results

	RS	KB	RC
C	-0.000132	0.012933	0.015338
	-0.00069	-0.00283	-0.00462
	[-0.19222]	[4.56606]	[3.31959]
RS(-1)	-0.020157	0.023753	0.099923
	-0.02959	-0.12228	-0.19947
	[-1.68128]	[2.19426]	[2.50095]

To be continued

Continued

	RS	KB	RC
RS(-2)	-0.010977	0.030829	-0.046921
	-0.02951	-0.12197	-0.19897
	[-1.37195]	[2.25276]	[-2.23582]
RB(-1)	-0.023136	0.097261	0.265555
	-0.00771	-0.03187	-0.05198
	[-3.00054]	[3.05216]	[5.10846]
RB(-2)	-0.001117	-0.023395	-0.017731
	-0.0078	-0.03222	-0.05257
	[-0.14330]	[-0.72602]	[-0.33731]
RC(-1)	-0.006664	0.121365	0.301513
	-0.00469	-0.0194	-0.03165
	[-1.41953]	[6.25511]	[9.52615]
RC(-2)	0.007492	-0.009652	0.062288
	-0.00462	-0.01911	-0.03117
	[1.62022]	[-0.50508]	[1.99813]
D1	-0.08041	0.041298	0.064176
	-0.00113	-0.00469	-0.00765
	[-2.36145]	[3.27663]	[2.54575]
D2	-0.150504	-0.071267	0.090609
	-0.01837	-0.07593	-0.12386
	[-3.02744]	[-4.01668]	[8.00492]
D3	-1.501589	0.729043	0.905498
	-0.01769	-0.07309	-0.11923
	[-4.08986]	[3.39737]	[6.04611]
R-squared	0.34478	0.465767	0.374694
Adj. R-squared	0.307123	0.448506	0.36828
Sum sq. resids	0.389657	6.655206	17.7102
S.E. equation	0.018344	0.07581	0.123668
F-statistic	6.930182	9.057687	27.23518
Log likelihood	3017.914	1360.587	789.0017
Akaike AIC	-5.150537	-2.312648	-1.333907
Schwarz SC	-5.107189	-2.2693	-1.290559
Mean dependent	-0.000641	0.016989	0.028609
S.D. dependent	0.018409	0.07813	0.135603

Note: Values in the ( ) are the standard errors. Values in the [ ] are t statistics.

2.5.2 Dynamic Impact Effect Analysis

In order to intuitively reflect the impact process of unconventional emergencies on Chinese stock market, Treasury bond market and enterprise bond market, this paper builds the impulse response function of the Shanghai composite index, Shanghai Treasury bond index and Shanghai enterprise bond index to unconventional emergencies. As shown in Figure 1 to Figure 9.

Figure 1 to Figure 3 are the impulse response functions of the stock market, Treasury bond market and enterprise bond market to Japan's Fukushima nuclear leak. Figure 1 shows that, the maximum impact of Japan's Fukushima nuclear leak on the stock market is in the second period. The minimum is in the third period. It's gradually stable after the fourth period. Figure 2 and Figure 3 show that, the impact of Fukushima nuclear leak on the Treasury bond market is similar to that on enterprise bond market. The maximum impact of Japan's Fukushima nuclear leak on the Treasury bond market and the enterprise bond market is in the second period. It decreases gradually after the second period, and it's gradually stable after the third period.

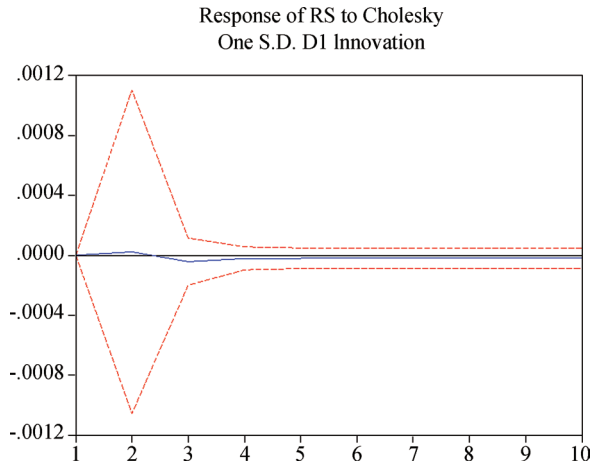

Figure 1
Impulse Response Function of the Stock Market to the Fukushima Nuclear Leak

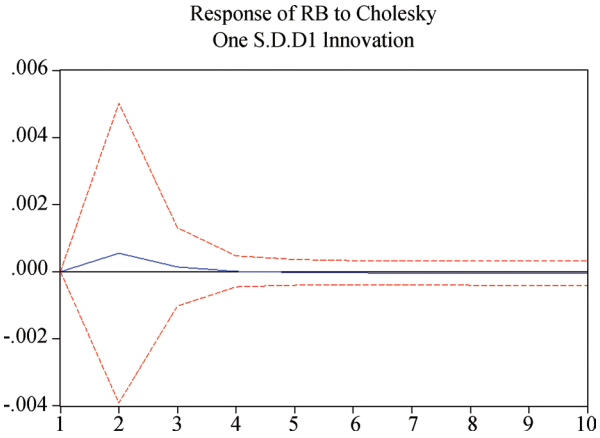

Figure 2
Impulse Response Function of the Treasury Bond Market to the Fukushima Nuclear Leak

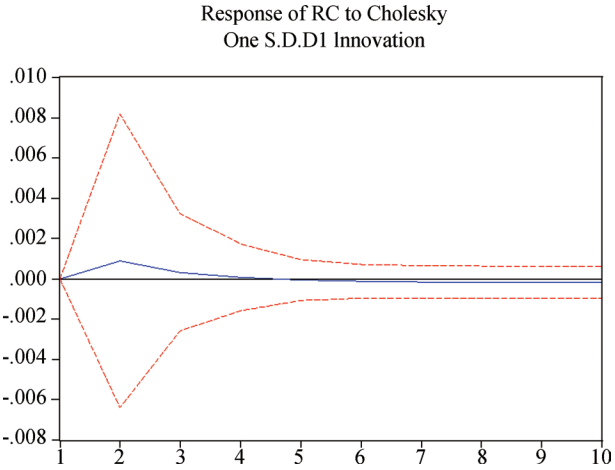

Figure 3
Impulse Response Function of the Enterprise Bond Market to the Fukushima Nuclear Leak

Figures 4 to Figure 6 are the impulse response functions of the stock market, Treasury bond market and enterprise bond market to Boston terrorist attack. Figure 4 show that, the maximum impact of Boston terrorist attacks on the stock market is in the second period. It decreases

after the second period. The minimum impact is in the third period. It increases gradually after the third period. The impact gradually disappears after the fourth period. Figure 5 shows that, the impact of Boston terrorist attack on the Treasury bond market is similar to that on stock market. The maximum impact of Boston terrorist attack on the Treasury bond market is in the second period. The minimum impact is in the third period. The impact gradually disappears after the fourth period. Figure 6 shows that, the maximum impact of Boston terrorist attack on the enterprise bond market is in the second period. It decreases after the second period. The impact gradually disappears after the third period.

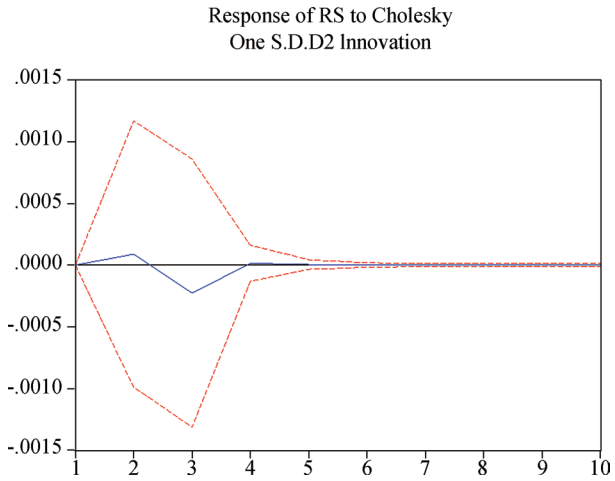

Figure 4

Impulse Response Function of the Stock Market to the Boston Terrorist Attack

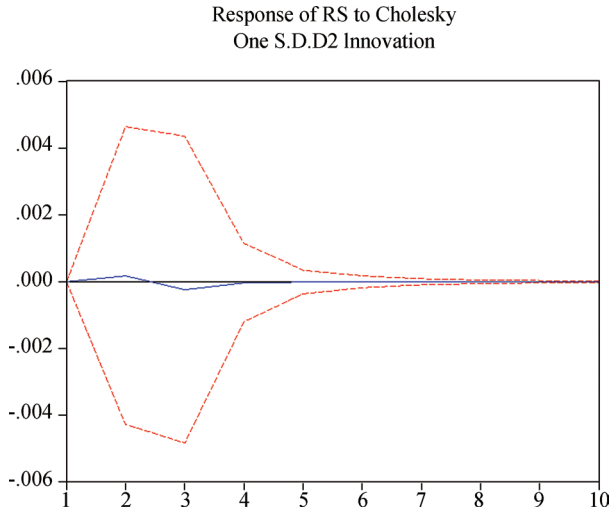

Figure 5
Impulse Response Function of the Bond Market to the Boston Terrorist Attack

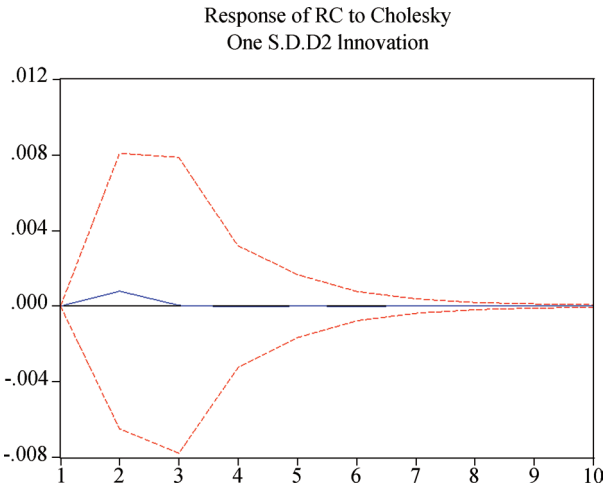

Figure 6
Impulse Response Function of the Enterprise Bond Market to the Boston Terrorist Attack

Figures 7 to Figure 9 are the impulse response functions of the stock market, Treasury bond market and enterprise bond market to the Wenchuan earthquake. Figure 7 to Figure 9 shows that, the impact processes of Wenchuan earthquake on the stock market, Treasury bond market and enterprise bond market are more complicated, and have longer duration. Figure 7 shows that, the minimum impact of Wenchuan earthquake on the stock market is in the second period. Then it increases gradually after that, and increases to the maximum in the third period, and then it decreases gradually, until it's gradually stable after fourth period. Figure 8 shows that, the maximum impact of Wenchuan earthquake on the Treasury bond market is in the second period, and then it decreases gradually, and decreases to the minimum in the third period. Then it increases gradually and it's stable after fifth period. The maximum impact of Wenchuan earthquake on the enterprise bond market is in the second period. It decreases after the second period, until it's gradually stable after the fifth period.

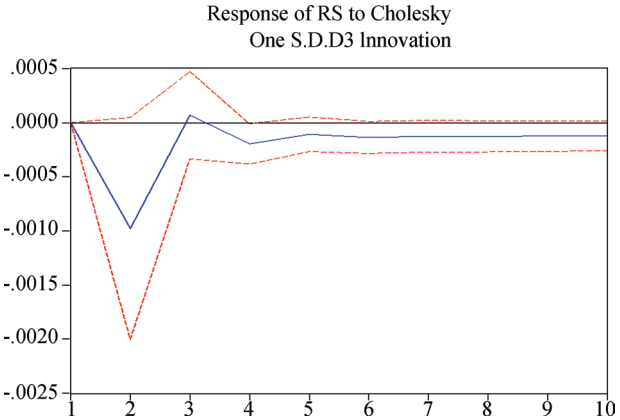

Figure 7
Impulse Response Function of the Stock Market to Wenchuan Earthquake

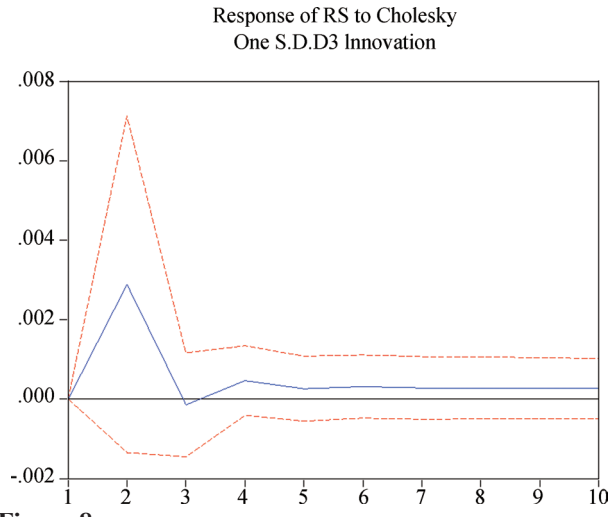

Figure 8
Impulse Response Function of the Treasury Bond Market to Wenchuan Earthquake

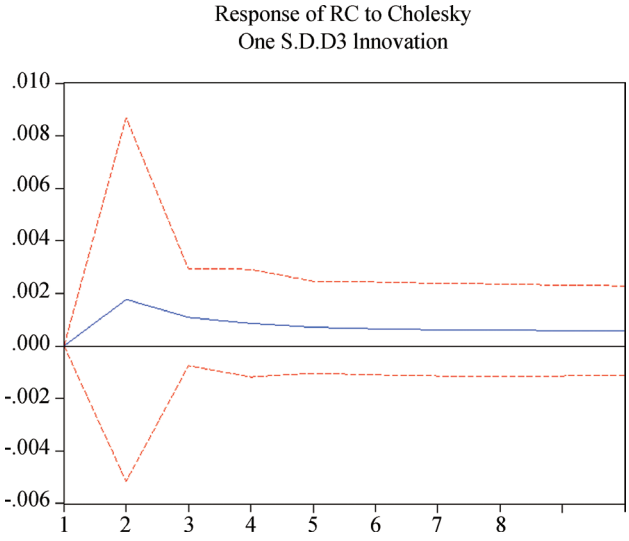

Figure 9
Impulse Response Function of the Enterprise Bond Market to Wenchuan Earthquake

CONCLUSION

This paper uses the VAR model to empirically analyze of the dynamic impact effect of unconventional emergencies on Chinese stock market, Treasury bond market and enterprise bond market. The unconventional emergency is divided into three types in this paper: terraced events, pulse events and gradual change events. In order to describe the different types of unconventional emergencies, this paper builds virtual variable to indicate them, and builds VAR model containing the three types of unconventional emergency. Estimation results of the VAR model show that, it has a significant impact on the stock market, Treasury bond market and enterprise bond market when unconventional emergencies happen. On this basis, this paper builds the impulse response functions of unconventional emergency on the stock market, Treasury bond market and enterprise bond market. Impulse response functions display that the impacts of unconventional emergencies on the stock market, Treasury bond market and enterprise bond market are dynamic process.

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