

The Impact of COVID-19's External Shocks on Bond Market in China

-- Evidence from Bonds, National Bonds and Corporate Bonds

Wenlei Zhang*

School of Finance, Anhui University of Finance & Economics, Bengbu 233030, China

*Sycamore1998@163.com

Abstract

This paper constructs COVID-19 impact index and bond market return index in China, bond market earnings index and corporate bond market return index. Based on dynamic time varying and state transition characteristics, this paper uses various wave models to quantify the impact and impact characteristics of COVID-19's external shocks on bond market in China since January 11, 2020. It is found that the impact and impact of COVID-19 impact on the bond market in different stages are different, and there are dynamic delay and state transition characteristics. In addition, the impact of COVID-19's impact on the bond market, the bond market and the corporate bond market is different. Therefore, combined with the theoretical framework of the impact of investor structure and investor sentiment on the fluctuation of the bond market, this paper puts forward policy suggestions on how to deal with the impact of sudden external public events in the bond market, so as to maintain the stability of the bond market.

Keywords

COVID-19's External Shock; Bond Market; Phase Reversal; Regime Switching; Volatility Model.

1. Introduction

In 2020, the outbreak of COVID-19 caused global panic and overall economic decline, bringing huge negative impacts to the world (Tong et al., 2020). Under this shock, the bond market vibrated violently, and the China Securities all bond index rose abnormally high (Fang et al., 2020), which means that people have too much pursuit of safe asset bonds, which is prone to the bond market's own risks and risk contagion, and poses a threat to financial stability and security. Therefore, studying the impact of the COVID-19 on China's bond market has important practical significance for stabilizing the bond market and maintaining the security of the financial market in the special period of the epidemic. In view of this, this paper constructs the COVID-19 impact index and bond market index, quantitatively analyzes the impact characteristics and degree of COVID-19 on the bond market, and puts forward targeted suggestions combined with investor sentiment and investor structure impact mechanism.

2. Literature Review

As the COVID-19 has had a noticeable impact on the global economy, it is a hot topic of great concern. The initial research on the epidemic mainly focuses on the short-term impact of COVID-19 on the real economy: on the one hand, the epidemic has brought about production stagnation, insufficient supply, and a negative impact on the supply side (Zhu et al., 2020); On the other hand, unemployment caused by the epidemic has led to a decline in social purchasing

power, insufficient demand, and a negative impact on the demand side (He et al., 2020; Baker et al., 2020; Chen et al., 2021; Zhu et al., 2022). The impact of the COVID-19 on the demand side and the supply side occurs simultaneously (Wu and Liu, 2021). In addition, some scholars have studied the long-term impact of the COVID-19 on the macro-economy and found that the COVID-19 will have a complex impact on total factor productivity through education, innovation, market efficiency, infrastructure and system, and bring uncertainty risks to the long-term economic development (Wang and Li, 2021). Later, some scholars further deepened the impact of the real economy and began to study the impact of the epidemic on Finance: Yang et al. (2020) believed that the impact of the COVID-19 not only weakened consumer demand, but also caused risks in the financial sector by impacting the capital chain in the supply industry chain. Zhang and Jing (2021) found that the COVID-19 affected financial stability by impacting investor confidence, and the government's fiscal and monetary policies could reduce the impact of the epidemic.

As the impact of the COVID-19 on finance has attracted more and more attention, many scholars have carried out relevant research on how the COVID-19 affects financial markets: Fang et al. (2020) using dynamic event analysis, they found that the initial COVID-19 impact enhance the original substitution effect or risk resonance effect among markets, and then enhance risk resonance. Jiang et al. (2021) found that the COVID-19 had a significant positive impact on the stock market risks of China, the United States and Europe, and the first impact was greater than the second impact. Yuan and Hu (2021) established a global stock market risk spillover network. The study found that the total global stock market risk spillover first increased and then decreased during the epidemic, and its intensity was significantly higher than that of the 2008 financial crisis. Lan and Zhuang (2021) constructed the COVID-19 development index, and systematically analyzed the actual impact of COVID-19 on the segmented financial market by using the fluctuation model. Sui et al. (2022) empirically found that during the COVID-19, the external impact intensity and volatility spillover effect of China's financial market were significantly asymmetric.

To sum up, existing studies have reached a consensus on the important negative short-term impact and long-term uncertain impact of the external impact of COVID-19 on the macro economy and financial markets. However, there is still the following research space: the existing research on the external impact of COVID-19 mostly focuses on combining all kinds of financial markets in the same analytical framework or conducting comparative research on similar financial markets (mainly stock markets) in different countries, and few studies specifically analyze the impact of the external impact of COVID-19 on the bond market. As a safe asset and basic asset in the financial market, bonds will cause abnormal fluctuations in the bond market in the short term due to investors' pursuit of safe asset effect (Fang et al., 2020) during the epidemic period, and as a basic financial market, it will affect other financial market risks. Therefore, it is necessary to clarify the specific process of the impact of the COVID-19 on the bond market. In this regard, this paper constructs the COVID-19 impact index and the bond market, bond market and corporate bond market yield index, systematically analyzes the impact characteristics and degree of the external impact of COVID-19 on the bond market yield index, and puts forward targeted suggestions to reduce the impact of COVID-19 on the bond market and maintain the stability of the bond market. The possible marginal contributions of this paper are as follows. By constructing the impact index of the COVID-19 and the yield index of the bond market, the government bond market and the corporate bond market, this paper specifically explores the impact of the external impact of the COVID-19 on the bond market, the government bond market and the corporate bond market, provides empirical and theoretical explanations for the abnormal fluctuations of the bond market during the epidemic, and then has a certain reference significance on how to reduce the abnormal fluctuations of the bond market during the epidemic and maintain the stability of the bond market.

3. Mechanism Analysis and Research Hypothesis

As for the impact mechanism of the COVID-19 impact on the bond market, there are mainly the following two aspects: first, the investor sentiment mechanism (Antoniou and Doukas, 2015; Han and Li, 2017; Li et al., 2018), the epidemic impact will trigger irrational emotions such as excessive pessimism among investors, will trigger irrational behavior, and then have an impact on the bond market; Second, the effect of chasing safe assets (Fang et al., 2020). Under the impact of the epidemic, economic uncertainty increases, which will cause many investors to excessively chase safe assets such as bonds, thus causing abnormal fluctuations in the bond market; The third is the asset allocation mechanism (Goyenko and Ukhov, 2009). In the face of the external impact of the COVID-19, it is rational for a single investor to adjust the asset allocation to safety assets, but if many investments make the same expected judgment and investment behavior, it will cause abnormal fluctuations in the bond market and increase the risk of the bond market.

In terms of the impact characteristics of the COVID-19 on the bond market, the details are as follows:

It often takes time for the bond market to respond to the external shocks of the COVID-19. Generally speaking, the COVID-19 first affects the real economy. After the impact on the real economy, it will affect the financial market and cause investors' panic. Through the investor sentiment mechanism, it will increase the demand for safe assets such as bonds, which will further lead to investors' excessive pursuit of bond assets. This series of conduction takes some time. Therefore, this paper proposes research hypothesis 1:

H1: The impact of the COVID-19 on the bond market is lagging.

When there is no important information or major event impact, the volatility of financial market yield is self-correlated and has dynamic stability. However, once a major emergency occurs, there will be competition in the short term, resulting in market congestion and greater fluctuations in market transactions (Dicks et al, 2018). Combined with the investor sentiment mechanism and asset allocation mechanism, it can be seen that when the impact of the COVID-19 occurs, it will cause market panic in the short term. Investors tend to invest in high security assets such as bonds, which will lead to a sharp rise in the yield of the bond market in the short term. However, with the introduction of the government's proactive fiscal and monetary policies, investors tend to be rational and no longer excessively pursue safe assets such as bonds, and the volatility of the bond market slows down. In addition, the development of COVID-19 shows obvious stage effect, and the impact on the financial market will have a state transition, which is manifested in the obvious stage effect and reversal effect of the fluctuation of the yield of the financial market. Therefore, it can be further reasonably concluded that the impact of the external impact of the COVID-19 on the bond market has a state transition effect. Therefore, this paper proposes research hypothesis 2 and research hypothesis 3:

H2: The impact of the COVID-19 on the bond market has a stage effect and a reversal effect.

H3: The impact of the COVID-19 on the bond market has a state transition effect.

In the face of the impact of the COVID-19, due to the differences in the anti-risk ability of different bond markets, the impact of the impact is also different (Yang and Zhou, 2016). Generally speaking, National bonds are safer than corporate bonds. In the face of the same impact of the COVID-19, National bonds will be more popular with investors than corporate bonds, and will be excessively chased by investors due to market panic in the short term, resulting in greater fluctuations in the National bond market than the corporate bond market. In addition, the bond market includes not only National bonds, corporate bonds, but also financial bonds. Asset security has more complex characteristics, which is necessarily different from National bonds and corporate bonds. Therefore, it can be reasonably introduced that the

impact of the external impact of the COVID-19 on the National bond market and corporate bond market is different.

Therefore, this paper proposes research hypothesis 4:

H4: The impact of the COVID-19 on the bond market, National bond market and corporate bond market is different.

4. Research Design

4.1. Samples and Data Sources

Considering the availability and integrity of data, this paper selects COVID-19 data and bond market data from January 12, 2020 to April 1, 2022. And carry out the following data processing: (1) Match the bond market data according to the date of COVID-19 data; (2) Replace the missing data in the bond market on January 12, 2020 with the nearest data on January 10, 2020; (3) A small number of missing values of daily data of other bond markets are supplemented by Stata17.0 interpolation. Finally, 811 sets of daily time series data are obtained. The data of COVID-19 epidemic in China comes from the information released by the national health commission and provincial health commissions. The bond market data comes from the rest financial research database, including the China securities all bond index, China securities government bond index, and China securities enterprise bond index.

4.2. Variables Selection and Description

The target variables of this paper are COVID-19 epidemic impact variables and bond market variables. Among them, the COVID-19 epidemic impact variable is calculated according to the epidemic data of China, and the bond market variable is calculated according to the logarithmic yield of the bond market. Specific variables are shown in [Table 1](#).

Table 1. Variable Selection

Type	Name	Variables
External Shock	COVID-19 Impact Index	<i>COVimpa</i>
Bond Market	Bond Market Index Yield	<i>R_b</i>
	National Bond Index Yield	<i>R_{nb}</i>
	Corporate Bond Index Yield	<i>R_{cb}</i>

4.2.1. COVID-19 Impact Index (*COVimpa*)

For the quantification of the COVID-19 impact index, considering the large fluctuation range of indicators such as "new confirmed cases" and "new deaths", its trend is inconsistent with the overall trend of the bond market. The growth rate of newly diagnosed COVID-19 is stable, and its trend is similar to that of the bond market as a whole. Therefore, the growth rate of newly confirmed cases of COVID-19 is selected to measure the impact index of COVID-19, and its formula is:

$$COVimpa = \frac{new_confirmed_cases_t}{cumulative_confirmed_cases_{t-1}}$$

4.2.2. Bond Market Variables: Bond Market Index Yield (*R_b*), National Debt Index Yield (*R_{nb}*), Corporate Bond Index Yield (*R_{cb}*)

Select the bond market index yield (*R_b*) to represent the dynamic impact of the COVID-19 on the bond market as a whole. The specific data is the yield of the net price of the China Securities all bond index (H01001). Select the National bond index (000012) yield (*R_{nb}*) to represent the dynamic impact of the COVID-19 on the National bond market. Select the corporate bond index

(000013) yield (R_{cb}) as the dynamic impact of the COVID-19 on the corporate bond market. Among them, the yield is the exponential logarithmic first-order difference, and the formula is:

$$R_{it} = \ln p_{it} - \ln p_{it-1}$$

4.3. Model Building

4.3.1. VAR Model

Considering the autocorrelation and dynamic interaction of the impact of COVID-19, the VAR model is constructed as follows:

$$R_{bt} = \alpha_1 R_{bt-1} + \beta_1 COVimpa_t + \varepsilon_{1t} \quad , \quad t = 1, 2, \dots, k \tag{1}$$

$$R_{nbt} = \alpha_2 R_{nbt-1} + \beta_2 COVimpa_t + \varepsilon_{2t} \quad , \quad t = 1, 2, \dots, k \tag{2}$$

$$R_{cbt} = \alpha_3 R_{cbt-1} + \beta_3 COVimpa_t + \varepsilon_{3t} \quad , \quad t = 1, 2, \dots, k \tag{3}$$

Among them, α represents the autocorrelation coefficient of the bond market index yield, and β represents the influence coefficient of the COVID-19 impact index.

4.3.2. GARCH Model

$$R_{bt} = \mu_1 + \alpha_1 R_{bt-1} + \beta_1 COVimpa_t + \lambda_1 \varepsilon_{1t} \tag{4}$$

$$R_{nbt} = \mu_2 + \alpha_2 R_{nbt-1} + \beta_2 COVimpa_t + \lambda_2 \varepsilon_{2t} \tag{5}$$

$$R_{cbt} = \mu_3 + \alpha_3 R_{cbt-1} + \beta_3 COVimpa_t + \lambda_3 \varepsilon_{3t} \tag{6}$$

4.3.3. TGARCH Model

$$\sigma_{bt}^2 = \lambda_0 + \varphi_1 \varepsilon_{1t-1}^2 + \eta_1 \sigma_{bt-1}^2 \tag{7}$$

$$\sigma_{nbt}^2 = \lambda_0 + \varphi_2 \varepsilon_{2t-1}^2 + \eta_2 \sigma_{nbt-1}^2 \tag{8}$$

$$\sigma_{cbt}^2 = \lambda_0 + \varphi_3 \varepsilon_{3t-1}^2 + \eta_3 \sigma_{cbt-1}^2 \tag{9}$$

4.3.4. Markov Regime Switching Model (MRS)

$$\sigma_{bt}^2 = \lambda_0 + \varphi_1 \varepsilon_{1t-1}^2 + \eta_1 \sigma_{bt-1}^2 + \mu_1 D_{t-1} \tag{10}$$

$$\sigma_{nbt}^2 = \lambda_0 + \varphi_2 \varepsilon_{2t-1}^2 + \eta_2 \sigma_{nbt-1}^2 + \mu_2 D_{t-1} \tag{11}$$

$$\sigma_{cbt}^2 = \lambda_0 + \varphi_3 \varepsilon_{3t-1}^2 + \eta_3 \sigma_{cbt-1}^2 + \mu_3 D_{t-1} \tag{12}$$

Among them, $\mu_i D_{t-1}$ is the asymmetric effect, which measures the threshold or state of the impact of COVID-19.

5. Empirical Analysis

5.1. Descriptive Statistics and Stationarity Analysis

As shown in Table 2: the average value of the COVID-19 impact index is 1.20%, the volatility range is 95.2%, the average yield of the bond market index is 0.004%, the volatility range is 0.926%, the average yield of the National bond market index is 0.019%, the volatility range is 0.625%, the average yield of the corporate bond market index is 0.021%, and the volatility range is 0.243%. From the perspective of standard deviation, the impact of COVID-19 on the National bond market from large to small is the whole bond market, the National bond market, and the corporate bond market.

Table 2. Descriptive Statistical Results

Variables	N	Mean	Std Deviation	Min	Max	ADF test
<i>COVimpa</i>	811	0.012000	0.070700	0.000000	0.952000	-8.933***
<i>R_b</i>	811	0.000038	0.000821	-0.003070	0.006190	-18.394***
<i>R_{nb}</i>	811	0.000193	0.000414	-0.002290	0.003960	-23.439***
<i>R_{cb}</i>	811	0.000207	0.000210	-0.001100	0.001330	-25.011***

Note: *, **, *** are significant at 10%, 5% and 1% levels respectively.

As shown in Figure 1, the impact of the COVID-19 was concentrated in the early stage and gentle in the late stage; The yield index of the bond market, the national bond market and the corporate bond market keeps oscillating in an "M" shape. The four groups of curves have obvious periodicity: (1) The impact index of COVID-19 fluctuated the most in January and February 2020, which is in the first stage of the outbreak; After March, the epidemic was in a stable stage of recovery. (2) The three indexes of the bond market fluctuated significantly from January 2020 to August 2020, and the fluctuation slowed down in the later period, which was close to the trend of the COVID-19 impact index.

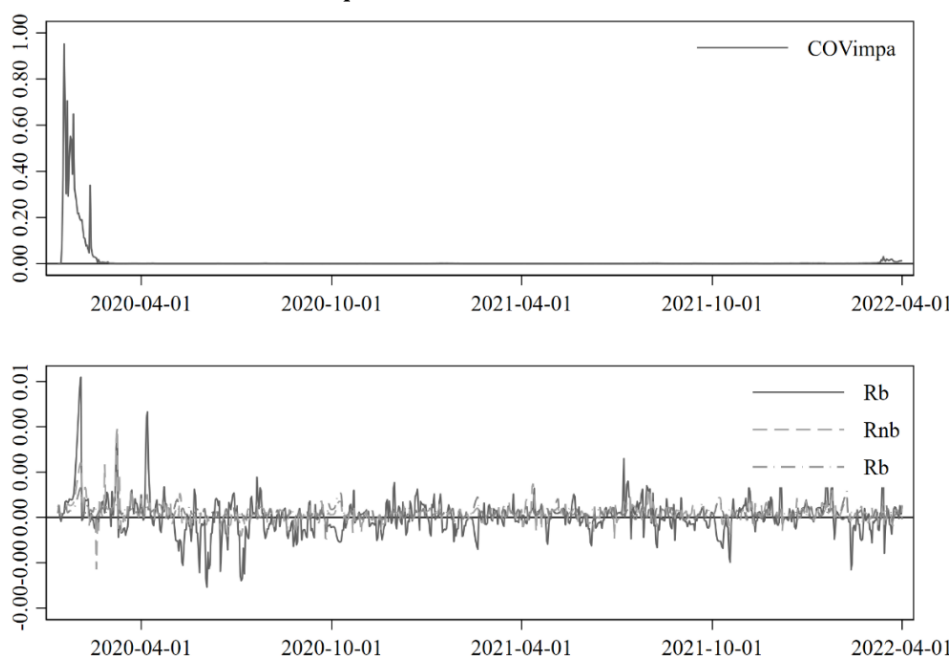


Figure 1. Time Series Diagram of all Variables

5.2. Correlation Analysis

It can be seen from [Table 3](#) that COVID-19 Impact Index (*COVimpa*) is significantly positively correlated with the bond market index yield (R_b), national bond index yield (R_{nb}) and corporate bond index yield (R_{cb}), indicating that COVID-19 has a positive impact on the fixed income bond market.

Table 3. Correlation Test Results

Variables	<i>COVimpa</i>	R_b	R_{nb}	R_{cb}
<i>COVimpa</i>	1			
R_b	0.205***	1		
R_{nb}	0.181***	0.549***	1	
R_{cb}	0.128***	0.155***	0.403***	1

Note: *, **, *** are significant at 10%, 5% and 1% levels respectively.

VAR model is used to estimate the relationship between COVID-19 impact index (*COVimpa*) and bond market index (R_b), national bond index (R_{nb}), corporate bond index (R_{cb}), and impulse response and variance analysis are used to test the impact of COVID-19 impact on the bond market. The results are shown in [Figure 2](#) and [Table 4](#).

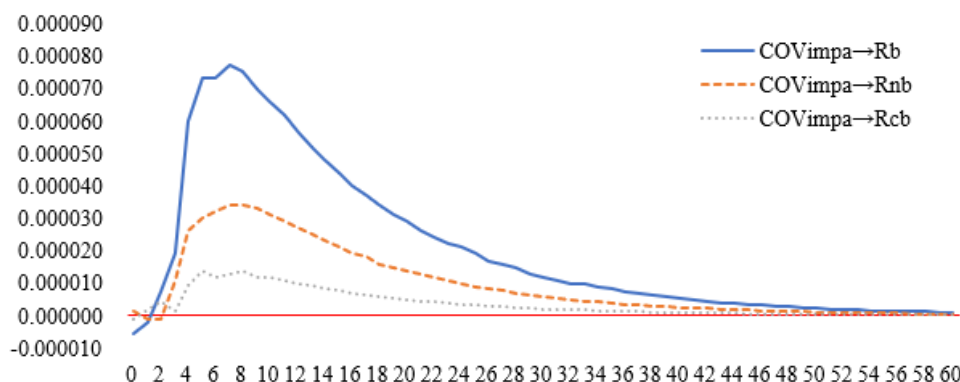


Figure 2. Impulse Response Function Diagram of Three Bond Markets

Table 4. Variance Decomposition Results of Bond Market

Step	R_b	<i>COVimpa</i>	R_{nb}	R_{cb}
0	0.000%	0.000%	0.000%	0.000%
1	100.000%	0.000%	0.000%	0.000%
2	100.000%	0.001%	0.000%	0.000%
3	99.800%	0.017%	0.040%	0.153%
4	99.700%	0.083%	0.042%	0.168%
5	99.000%	0.683%	0.119%	0.197%
6	97.900%	1.540%	0.217%	0.315%
7	96.900%	2.370%	0.282%	0.416%
8	95.900%	3.290%	0.313%	0.474%
9	95.000%	4.140%	0.323%	0.515%
10	94.300%	4.870%	0.325%	0.539%
11	93.600%	5.510%	0.323%	0.552%
12	93.100%	6.060%	0.321%	0.559%
13	92.600%	6.520%	0.320%	0.562%
14	92.200%	6.900%	0.319%	0.562%
15	91.900%	7.220%	0.318%	0.562%

As can be seen from [Figure 2](#), (1) the impact of the external impact of the COVID-19 on the bond market, the national bond market and the corporate bond market was 0 in phase 0. After the positive external impact of the COVID-19, the bond market, the national bond market and the corporate bond market appeared to be positively affected, and the degree of impact continued to increase until around phase 8, and it began to decrease, and the degree of impact was close to 0 around phase 50. On the whole, the impact of the impact was relatively mild in other periods, except that it was relatively severe in the early stage. It shows that the impact of the COVID-19 on the bond market is generally flat and has a lag effect. Research hypothesis 1 is proved. (2) The impact of the COVID-19 on the bond market is obvious and has a phased reversal. The first stage of the epidemic impact caused a sharp rise in bond yields, and the second-order impact caused a sharp decline in bond yields and then leveled off. Research hypothesis 2 is proved. (3) According to the market analysis, the impact of the COVID-19 has the greatest impact on the overall bond market, followed by the national bond market, and the smallest impact on corporate bond. Combined with the variance decomposition results in [Table 4](#), it can see that for the overall volatility of the bond market, the volatility contribution rate of the bond market itself is more than 90%. In addition, compared with the corporate bond market, the contribution rate of the bond market to the volatility of the bond market is lower than that of the corporate bond market. It can be seen that the impact of the COVID-19 on the bond market, the national bond market and the corporate bond market are different, and the research hypothesis 4 is proved.

5.3. Dynamic Analysis

Table 5. VCC-M-GARCH Model Estimation Results

Variables	R_b	R_{nb}	R_{cb}
<i>COVimpa</i>	0.001** (2.12)	0.001*** (3.27)	0.0002** (2.52)
_cons	0.000** (2.32)	0.000*** (12.74)	0.000*** (27.01)
ARCH L.arch	0.728*** (8.59)	0.452*** (6.49)	0.658*** (7.58)
ARCH L.garch	-0.009*** (-2.98)	0.092* (1.65)	
ARCH L2. garch			-0.018*** (-4.12)
_cons	0.000*** (12.10)	0.000*** (10.03)	0.000*** (9.48)
Wald chi2	4.52	10.71	6.35
N	811	811	811

Note: *, **, *** are significant at 10%, 5% and 1% levels respectively. The values in brackets are t-values.

As shown in [Table 5](#), the COVID-19 impact index (*COVimpa*) is significantly positively correlated with the yield index (R_b , R_{nb} , R_{cb}) of the bond market, National bond market and corporate bond market. Moreover, the COVID-19 impact index (*COVimpa*) has a significant first-order arch effect on the bond market, the National bond market, and the corporate bond market yield index (R_b , R_{nb} , R_{cb}), a significant first-order GARCH effect on the bond market, the National bond market (R_b , R_{nb}), and a significant second-order GARCH effect on the corporate bond market yield index (R_{cb}). These results show that after considering the time variability and linkage, the COVID-19 impact on the bond market, the National bond market The influence of corporate bond market

has time lag, which further verifies the research hypothesis 1.

5.4. Regime Switching Analysis

Empirical findings show that the impact of the COVID-19 on the bond market has a threshold, and the threshold effect is significant. Combined with the state transition characteristics of the COVID-19 external impact on the bond market, national bond market and corporate bond market, the dynamic Markov Regime Switching model test is carried out. The results are shown in Table 6: (1) The state coefficients of the first and second times are significant, so the COVID-19 impact has obvious state transition characteristics, and research hypothesis 3 is proved; (2) The COVID-19 epidemic impact index (*COVimpa*) has a significant positive impact on the bond market, the National bond market, and the corporate bond market yield index (R_b, R_{nb}, R_{cb}), but in different markets, the degree of impact varies from large to small, which are the bond market as a whole, the National bond market, and the corporate bond market. The research hypothesis 4 is further confirmed.

Table 6. Dynamic Markov Regime Switching Model Estimation Results

Variables	R_b	R_{nb}	R_{cb}
<i>COVimpa</i>	0.003*** (6.53)	0.001*** (3.41)	0.0004*** (3.08)
State1	-0.001*** (-3.38)	0.0002*** (13.12)	0.0002*** (28.43)
_cons			
State2	0.0002*** (3.14)	0.002*** (16.69)	0.001*** (22.79)
_cons			
lnsigma	-7.269*** (-266.11)	-7.999*** (-318.15)	-8.726*** (-336.89)
_cons			
p11	-2.178*** (-5.06)	-5.069*** (-11.05)	-4.373*** (-12.56)
_cons			
p21	3.344*** (8.18)	0.145 (0.23)	1.103*** (2.89)
_cons			
AIC	-11.5306	-13.0557	-14.4441
N	811	811	811

Note: *, **, *** are significant at 10%, 5% and 1% levels respectively. The values in brackets are t-values.

6. Conclusion and Suggestions

This paper constructs the impact index of COVID-19 and the yield index of bond market, national debt market and corporate bond market, and systematically analyzes the impact of the external impact of COVID-19 on the bond market. The research conclusions are as follows. Firstly, the impact of the COVID-19 epidemic on the bond market has different directions and degrees of impact at different stages. Secondly, the impact has the characteristics of dynamic time lag and state transition. In addition, the impact of the COVID-19 on the yields of the bond market, the National bond market and the corporate bond market is different.

Accordingly, the following suggestions are put forward: in the face of the impact of external shocks such as the COVID-19, the first is to stabilize investor sentiment and avoid investors from being affected by irrational sentiment and asset allocation mechanism, so as to avoid excessive chasing of bond assets and massive selling of other assets, further prevent abnormal fluctuations in the bond market and reduce risk spillovers to other financial markets. The second is to introduce institutional investors' participation and regulate the behavior of

institutional investors. On the one hand, it can guide some individual investors' irrational emotions into rationality. On the other hand, the rational behavior of institutional investors can hedge the irrational factors of individual investors, and then partially resolve the impact of external shocks on the bond market.

References

- [1] Jiadong Tong, Bin Sheng, Dianchun Jiang, Bing Yan, Jinping Dai and Cheng Liu: Global Economy amid the COVID-19 Outbreak and Challenges for China, *International Economic Review*, (2020) No.3, p.9-28+4.
- [2] Yi Fang, Bo Yu and Wei Wang: China's Financial Market Risk Measurement and Controlling under COVID-19 Shock, *Journal of Central University of Finance & Economics*, (2020) No.8, p.116-128.
- [3] Kunfu Zhu, Xiang Gao, Cuihong Yang and Shouyang Wang: The COVID-19 Shock on Global Production Chains and Risk of Accelerated China's Industrial Chains Outflow, *Bulletin of Chinese Academy of Sciences*, Vol.35 (2020) No. 3, p.283-288.
- [4] Scott R. Baker, Robert A. Farrokhnia, Steffen Meyer, Michaela Pagel and Constantine Yannelis: How Does Household Spending Respond to an Epidemic? Consumption during the 2020 COVID-19 Pandemic, *The Review of Asset Pricing Studies*, Vol.10 (2020) No.4, p.834-862.
- [5] Haiqiang Chen, Wenlan Qian and Qiang Wen: The Impact of the COVID-19 Pandemic on Consumption: Learning from High-Frequency Transaction Data, *AEA Papers and Proceedings*, Vol.111 (2021) No.3, p.7-11.
- [6] Chengying He, Yuechun Wen, Yali Chang and Xiaoxu Geng: Measurement and Analysis of the COVID-19 Epidemic Impact on China's Economy, *The Journal of Quantitative & Technical Economics*, Vol.37 (2020) No.5, p. 3-22.
- [7] Feifei Zhu, Jing Chen and Huixuan Li: Exogenous Shock, Financial Participation and Household Consumption, *Studies of International Finance*, (2022) No.3, p.13-22.
- [8] Liyuan Wu, Yanzhao Liu: The Impact of Structural Shocks on China's Economy: Also on the Economic Impact of the COVID-19 Epidemic, *Contemporary Finance & Economics*, (2022) No.11, p.3-15.
- [9] Bing Wang and Lin Li: Long-term Impact of COVID-19 on China's Economy and Countermeasures, *Modern Economic Research* (2021) No.2, p.1-8.
- [10] Zihui Yang, Yutian Chen and Pingmiao Zhang: Macroeconomic Shock, Financial Risk Transmission and Governance Response to Major Public Emergencies, *Journal of Management World* 36, Vol.36 (2020) No. 05, pp. 13-35+7.
- [11] Sheng Zhang and Xinxin Jing: Covid-19 Epidemic, Investor Confidence and the Effect of Macroeconomic Policy, *Journal of Zhongnan University of Economics and Law*, No.6, p.77-92+159-160.
- [12] Hai Jiang, Wenyang Wu and Shiwei Wei: Research on the Impact of COVID-19 on the Risks of Global Stock Market-Cross Market Test Based on ESA Method, *Studies of International Finance*, (2021) No.3, p.3-13.
- [13] Mengyi Yuan and Di Hu: Study of Risk Spillover Effect of Global Stock Market against Background of COVID-19 Impact, *Finance Forum*, Vol.26 (2021) No.9, p.36-48.
- [14] Bo Lan and Lei Zhuang: Research on the Impact of COVID-19 Epidemic on Financial Market Shocks, *Statistics & Decision*, Vol.37 (2021) No.5, p.129-133.
- [15] Jianli Sui, Qingwei Yang and Jinquan Liu: Price Co-movement, Risk Contagion and Risk Traceability under the Impact of Extreme Events: New Discoveries from the International Crude Oil Market and Sino-US Financial Market, *World Economy Studies*, (2022) No.4, p.47-62+136.
- [16] Constantinos Antoniou, John A. Doukas and Avanihar Subrahmanyam: Investor Sentiment, Beta, and the Cost of Equity Capital, *Management Science*, Vol.62 (2015) No.2, p.347-367.
- [17] Xing Han and Youwei Li: Can investor sentiment be a momentum time-series predictor? Evidence from China, *Journal of Empirical Finance*, Vol.42 (2017) p.212-239.

- [18] Yong Li, Yalin Wang and Weiwei Deng: Investor Sentiment, Heterogeneity and the Credit Spread of Chinese Corporate Bonds, *Finance and Trade Research*, Vol.29 (2018) No.3, p.100-110.
- [19] Ruslan Y. Goyenko and Andrey D. Ukhov: Stock and Bond Market Liquidity: A Long-Run Empirical Analysis, *Journal of Financial and Quantitative Analysis*, Vol.44 (2009) No.1, p.189-212.
- [20] David L. Dicks and Paolo Fulghieri: Uncertainty Aversion and Systemic Risk, *Journal of Political Economy*, Vol.127 (2018) No.3, p.1118-1155.
- [21] Zihui Yang and Yinggang Zhou: Quantitative Easing and Volatility Spillovers Across Countries and Asset Classes, *Management Science*, Vol.63 (2016) No.2, p.333-354.