Impact of COVID-19 on China's Infrastructure Sector Bonds

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Abstract. The global economy seems to have been affected to varying degrees by the COVID-19 pandemic. So is the bond market in China, where COVID-19 first emerged, tanked because of the outbreak? In this paper, Macaulay Duration and Modified Duration are used to calculate the data of four infrastructure industry bonds of the same type, same rating and same maturity from China's bond market before and after the outbreak of COVID-19, and then the data are grouped for comparison. In the end, we concluded that the impact of COVID-19 on China's bond market was not very serious, and the data of the four bonds showed that their maturity changes within the 5% level was normal. This result is likely due to increased, rather than reduced, demand for infrastructure in China during the COVID-19 pandemic. After the strong intervention of the government, the order of the Chinese market was obviously restored. However, the outbreak of COVID-19 has not stopped and the global economy has not shown a trend of recovery. Therefore, COVID-19 still has a lot of uncertain impact on China's bond market.

Keywords-duration; COVID-19; bond market; modified duration

1 INTRODUCTION

Due to the COVID-19 pandemic, countries around the world have been affected to varying degrees socially and economically. The reasons include redundancies in many large companies, the loss of jobs in small and medium sized businesses or companies that have closed, and the negative ripple effect of COVID-19 on markets, the economic situation around the world is not optimistic. For China, the attack of COVID-19 led to the almost complete suspension of offline activities in all industries. At this time, Chinese Spring Festival is the golden period of consumption by the whole people, but it was also stopped because of COVID-19. This left China's economic development almost stranded during this period. Although some enterprises and people have been on guard against such problems, for example, Bill Gates expressed his concern about microbes, also known as viruses, in TED Talks. Countries around the world still need to face global economic stagnation as a result of the COVID-19 pandemic. However, it is

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also because of COVID-19 that we have the opportunity to assess the impact of the crisis on the bond market, particularly corporate bonds in the infrastructure sector.

2 LITERATURE REVIEW

There are a number of papers looking at the impact of COVID-19 on the global economy, such as stock market, bond market and financial industry and so on.

Professor Maital and Professor Barzani argue that COVID-19 is affecting the global economy in three main ways: affecting production, disrupting supply chains and markets, and affecting the finances of companies and markets [1]. Xu's research shows that the impact of COVID-19 on the market is continuous and gradual, which increases the risk of the bond market and the stock market [2]. Through data comparison, He et al. showed that the overall economy of Both China and the United States was affected by COVID-19. China's PMI and composite PMI in February 2020 were 29.6% and 28.9%, respectively, down 14.3% and 24.1% month-on-month, and 19.6% and 23.5% lower than the same period in 2019. The US economy grew at -1.2627 in the fourth quarter of 2019 and -1.2627 in the first quarter of 2020. The growth rate was -9.4947. These papers mainly focus on the macroeconomic indicators of COVID-19, and they are all negative. The bond market is not paid too much attention, but it is not without, and the information given by these papers is the direction of preference [3]. Through VAR Model, data and descriptive statistics, Chen et al. concluded that COVID-19 had a significant negative impact on China's stock market and a significant positive impact on China's bond market. However, some people are concerned [4]. Cao said the trend of China's bond market is uncertain after COVID-19, and the trend of bond yields will be uncertain if the global economy falls into a prolonged recession due to the development of overseas epidemic [5].

Besides these, there are some studies predict the future development of China's bond market by studying the development trend of China's property market and the correlation between China's property market and the bond market. Cao's research shows that China's bond market development is closely linked to PMI. In the future, the control of the epidemic has a direct bearing on the development of China's bonds [6]. And China's PMI shows a positive correlation with real estate prices. Liu's research shows that overall Chinese bond prices are positively correlated with investor enthusiasm. The depression of the property market and the long-term impact of the epidemic on economic development make the bond market lack of stimulation in the future [7].

In recent years, the policy adjustment on real estate is gradually increasing. CAI's research shows that China's real estate market has been in an overheated state for a long time in the past, and the excessively high housing price leads to the rise of the price of raw products. However, the outbreak of the epidemic makes the major adjustment of the real estate market come ahead of schedule. In the future, the government will focus on adjusting the privileges attached to the purchase of real estate, which will also severely discourage the expansion and development of the real estate market and further affect the nationwide infrastructure [8].

In terms of the actual change trend, China's real estate market will also suffer a severe blow in 2021, leading to the decline of the bond market. Chen's research shows that in the second half of 2021, the overall real estate market in China will decline, and the growth rate of the domestic

economy will also fall rapidly. As industrial prices continue to rise, fiscal policy tends to be conservative. In the bond market, China's overall bond yields have shown a downward trend throughout the year. The yield on ten-year Treasury bonds has gradually fallen from 3.3% to 2.8% as monetary policy has shifted. And bond yields will continue to fall as recessionary pressures bite.[9] Finally, from the perspective of China's economic reconstruction process, the overall market environment of China in 2022 is in a positive trend. Yang's research shows that although the overall global economy is in a state of recovery, repeated outbreaks of global epidemics in early 2022, sharp increases in global energy prices, and disruptions in supply chains all make it difficult for the global economy to return to the normal track. At the same time, the historical economic problems of various countries around the world have also erupted, and the fiscal policies of various governments tend to be conservative. It is estimated that the global economy will struggle to maintain growth in 2022, but China is expected to maintain a high economic growth rate due to the implementation of the RCEP agreement and the good epidemic prevention effect [10].

Based on the above studies, it can be seen that the development of China's bond market is affected by many factors, among which the macro-economic market environment is the most influential. From the perspective of market performance, China's bond market and real estate market also have a certain correlation. According to the adjustment trend of China's economic policies, in 2022, China's real estate market will usher in a series of policy adjustments, and the bond market may also be affected accordingly, and the overall trend may be downward.

3 CHOOSING THE DATA

To find out the COVID-19's influence on the bond market, we select four bonds which were issued before COVID-19 and after COVID-19 (Table 1) to make a comparison.

According to previous studies, there is a positive correlation between the development trend of China's bond market and the real estate market, and there is also a positive correlation between the development of the real estate market and the infrastructure market, and the three correlations are not mutually exclusive. Based on this, we finally selected four bonds issued by the infrastructure construction industry as the data for our research by referring to the difficulty of data acquisition and reference.

Table 1. Bond factors of 4 bonds

	A	B	C	D
Type	**Corporation bond**			
Bond rating	AA+	AA+	AA+	AA+
Issuer rating	AA+	AA+	AA+	AA+
Coupon rate	5.32%	5.38%	3.85%	5.06%
Issue price	￥100	￥100	￥100	￥100
Release time	03/15/2019 - 03/15/2026	04/10/2019 – 04/10/2026	01/14/2022 – 01/14/2029	01/18/2022 – 01/18/2029
Maturity	7Y	7Y	7Y	7Y

Source: SSE BOND [11]

All these four bond's Bond rating and Issuer rating are both AA+, and their Maturity are all 7 years. The issuing price of the four bonds is ￥100, and the type of the four bonds is corporation bond.

Bond A is issued by Urumqi Economic and Technological Development Zone Construction Investment Development Co. LTD in March 15，2019.Bond B is issued by Hanjiang State-owned Capital Investment Group Co. LTD in April 10，2019.Bond C is issued by Jiaxing Science and Technology City Investment Development Group Co. LTD in January 14，2022.Bond D is issued by Hunan Jinyang New Town Construction and Development Group Co. LTD in January 18，2022.

The issuing price of the four bonds is 100 Chinese Yuan, and the type of the four bonds is corporation bond. The coupon rate of Bond A was 5.32%. The coupon rate of Bond B was 5.38%. The coupon rate of Bond C was 3.85%. The coupon rate of Bond D was 5.06%

Bond A and Bond B were issued before the Covid-19. Bond C and Bond D were issued after the Covid-19.

4 USING THE MODEL

Referring to the research methods and logic used in previous studies, we will use Macaulay duration and modified duration to calculate and compare data in this paper.

4.1 Macaulay Duration

Duration was first developed by Frederick Robertson Macaulay [12], and it's also known as the Macaulay duration. The Macaulay duration is the weighted average term to maturity of the cash flows from a bond. The weight of each cash flow is determined by dividing the present value of the cash flow by the price. Macaulay duration is frequently used by portfolio managers who use an immunization strategy.

It has two basic assumptions: 1. Yield curve is flat 2. The discount rate applied to all future cash flows is fixed.

When applied to non-callable bonds, the Macaulay duration is a weighted average of the time value of money, expressed in years, that can be used to cover the initial cost of the security. The significance of the duration is that it is a direct measure of interest rate risk, and the longer the duration, the greater the interest rate risk.

$$D = \sum_t \frac{PV(CF)}{P} \tag{1}$$

where D is Duration; t is time period; PV(CF) is the present value of bond's cash flow; P is price(1).

Duration is the cash flow occurring at the future time, discounts the present value according to the current rate of return, and then multiplies each present value by the number of years between

now and the time point of occurrence of the cash flow, and sums. Present value refers to the discounted value of future cash flow at an appropriate discount rate. It is a measurement attribute that takes time value of money into consideration. Cash flow refers to the total amount of Cash outflow and Cash inflow during the entire life of an investment project.

4.2 Modified Duration

The modified duration is an adjusted version of the Macaulay duration, which accounts for changing yield to maturities. The formula for the modified duration is the value of the Macaulay duration divided by 1, plus the yield to maturity, divided by the number of coupon periods per year. The modified duration determines the changes in a bond's duration and price for each percentage change in the yield to maturity. When market interest rates change, the price of a bond with a larger Modified duration will fluctuate more.

$$\mathrm{MD} = \frac{Macaulay\ Duration}{(1+YTM)} \tag{2}$$

where YTM is Yield to Maturity which means the income earned by holding a bond until maturity, including all interest due, n is number of coupon periods per year(2).

5 RESULT

Table 2. Calculation result

Unit: Year	**Bond A**	**Bond B**	**Bond C**	**Bond D**
Macaulay Duration	6.02Y	6.01Y	6.26Y	6.06Y
Modified Duration	5.72	5.70	6.03	5.77

According to Table 1, Bond B have the highest coupon rate of 5.38%. Secondly, the coupon rate of the bond of Bond A is 5.38%. Thirdly, the coupon rate of the bond of Bond D is 5.06%. Lastly, the coupon rate of the Bond C is 3.85%.

Then, according to table 2, the Macaulay duration of Bond C is 6.26 which is the highest one among four bonds. Secondly, the Macaulay duration of Bond D is 6.06. Thirdly, the Macaulay duration of Bond A is 6.02. Finally, The Macaulay duration of Bond B is 6.01.

Through the comparison of the data can we found: 1. Bond C' Macaulay duration is significantly higher than Bond A's and Bond B's.2. Bond D's Macaulay duration is slightly higher than Bond A's and Bond B's.

By further calculation of the data, we can get the modified duration of all bonds. According to Table 2, the modified duration of Bond C is 6.03 which is the highest one among four bonds. Secondly, the modified duration of Bond D is 5.77. Thirdly the modified duration of Bond A is 5.72. Fourthly, the modified duration of Bond B is 5.70.

Similar to the previous result, Through the comparison of the data can we found:1. Bond C' modified duration is significantly higher than Bond A's and Bond B's. 2. Bond D's modified duration is slightly higher than Bond A's and Bond B's. After the modification of YTM, the gap

between the data increases and the significance of the impact of key events increases further also.

Through the comparison of four bonds, we find that COVID-19 has had an impact on China's bond market to a certain extent, but the impact is smaller than expected.

The likely reason is that China's demand for infrastructure has increased rather than decreased during the global pandemic. Thanks to strong government intervention, China's market order has recovered remarkably since the outbreak. And good market order also provides conditions for subsequent infrastructure construction. In addition, China's All-round well-off plan, which is scheduled to be completed by 2021, has led to large-scale infrastructure construction across the country. As a result, China's infrastructure still maintains a very high growth rate after the outbreak.

In the future, as China's epidemic prevention and control work is further carried out, market order will be further restored. The impact of COVID-19 will also recede, and China's overall economic market order will return to normal, with production and consumption returning to the right track.

But in terms of economic policy, the Chinese government seems intent on slowing down the economy and slowing down construction. From the perspective of the real estate market, in recent years, a series of policies have been continuously promulgated to restrict the development of real estate. Both the restrictions on the purchase conditions of investors and the restrictions on the development of new commercial houses by builders have greatly affected the operation of the market. From 2021 to the whole year, many credit default incidents occurred in real estate developers, and also reflected the enormous pressure of the real estate manufacturers and the whole market.

Such a bad situation also makes China's bond market face a huge potential crisis in the future. In 2021, the yield of treasury bonds decreased from 3.3% to 2.8%. Combined with the adjustment direction of the policy, this trend is also likely to continue. It can be predicted that China's bond market will usher in a new round of challenges in 2022.

6 CONCLUSION

After calculation the Macaulay durations of pre-outbreak bonds A and B are 6.02 and 6.01, respectively, and their modified durations are 5.72 and 5.70, respectively. The Macaulay duration of bond C and Bond D issued after the outbreak is 6.26 and 6.06, respectively, and their modified duration is 6.03 and 5.77, respectively.

In general, the outbreak of the epidemic increased the duration of bonds, but the impact was relatively small, with the duration changing within the 5% level. However, as the epidemic continues to spread, the recovery of the global economy is far from being achieved, and there are many uncertainties in the future market reform in China caused by the epidemic. The impact of the epidemic continues to grow.

Based on the Macaulay duration and modified duration statistics and research, it is found that the Chinese bond market is less affected by COVID-19, and the change degree of yield and

duration is small, with the fluctuation level below 5%. The negative impact of the epidemic is not very significant in the short term.

However, considering the changing trend of the Chinese government's economic development planning and economic policy making in recent years, various industries closely linked with China's bond market have been greatly restricted. In the long run, the outbreak of the epidemic has accelerated the process of China's economic adjustment. During the epidemic, credit crisis and operation crisis broke out in a large number of enterprises and industries, and the regulatory authorities strengthened supervision accordingly, and the loopholes in the mechanism were also discovered and made up at this time.

In the future, influenced by the implementation of the monetary policy and the strengthening supervision, China's economic growth will face great downward pressure. China's bond market will also usher in a new round of challenges.

As an investor, on the one hand, the continuous decline in Chinese bond yields, and on the other hand repeated outbreaks of the epidemic have seriously weakened investors' enthusiasm for investment. Therefore, this paper suggests that during the special period, investors should appropriately reduce investment behavior and increase the proportion of hedge assets to cope with the challenge of public health crisis. Considering the characteristics of China's bond market, its current development is most affected by the progress of COVID-19 resolution and macroeconomic trends. Investors need to wait until the epidemic situation abates and China's economic planning and policy making trends change before appropriately increasing their attention to the bond market.

REFERENCES

[1] M. Shlomo, and E. Barzani, "The global economic impact of COVID-19: A summary of research." Samuel Neaman Institute for National Policy Research, pp. 1-12, 2020.

[2] X. Weijia, A. Li, and L. Wei. "The Impact of COVID-19 on China’s Capital Market and Major Industry Sectors." Procedia Computer Science 199, pp. 87-94, 2022.

[3] H. Chengying, et al. "The comparison of economic impacts of COVID-19 between China and the United States." Procedia Computer Science 187, pp. 307-3150, 2021.

[4] C. Xingyi, et al. "The impact of Covid-19 on the securities market: evidence from Chinese stock and bond markets." Procedia Computer Science 187, pp. 294-299, 2021

[5] C. Kerui. " Impact of COVID-19 Epidemic on Bond Market and Investment Strategy Suggestions." Chinese money market 4, 2020.

[6] C. Kerui. ”Impact of COVID-19 Epidemic on Bond Market and Investment strategy suggestion”[J].China money, pp. 27-29, 2020.

[7] M. Liang W. Zhonghua Z. Jialu Chen. “The Pandemic-era Development of Property Market and Its Impact on Bond Market”[J]. China Bond, pp. 46-48, 2020.

[8] C. Zhen. “Improving the Real Estate Market Amid the Pandemic”[J].Financial Market Research, pp. 58-66, 2021.

[9] C. Jianhen."Retrospect of the Bond Market in 2021 and Outlook." China Money, pp. 28-31, 2021.

[10] Y Xing. L Xin. L Yisu.”Analysis of the global economic and financial situation in 2021 and prospects for 2022”[J]. Morden Finance Guide, pp. 13-16, 2022.

[11] SSE BOND: SHANGHAI STOCK EXCHANGE. http://bond.sse.com.cn/

[12] F. Robertson Macaulay."Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856." pp. 24-53, 1938.