The Impact of the New Crown Epidemic on the Chinese Government Bond Market

Yuexin Chen
National University of Malaysia, 43600 Bangi, Malaysia.

Abstract: Treasury bonds are a source of funds obtained by a government on a borrow-and- repay basis and are a form of reimbursable, non-recurring fiscal revenue whose main functions are to cover fiscal deficits, raise construction funds, regulate money supply and interest rates and control the macro economy. When the Treasury Bond Index rises it indicates a better developed bond market in China, while a rising bond index also indicates falling interest rates and easing liquidity. For individual investors, a rise in the treasury bond index causes bond market interest rates to fall, treasury bond rates to fall and investors' expected returns from investing in treasury bonds to fall. Conversely, when the Treasury Bond Index falls, it means that the bond market is less developed. At the same time, a falling bond index also indicates rising interest rates and tight liquidity, and if the Treasury Bond Index falls for a long period of time, it will mean that inflationary expectations gradually decrease. For individual investors, a falling Treasury Bond Index causes bond market interest rates to rise, Treasury bond interest rates to rise, and investors' expected returns from investing in Treasury bonds to increase accordingly. Data from Baidu Stock Market Access.

Keywords: Coronavirus; National Debt; Macroeconomic

1. Variables and Data
1.1 Explanatory Variables

Treasury Bond Index Closing Price (CLOS, in RMB): The Treasury Bond Index (SH.000012) is a sample of all fixed rate government bonds listed on the Shanghai Stock Exchange, weighted by the volume of government bond issues. The purpose of the Treasury Bond Index is to reflect the overall movement of our bond market and to act as an "indicator" of price movements in our bond market.

1.2 Core explanatory variables

The cumulative number of confirmed cases of NCC in China (cov, in persons) is the cumulative number of confirmed cases, including those who have been cured and discharged from hospital, the number of deaths, and the number of existing confirmed patients, which better reflects the development trend and severity of the NCC epidemic in China, including the transmission intensity and cure rate of the NCC virus. The government uses these figures to make decisions on the response to the epidemic, to deploy relief supplies and personnel, and to implement fiscal and monetary policies based on the extent of economic damage caused by the virus. Data from the official website of the National Health Commission of China.

2. Control variables

The control variables in this paper are selected from the monthly macroeconomic indicators of China, and the data are obtained from the official website of the National Bureau of Statistics of China. The sample period is selected from the monthly data of 36 months from January 2020, when the epidemic is officially named, to December 2022, when the optimal prevention and control policy is announced, so as to provide a comprehensive overview of the development of the New Coronavirus in China. The cumulative growth rate of state expenditure (exp, in %) mainly includes the central government's expenditure on people's livelihoods in education,

healthcare, social security and employment, housing security, and culture, which are directly related to people's lives, and the figure reflects the scope of activities and the propensity of policy choices made by a country's government to achieve its functions. And as an important reason for the issuance of national debt is to cover fiscal deficits, the pressure of demand for national fiscal expenditure is another important factor governing the size of national debt issuance. The size of treasury bonds is closely related to fiscal spending, for example, after the introduction of China's 1994 Budget Law, which stipulates that fiscal deficits cannot be covered by overdrafts from the central bank, but only by issuing treasury bonds. As a result, there has been a rapid development in the size of the national debt, and the increasing fiscal deficit has been met by an increasing scale of national debt issuance to cover the fiscal deficit. The cumulative value of state revenues (g, in billions of dollars) is a combination of all the funds raised by the government to fulfil its functions, implement public policies and provide public goods and services as needed. All studies have concluded that there is an important relationship between the government's fiscal deficit (the difference between fiscal expenditure and fiscal revenue) and the issuance of the national debt. According to Keynes, the issuance of national debt can expand aggregate demand, reduce unemployment, cover fiscal deficits and maintain social stability, and promote the long-term health of the national economy. Alvin Hansen believes that as long as a government keeps its national debt burden at a moderate size, no debt or economic crisis will arise, but there is a limit to the government's ability to repay its debts, and the government should pursue a prudent fiscal policy, maintain a reasonable size of national debt, and control the issuance of national debt appropriately when the economy is growing faster.

Year-on-year growth rate of total retail sales of consumer goods (consume, in %): As the starting and ending point of economic activities, consumption reflects final demand and has a guiding and pulling role in a country's economic growth, thus playing a fundamental role in economic development. Therefore, total retail sales of consumer goods is a good indicator of macroeconomic prosperity, and it is an important reference for national macroeconomic regulation and control, especially for the issuance of national debt.

2.1 Descriptive statistics of variables

Table 1. Descriptive Statistics Variable Obs Mean Std. Dev. Min Max

Variable	Obs	Mean	Std. Dev.	Min	Max
clos	36	188.557	6. 113	178. 15	198.58
cov	36	1543863 7	2878244 2	835	9137495
exp	36	2.794	4.09	-5.8	10.5
g	36	114661.98	54166.433	20000	202539
consume	36	2 656	10 321	- 15 8	35

According to Table 1, during the three years of the New Coronavirus epidemic, the variation of the national debt index ranged from 178. 15 to 198.58, with a wide range of fluctuation, indicating the existence of macroeconomic fluctuations. The cumulative number of confirmed new coronavirus cases soared from 835 to 9,255,990, which is a side-effect of the long incubation period, diverse transmission routes, high recurrence rate and easy mutation of the new coronavirus. In terms of control variables, except for the cumulative government revenue which did not fluctuate much, the cumulative growth rate of government expenditure and the growth rate of total retail sales of consumer goods both fluctuated in a wide range, with the absolute value of the lowest value almost half of the highest value, indicating that the macroeconomic fluctuations in China during the three years of the epidemic led to large fluctuations in state fiscal expenditure.

3. Model Construction

This paper constructs two linear regression models, a simple linear regression and a multiple linear regression to examine the impact of the new crown epidemic on the Chinese bond market, respectively. In addition, as the units of the cumulative value of state revenue, g, differ significantly from the other explanatory variables, their natural logarithmic form, lng, is taken to mitigate heteroskedasticity. the form of the model equation is as follows.

$lnclos_t = \alpha_0 + \alpha_1 cov_t + \varepsilon_t$ $lnclos_t = \beta_0 + \beta_1 cov_t + \beta_2 exp_t + \beta_3 consum_t + \beta_4 lng_t + \varepsilon_t$

(Model 1)

(Model 2)

Among them, t represents time, and ε_t is the residual term.

4. Correlation analysis and cointegration tests
4.1 Correlation analysis

Table 2.Matrix of correlations

Variables	clos	cov	exp	g	consume
clos	1 000				
cov	0.761	1.000			
exp	0.687	0.432	1.000		
g	0.429	0.407	0.033	1.000	
consum	-0.141	-0.189	0.398	-0.046	1.000

Based on the correlation coefficient matrix above, it can be found that the correlation coefficients between the explanatory variables are not high, while the explanatory variable clos has a high correlation with the explanatory variables cov and exp, at 0.761 and 0.687 respectively. to further confirm whether there is a problem of multicollinearity in the model, the calculation of the variance inflation factor is performed in the next section.

4.2 Analysis of covariance

Table 3.VIF Variable

	VIF	1/VIF
cov	1.860	0.537
exp	1.830	0.545
g	1.510	0.663
consum	1.230	0.814
Mean VIF_	1.610	

According to the above table, the VIF of all the explanatory variables in the model is low and the overall VIF is less than 2. We can assume that there is no multicollinearity problem in the model and the validity of the model is ensured and the model is well constructed.

5. Estimation of main effects

Table 4. OLS regression results

	Model 1 clos	Model 2 clos
cov	0.00000162*** (0.000000236)	0.000000546** (0.000000172)
exp		1.066*** (0. 120)
consume		-0.217***

		(0 0431)
ng		3.439***
		(0.673)
cons	186. 1***	145.7***
_	(0 764)	(7 698)
N	36	36
R2	0.579	0.891
adj. R2	0.566	0.877

Standard errors in parentheses * $p < 0.05$, **$p < 0.01$, ***$p < 0.001$

According to the regression results in Table 4, all the explanatory variables are significant within the 1% significant level, and the vast majority of the explanatory variables are significant within the 0. 1% significant level, indicating that the explanatory variables in this paper are appropriately selected. Model 1 is a simple regression model that examines the relationship between the closing and closing prices of treasury bonds and the cumulative number of confirmed new crowns. The fitted line is shown below, with the cumulative number of confirmed new crowns cov showing a significant positive relationship with lncp. According to the regression results, it can be seen that the closing price of the treasury bond index increases by $0.00000162 for every increase of 1 person in cumulative confirmed diagnosis. This is because the increasing severity of the New Crown epidemic leads the government state to stimulate the growth of aggregate demand by issuing treasury bonds and increasing fiscal spending to reduce the unemployment rate so that the economy can recover as soon as possible. As a result, the equilibrium interest rate on bonds fell, the bond market was oversupplied and the closing price of the Treasury Bond Index increased.

The cumulative growth rate of government fiscal expenditure and the cumulative value of fiscal revenue both have a positive impact on the closing price of the government bond index. Specifically, when there is a large increase in government fiscal spending, such as the increased investment in the healthcare system during the epidemic, a large source of funding is required and the issuance of treasury bonds to raise funds becomes the obvious choice. At a time when the epidemic has caused a significant decline in the returns of various securities products, treasury bonds have become extremely sought after due to their high safety and yield characteristics, and the high demand has led to an increase in the closing price of the treasury bond index.

Figure 1. Regression fitting line of model 1
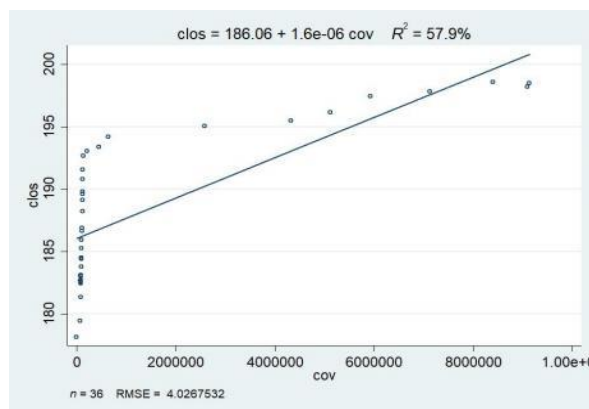
According to the results of model 1, when the three control variables of government revenue and expenditure and social consumption are added, the coefficient of cov becomes smaller. Except for the negative coefficient before consumption, all other explanatory variables have a positive relationship with the closing price of the national bond index. The total retail sales of social consumer goods grew by 1% year-on-year, and the closing price of the national bond index fell by 0.217 yuan. Because the quality of the macro economy will directly affect the market conditions of the national bond market. When the economy is on the rise, the growth of social consumption is positive, the country's expansionary macroeconomic policies are weakened, the scale of national debt is reduced, and the national debt index falls.

6. Heteroscedasticity Test


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White's test for Ho: homoskedasticity
            against Ha: unrestricted heteroskedasticity

    chi2(14)    =      8.45
    Prob > chi2 =    0.8645

Cameron & Trivedi's decomposition of IM-test
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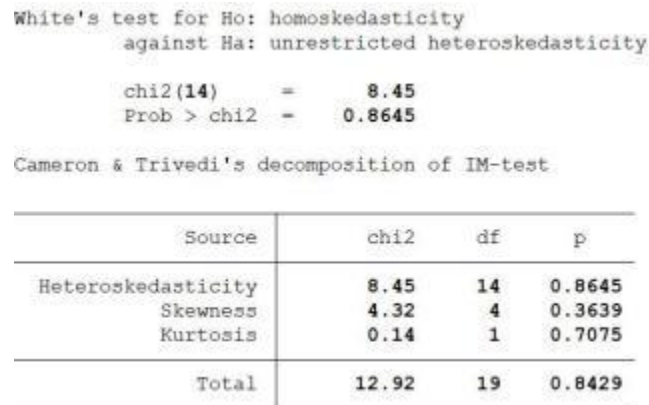| Source	chi2	df	p
Heteroskedasticity	8.45	14	0.8645
Skewness	4.32	4	0.3639
Kurtosis	0.14	1	0.7075
Total	12.92	19	0.8429

Figure 2. White test results

The heteroscedasticity problem means that the fluctuation range of the explained variable changes with the different explanatory variables, that is, the variance of the random interference item is no longer constant. The heteroscedasticity problem of the model will cause the estimator to be no longer valid, and the significance test of the estimated value of the model parameters will be invalid, thereby reducing the prediction accuracy of the regression result of the model. Next, use White's test to see if there is a problem of heteroscedasticity in the mode.

According to the regression results in Figure 1, the p-value equals to 0.8645, which is greater than 0.05, so we cannot reject the original hypothesis (homoscedasticity), so there is no evidence of heteroscedasticity problem in the model.

7. Sequence Correlation Test

Sequential correlation means that there is a certain correlation between random interference items. The consequences are the same as the heteroscedasticity problem, which will make the parameter estimator of the model no longer valid, and the significance test of the variable will lose meaning, thus making the prediction of the model invalidated. This article will use the graphical method to test whether there is serial correlation in Model 2.
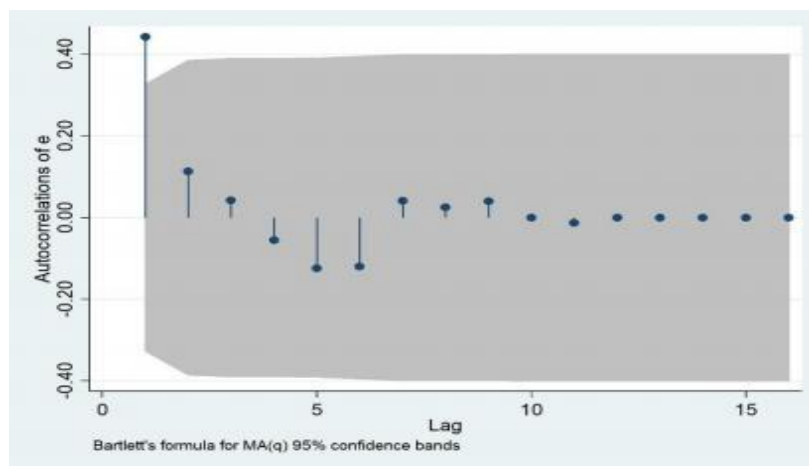

Figure 3. Autocorrelation of residual sequence in model 2

According to model 2, it can be found that the vast majority of autocorrelation coefficient points for the multiple regression are inside the shaded area, indicating that there is no significant serial autocorrelation in the data chosen for this paper.

8. Robustness Test

Table 5. Robustness test results

	Model 1	Model 2
	clos	clos

cov	0.00000162***	0.000000546**
	(0.000000153)	(0.000000169)
exp		1.066***
		(0. 106)
consum		-0.217***
		(0 0395)
ng		3.439***
		(0.829)
cons	186. 1***	145.7***
_	(0 817)	(9 346)
N	36	36
R2	0.579	0.891
adj. R2	0.566	0.877

Standard errors in parentheses * p < 0.05, **p < 0.01, ***p < 0.001

In order to further verify the robustness of the conclusions, Table 5 reports the robustness test results of the two models. When changing some conditions or assuming that the conclusions obtained remain unchanged, then our conclusions are robust. On the contrary, the conclusions obtained are open to discussion, and we need to find out the reasons for the changes in the conclusions and explain them. Judging from the robustness test results in the above table, the positive and negative signs of the coefficients in Table 5 and Table 4 are consistent, and the model has passed the robustness test, indicating that the conclusions of this study are stable and reliable.

References

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