Analysis of Influencing Factors of Chinabond Government Securities Yield

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Abstract

This paper uses SPSS software, using the method of combination of factor analysis and linear analysis to analyze the factors that affect the yield of Chinabond government securities. Firstly, this paper studies the domestic related literature, sums up the factors that will affect the bond yield, and then uses these factors as independent variables to further study the impact of these independent variables on the yield of Chinabond government securities. This article ranks the impact of these factors on the yield of 1-year Chinabond government securities and finds the factors that have the greatest impact on Chinabond government securities. At the same time, it also studies the degree of influence and the direction of influence of the yields of Chinabond government securities with different terms due to these factors.

Keywords

Yield rate, Chinabond government securities, influencing factors.

1. Introduction

In recent years, China financial market has developed rapidly, and residents' income level has been generally improved. With the rise of the financial industry, residents' investment consciousness is gradually enhanced. Bonds are becoming more popular. First of all, bonds are more flexible than bank loans for companies, and active financial derivatives have created more favorable conditions for bond financing. Secondly, compared to stocks and futures, there's more investment in bonds. Investors are increasingly attaching importance to risk management, so government securities become the most attractive investments investors can make when building their portfolios.

When buying bonds, investors will fully consider the safety, profitability, maturity and liquidity of the bonds. As a kind of government securities , the Chinabond government securities has the highest credit rating and high safety, and its interest rate is often regarded as the risk-free interest rate. Investors also tend to hold Chinabond government securities when building their bond portfolios.But the profitability of bonds is not high, and bond yields tend to be affected by macro factors. Bond yields also vary with maturity, and bonds of different maturities are subject to different degrees of external influence. Meanwhile, changes in yields in turn affect the pricing of bonds and other financial assets. Chinabond government securities yield is one of the most important reference interest rates in China capital market, so it is of great significance to explore the influencing factors of bond yield. This paper will study the influencing factors of the yield of Chinabond government securities, and specifically analyze which factors are the most influential to Chinabond government securities of different maturities.

2. Literature Review

Weiyu Zhu (2014) studied the relationship between bond and stock portfolio yields. Based on the empirical analysis, the author found that there was a strong correlation between stock portfolio and bond yield, which had the characteristics of long life and low stock volatility. The research results of Zhenlong Zheng and Wei Yang (2012) showed that there was a correlation between the returns of China's stock market and bond market. There was also a significant correlation between inflation and bond yields. Jin Wei (2016) studied the impact of monetary policy on the bond market. Based on the

analysis of 15 years' monetary policy and the bond yield data, the author analyzed the influencing factors of bonds. Research showed that cuts in interest rates brought by monetary policy and stock market movements would have an impact on bond yields. Xi Li (2016) studied the impact of benchmark interest rate on bond yields. In this paper, Shibor (Shanghai interbank offered rate), bond collateral repo rate in the national interbank market and central bank bill yield rate were selected as the benchmark interest rate in the bond market. The research showed that Shibor, the national interbank market bond pledge repo rate and the central bank bill yield all affected the government securities yield, and the extent to which these three benchmark interest rates affect the government securities yield was related to the maturity of the government securities. Yiming Wang and Jianfeng Li (2005) made an empirical analysis of macroeconomic variables affecting the bond market. The research showed that both the consumer price index and the stock market index had an influence on the bond yield.

To sum up, there had been a lot of research on bond yields, and the analysis was basically on the impact of bond yields. However, there was relatively little literature on government securities. In this paper, these factors affecting bond yields were selected as independent variables, and this paper would further analyze the impact of these factors on the bond yield. There were many studies on the influencing factors of bond yields in existing literatures, but the effective factors obtained from each literature were only one or two, and the factors found by different scholars were not the same. Therefore, this paper will summarize the effective influencing factors found on the basis of these literatures, and find out the most effective factors of these influencing factors on the bond yield. At the same time, this paper will study the direction of these factors on the bond yield.

3. Research Methods and Variables Selection

3.1 Research Methods.

The research methods selected in this paper refer to the factor analysis method used by Yiming Wang and Jianfeng Li (2005) , and the principal component analysis method used by Guowe Han et al. (2016). Factor analysis method and principal component analysis method are similar, both of which can realize dimension reduction, and principal component analysis is a special case of factor analysis. Considering that there may be a large collinearity problem among the research objects selected in this paper, this paper chooses the factor analysis method for research. In addition, this paper will carry out multiple linear regression analysis for the newly constructed factors, so as to find the factors that have a greater impact on the yield of Chinabond government securities. Linear regression is then performed on the original variables to verify the results obtained after factor regression.

This paper firstly takes 1-year Chinabond government securities as the research object, carefully studies the influence of various factors on 1-year Chinabond government securities yield, and finds out the main influencing factors. Afterwards, this paper further explores the effects of these factors on 1-day, 3-year, 5-year, 7-year, 10-year and 30-year Chinabond government securities yields.

3.2 Variables Selection

In order to fully study yields influence factors in our country, this article chooses the dependent variable (Y) yields, respectively for 1 day, 1 year, 3 years, 5 years, 7 years, 10 years and 30 years period of Chinabond government securities for independent research, to explore whether the same influencing factors have the same impact on the yield of Chinabond government securities of different maturities.

The selection of independent variables mainly refers to the research conclusions obtained from existing literatures. In this paper, 5 independent variables are selected:(X_1) Shanghai interbank offered rate -Shibor (1 year), (X_2) 7-day bond pledged repo rate in the national interbank market, (X_3) 7-day national interbank offered rate, (X_4) M2 and (X_5) Shanghai composite index.

The selection of the Shanghai interbank offered rate (Shibor), the bond pledged repo rate in the national interbank market and the specific term of the national interbank offered rate is determined by referring to the selection criteria of existing literatures. Existing literature has studied interest rates

of various maturities, and the selected interest rate period is already a more appropriate research object. Therefore, this paper directly adopts the existing research results to determine.

According to literature studies, the stock market has a great correlation with bond yields, which is usually closely related to stock portfolios. Therefore, this paper chooses the Shanghai composite index as the representative of the stock market. Money supply can well reflect monetary policy. The money supply index includes base money M0, narrow money supply M1 and broad money supply M2. At the same time, these indicators are closely related to the overall situation of the macro economy and often become the leading indicators of the macro economy. But bond investors are most concerned about M2, the broad measure of money supply. Generally speaking, if the bank credit and money supply grow rapidly, the economic boom will be better, and the rate of return on capital will rise, and the bond yield will rise.Otherwise, the economic activity will contract, and the growth of credit and money supply will slow down, and the bond yield will decline.

In addition to the above variables, there are many factors that may affect the yield of Chinabond government securities, such as excess deposit reserve ratio, supply and demand of Chinabond government securities and so on. However, according to existing studies, compared with the five independent variables screened in this paper, these influencing factors have a relatively weak or no impact on the Chinabond government securities. Therefore, this paper will not study the influencing factors other than the five independent variables.

The data sources of the dependent variable and five independent variables selected in this paper are the People's Bank of China1, and the data range is from January 2014 to March 2018.

4. Empirical Analysis

4.1 Empirical Analysis of the Influencing Factors of 1-year Chinabond Government Securities Yield.

In this paper, SPSS V21.0 is used for empirical analysis. Firstly, factor analysis is carried out for independent variables X_1-X_5. Factors with eigenvalues greater than 1 are selected, and the results are as follows:

Table 1 Total variance of interpretation

Component	Initial eigenvalues			Extraction sums of squared loading			Rotate sum of squares load		
	Total	Variance %	Accumulation %	Total	Variance %	Accumulation %	Total	Variance %	Accumulation %
1	3.082	61.648	61.648	3.082	61.648	61.648	2.705	54.107	54.107
2	1.103	22.062	83.710	1.103	22.062	83.710	1.480	29.603	83.710
3	.586	11.729	95.439						
4	.216	4.324	99.764						
5	.012	.236	100.000						
Extraction method:Principal Component Analysis									

Finally, two factors are obtained, which could explain 83.71% of the total variation.It is very high in interpretation.According to the scree plot, only the eigenvalues of factor 1 and factor 2 are greater than 1, while the eigenvalues of other factors are far less than 1.Therefore, this paper will use two factors for subsequent regression analysis.

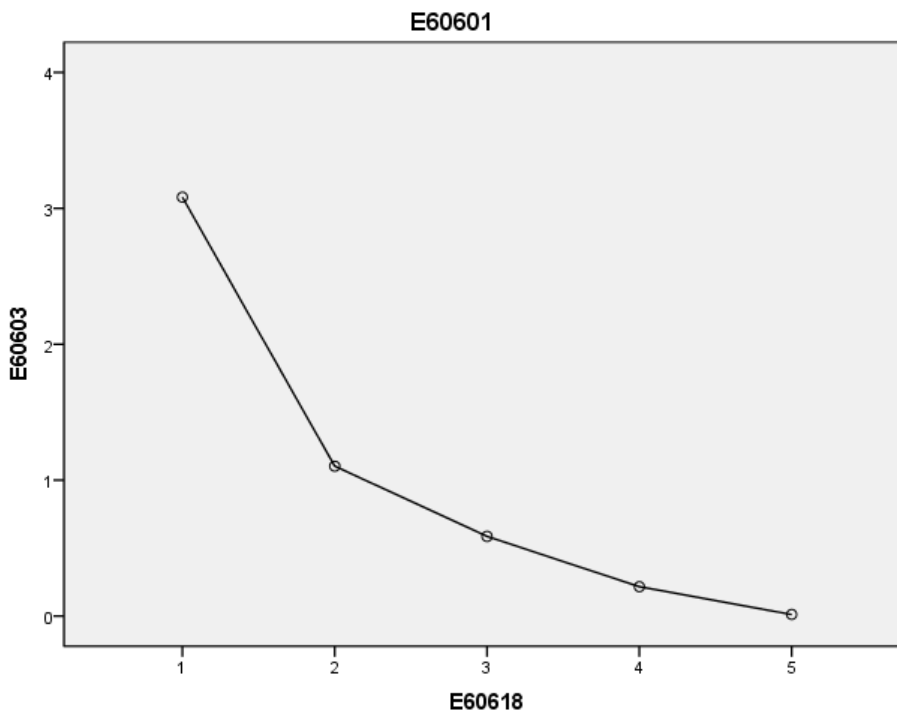[1]URL：http://www.pbc.gov.cn/diaochatongjisi/116219/116319/index.html

Fig. 1 Scree plot

The factor load matrix is rotated and the factor score is calculated, as shown in table 2.As you can see from table 2, factor 1 mainly explains X_1, X_2, and X_3, the three interest rates.Factor 2 mainly explains X_4 and X_5, namely the stock market and M2.Therefore, factor 1 can be named as the interest rate factor and factor 2 as the external impact factor.

Table 2 Component Score Coefficient Matrix

	Component	
	1	2
X5	.108	.609
X1	.336	.023
X4	.132	.637
X3	.372	.061
X2	.394	.123

According to table 2, the factor scoring formula can be written as follows:

$$F_1=0.336X_1+0.394X_2+0.372X_3+0.132X_4+0.108X_5$$
$$F_2=0.023X_1+0.123X_2+0.061X_3+0.637X_4+0.609X_5$$

In this paper, SPSS is used to directly output the factor score results, and then multiple linear regression analysis is conducted with F_1 and F_2 as independent variables and 1-year Treasury bond yield (Y) as dependent variables.Firstly, the significance of the whole model is checked, and the following two tables can be obtained:

Table 3 Model summary

Model	R	R Square	Adjusted R Square	Std.Error	Durbin-Watson
1	.841a	.707	.695	.3262255	.413
a. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1.					
b. Dependent Variable: Y					

Table 4 Anova results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.310	2	6.155	57.835	.000b
	Residual	5.108	48	.106		
	Total	17.418	50			
a. Dependent Variable: Y						
b. Predictors: (Constant), REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1.						

As can be seen from table 3, the overall R square of the model is 0.707 and the adjusted R square is 0.695, which indicates that the overall fitting degree of the model is good.Meanwhile, it can be seen from table 4 that after F test of the model, the P value is far less than 0.05.Therefore, this model has significant statistical significance.

Table 5 Linear regression results of two factors

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std.Error	Beta		
1	(Constant)	2.902	.046		63.532	.000
	REGR factor score 1 for analysis 1	.492	.046	.833	10.662	.000
	REGR factor score 2 for analysis 1	-.065	.046	-.110	-1.412	.165
a. Dependent Variable: Y						

According to the coefficient table of the final output (table 5), at the significance level of 0.05, factor F_2 is not significant, and only factor F_1 is significant.In other words, the interest rate factor has a significant impact on the bond yield, while M2 and Shanghai composite index are not significant.Since factor analysis has weakened the original variables, the correlation results of its regression will change.So, this paper do a linear regression for the original independent variable X_1 - X_5.

After the regression of X_1-X_5, the overall R power of the model is increased to 0.911, and the adjusted R power is 0.901, and the P value of its F test is also 0.000.Therefore, direct regression of these five independent variables can achieve better fitting effect.The final coefficients are listed as follows:

Table 6 Linear regression results of independent variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std.Error	Beta		
1	(Constant)	-.819	.344		-2.381	.022
	X5	.000	.000	-.224	-4.042	.000
	X1	.642	.065	.827	9.919	.000
	X4	1.045E-006	.000	.326	4.856	.000
	X3	.012	.266	.014	.045	.964
	X2	.082	.253	.091	.324	.748
a. Dependent Variable: Y						

As can be seen from table 6, the P value of variables X_2 and X_3 is much greater than 0.05, which means that the impact on the yield of Chinabond government securities is not significant.According to the results of factor analysis, the interest rate factor has a significant impact on the bond yield, which is much higher than M2 and the Shanghai composite index.Combined with the above table, X_1 (Shibor) has a very significant impact on Chinabond government securities yield, and is the most influential of all factors.Therefore, in the interest rate factor, Shibor has a great influence on the yield of Chinabond government securities, while the other two interest rates have little influence, and X_2

has a slightly larger influence than X_3. According to the data in the table above, the model results can be written as follows:

$$Y=-0.819+0.642X_1+0.082X_2+0.012X_3+1.045E\text{-}006X_4+0.000X_5$$

It can be seen from the coefficients of the model that although both X_4 and X_5 have significant influences on the yield of Chinabond government securities, their coefficients are so small that they can be ignored. Combined with the results of factor analysis, X_4 and X_5 actually have little effect on the yield of Chinabond government securities, and X_5 has the weakest effect. In addition, these five factors have a positive impact on the 1-year bond yield. Based on the above analysis, the influence degree of the factors affecting the Chinabond government securities yield is ranked, and the results are as follows: $X_1>X_2>X_3>X_4>X_5$, namely Shibor> 7-day national interbank market bond pledged repo rate > 7-day national interbank lending rate >M2> Shanghai composite index.

4.2 Empirical Analysis of Other Maturity Chinabond Government Securities Yield.

According to the research in this paper, the final results obtained by linear regression and factor analysis are consistent, and the fitting degree obtained by direct linear regression of variables is better, and the analysis of variables is more convenient. Therefore, for the analysis of 1-day, 3-year, 5-year, 7-year, 10-year and 30-year Chinabond government securities, this paper adopts the direct linear regression method for the study of 5 independent variables. Finally, the R square of the model corresponding to each period, the R square adjusted, the F value , the P value of the F test, and the P value and coefficient results of the t test are shown in the following table:

Table 7 Linear return results of Chinabond government securities yield of different maturities

	Model summary				Coefficients and P value of the t test						
	R Square	Adjusted R Square	F	Sig.	Const-ant	X1	X2	X3	X4	X5	
1-day	0.719	0.688	23.077	0.000	0.000	0.948	0.901	0.186	0.000	0.009	Sig.
					(2.922)	0.008	(0.059)	0.666	2.810E-006	0.000	B
3-Year	0.882	0.868	67.021	0.000	0.189	0.000	0.574	0.874	0.149	0.108	Sig.
					0.464	0.700	(0.145)	0.043	3.203E-007	-9.296E-005	B
5-Year	0.850	0.833	50.854	0.000	0.408	0.000	0.307	0.526	0.477	0.379	Sig.
					0.784	0.678	(0.294)	0.191	1.736E-007	-5.586E-005	B
7-Year	0.787	0.764	33.305	0.000	0.002	0.000	0.325	0.557	0.873	0.383	Sig.
					1.426	0.621	(0.319)	0.199	4.387E-008	-6.223E-005	B
10-Year	0.800	0.778	36.001	0.000	0.000	0.000	0.507	0.750	0.568	0.344	Sig.
					1.692	0.628	(0.217)	0.109	-1.586E-007	-6.835E-005	B
30-Year	0.809	0.787	38.000	0.000	0.000	0.000	0.327	0.570	0.199	0.338	Sig.
					2.624	0.602	(0.307)	0.186	-3.436E-007	-6.616E-005	B

It can be seen from the results in table 7 that, for Chinabond government securities of all maturities, the results of model R square, adjusted R square and F test are all good, indicating that the model has certain explanatory ability. X_4 (M2) and X_5 (Shanghai composite index) have a significant impact on the 1-day bond yield. X_1 (Shibor) is the main influencing factor for the yield of the remaining 3, 5, 7, 10 and 30 years Chinabond government securities, while other factors have no significant influence on the yield of the Chinabond government securities. The influences of X_2 and X_5 on most maturity Chinabond government securities are in the opposite direction, and the other variables basically change in the same direction as the yield of Chinabond government securities.

Although the variable coefficient and P value of t test obtained by the model are not perfect, it can still be explained that Shibor has a significant impact on most bond yields. Moreover, from the model coefficients obtained, it can be seen that the yields of Chinabond government securities with different maturities are affected by different factors in different degrees and directions.

5. Conclusion

Based on the existing literature, this paper selects five influencing factors that will affect the yield of Chinabond government securities, analyzes the five influencing factors, finds out the factors that have the biggest influence on the 1-year Chinabond government securities, and ranks the five factors.SPSS software is used to conduct an empirical analysis of the data from January 2014 to March 2018 by combining factor analysis and linear regression. Finally, it is found that the interest rate factor has the largest impact on the 1-year Chinabond government securities.In this paper, the five independent variables are ranked according to the degree of influence on the bond yield, and the results are as follows:Shibor> 7-day national interbank market bond pledged repo rate > 7-day national interbank lending rate >M2> Shanghai composite index.And the five influencing factors have the same direction of influence, all of which are positive.

In addition to 1-year Chinabond government securities, this paper also studies the yields of 3-year, 5-year, 7-year, 10-year and 30-year Chinabond government securities. Finally, it is found that Shibor has a great influence on most of the yields of Chinabond government securities.

The degree and direction of influence are not exactly the same.The yield of Chinabond government securities with different maturities is affected by different factors in different degrees and directions.In other words, Chinabond government securities are correlated with their maturities.

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