

Research on the Influencing Factors Affecting Bond Yield

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Abstract. With the appearance of more and more financial products, the significance of learning how to invest is widely known by the public. This paper aims to find the factors affecting bond yield, which is the rate of profit consumers can gain in the bond trading. In order to find the exact proportion between variables, multiple linear regression is used to create the relation equation. By creating a regression coefficient table and analysing the significance, the impact of interest rate and inflation rate on the bond yield is shown. Based on professional literature from scholarly journals, this paper found that the interest rate is directly proportional to the bond yield. In contrast, the inflation rate does not have an impact on bond yield. However, there still exist limitations in this paper, such as the lack of samples. Nevertheless, it reveals the phenomenon in some literature that their conclusions are overidealized and lack of data support. In addition, this paper also gives some insights for the public of investment strategies.

Keywords: Interest rate; inflation rate; bond yield; multiple linear regression.

1. Introduction

In modern society, more and more individuals and firms choose to use investment to make money. As a prevalent financial product, bond is widely accepted by the public. When corporations and government develop their business or invest in profitable projects, a large amount of money is usually sorely required. As a result, many of them intend to issue bonds, a fixed-income instrument and investment product, to the public [1]. The debt holders need to repay the interest as well as the original face value [2]. Hence, bond investors are able to gain profits in the bond trading. In order to analyse the change in bond price, different factors are going to be investigated in this paper. Linear regression is used as the methodology to figure out the precise relationship.

As a significant investment product, bond is always paid a lot of attention. Fernando introduced the basic concepts of bonds, including their definition, operation, and characteristics [3]. To understand the value of bonds, Lioudis introduced bond yield, which is the discount rate of cash flows. Additionally, Lioudis listed three factors that affect it: interest rates, inflation rates, and credit ratings [3]. Among them, interest rates and inflation rates are directly proportional to the bond yield, while credit ratings are inversely proportional to the bond yield [4]. To make the theory more specific, real-world examples are provided, including inflation rate, interest rate, and bond yield. The line chart of the inflation rate in US keeps fluctuating. The inflation rate in UK and China fluctuation as well [4]. The interest rates in the US and the UK continue increasing, while the interest rate in China remains decreasing [5]. By observing the bond yield in the US, the UK and UK, it is apparent that the trend of the curve is quite similar to the curve of interest rate, while its relationship to the inflation rate is not clear.

In order to reveal the relationship more directly, linear regression is contained when illustrating graphs. Wang and Li discussed the similarities and differences between simple linear regression and multiple linear regression, including the number of independent variables, complexity, use cases, and so on [6]. Next, Su et al. did the calculations of linear regression to illustrate the operations and includes model specification, least squares estimation, statistical inference, model selection, model diagnostics, and model deployment or prediction [7]. It provided a solid theoretical foundation for this research. As for the benefits and limitations multiple linear regression has comparing to simple linear regression, Bevans discussed them in her paper [8]. When analysing regression coefficient tables, Bobbitt introduced how to read regression coefficients and tell the conditions of whether the significance of data is shown in comprehensible words [9, 10].

To sum up, there existed quite a large amount of paper research on factors affecting bond price. This paper will use linear regression to structure the model of the relationship between different factors and bond prices as well as bond yield.

2. Methods

2.1. Data Source

The data used in this paper comes from Trading Economics website. This paper covers the inflation rate, interest rate, and bond yield from every January over the last ten years. In addition, SPSSAU is used to help with analysing data and creating regression coefficient tables.

2.2. Variable Selection

There are many factors that can affect bond yield. However, in order to create a multiple linear regression formula, factors that are not data-based cannot be used in analysis, such as credit ratings. Apart from that, data on some factors changes frequently or independently, like par value and maturity. They are excluded from the variable list as well. As a result, inflation rate and interest rate are chosen as independent variables because of their universality and accuracy. Their changing curves are also intuitive for researchers to compare with the curve of bond yield, and the relationship can be shown clearly. Here is a list of variables used in this paper and their symbols (Table 1):

Table 1. Variables selected

Variable	Logogram	Meaning
Inflation Rate	x_1	Inflation rate of every January over the last ten years
Interest Rate	x_2	Interest rate of every January over the last ten years
Bond yield	x_3	Bond yield of every January over the last ten years

2.3. Method Introduction

In this paper, multiple linear regression is used to analyse the relationship between bond yield and its several influencing factors. It is usually more comprehensive compared to simple linear regression, which only has one variable.

Multiple linear regression is able to interpret the influence of more than one variable. By illustrating the line of best fit representing the relationship between dependent and independent variables, multiple linear regression can help researchers to ascertain the extent of interactions between these variables.

3. Results and Discussion

3.1. Multiple Linear Regression

The bond yield is related to interest rate and inflation rate in different degree. This relationship can be represented by the equation of multiple linear regression,

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + e \quad (1)$$

where β_0 is a constant, β_1 , β_2 are regression coefficients, X_1 X_2 are independent variables, which are inflation rate and interest rate respectively, e is the model error. However, the conditions in different countries are not completely identical. As a result, US, UK and China are selected as the subject in this paper to make the findings more universal. The results of the research on US using multiple linear regression are listed in the table 2 below:

Table 2. Regression coefficient table of US

	Unstandardized Coefficients		Standardized Coefficients Beta	t	p	Collinearity Diagnostics	
	B	S.E.				VIF	Tolerance
Constant	1.63	0.224	-	7.281	0.000**	-	-
inflation rate	-0.001	0.06	-0.003	-0.02	0.985	1.097	0.912
interest rate	0.42	0.076	0.911	5.56	0.001**	1.097	0.912

From the above table 2, it can be seen that the inflation rate and interest rate are taken as independent variables, while the bond yield is taken as the dependent variable for linear regression analysis. Hence, the model formula can be written as

$$y = 1.63 - 0.001X_1 + 0.42X_2 \tag{2}$$

The regression coefficient value of inflation rate is -0.001 (t=-0.020, p=0.985>0.05), which means that inflation rate does not have an impact on bond yield. The regression coefficient value of interest rate is 0.420 (t=5.560, p=0.001<0.01), which means that interest rate has a significant positive impact on bond yield.

The results of the research on UK using multiple linear regression are listed in the table 3 below:

Table 3. Regression coefficient table of UK

	Unstandardized Coefficients		Standardized Coefficients Beta	t	p	Collinearity Diagnostics	
	B	S.E.				VIF	Tolerance
Constant	0.857	0.213	-	4.025	0.005**	-	-
inflation rate	0.052	0.063	0.14	0.819	0.44	1.492	0.67
interest rate	0.544	0.111	0.841	4.908	0.002**	1.492	0.67

Hence, the model formula can be written as:

$$y = 0.857 + 0.052X_1 + 0.544X_2 \tag{3}$$

The regression coefficient value of inflation rate is 0.052 (t = 0.819, p = 0.440 > 0.05), which means that inflation rate does not have an impact on bond yield. The regression coefficient value of interest rate is 0.544 (t = 4.908, p = 0.002 < 0.01), which means that interest rate has a significant positive impact on bond yield.

The results of the research on China using multiple linear regression are listed in the table 4 below:

Table 4. Regression coefficient table of China

	Unstandardized Coefficients		Standardized Coefficients Beta	t	p	Collinearity Diagnostics	
	B	S.E.				VIF	Tolerance
Constant	1.102	0.82	-	1.344	0.221	-	-
inflation rate	0.009	0.066	0.037	0.132	0.899	1.024	0.977
interest rate	0.488	0.198	0.683	2.468	0.043*	1.024	0.977

Hence, the model formula can be written as:

$$y = 1.102 + 0.009X_1 + 0.488X_2 \quad (4)$$

The regression coefficient value of inflation rate is 0.009 ($t = 0.132$, $p = 0.899 > 0.05$), which means that inflation rate does not have an impact on bond yield. The regression coefficient value of interest rate is 0.488 ($t = 2.468$, $p = 0.043 > 0.01$), which means that interest rate does not have an impact on bond yield.

3.2. Discussion

By observing the data from the US and UK, it is apparent that interest rate is approximately directly proportional to the bond yield, although the data from China reveals no relationship between them. One of the causes of the discrepancy between theory and data and the abnormality of data in China can be attributed to the data error. All of the data chosen are from every January over the last ten years. Thus, a large amount of data was ignored because of the limitation of data selection, which showed an inaccurate relationship. Hence, occasionality plays an important role in affecting the accuracy of outcomes.

The regression coefficients are usually between 0.4 and 0.6, which means on average, each additional percent of interest rate is associated with an increase of 0.4 to 0.6 percent in bond yield. However, the significance of the inflation rate is not exhibited (p is not smaller than 0.05 or 0.01) in the regression coefficient table from all three countries. Thus, a conclusion can be drawn that the inflation rate has no impact on bond yield in accordance with the dataset from US, UK, and China. Meanwhile, this outcome is against the theory support, because inflation can cause higher interest rates, and therefore increase the bond yield [2]. On one hand, this phenomenon shows the limitations of the research in this paper; The sample size can be expanded, such as every month over the last ten years; Also, the number of countries selected should be increased, although it would bring more work. On the other hand, the results also reveal the lack of data support in some literature, since they came to a conclusion by only analysing the theory instead of collecting actual data. Hence, this paper also brings insight for researchers about the possible improvement in their essays.

The aim of investigating the relationship between different factors and bond yield is to produce more information for the public about when and where should they buy the bonds as investments. They can predict future bond yield by observing the change in interest rates. Meanwhile, this paper also provides a piece of information that the inflation rate cannot be used as an indicator of bond yield, avoiding the appearance of related mistakes.

4. Conclusion

To sum up, this paper investigates the relationship between possible influencing factors and bond yield using multiple linear regression. The sample covers inflation rates, interest rates, and bond yields from 3 countries over the last ten years. According to the data from the regression coefficient table, the interest rate is directly proportional to the bond yield, while the inflation rate does not show its impact on the bond yield. Apart from that, the data from China shows that both interest rate and inflation rate have no relationship with bond yield. The reason leading to this situation is mainly because of the lack of enough data and simplistic analysis method. This model can be improved by expanding the sample size. This paper can provide more insights for the government and correlative researchers about the indicators of changing the bond yield and the existence of insufficient data support in the pertinent literature.

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