Research on the Investment Value of Bond Analysis based on Linear Regression Model

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Abstract. The research background of this paper is the linear regression analysis of bond market based on the study of econometrics. In order to achieve this goal, the author will conduct linear regression analysis through online bond fund data to determine the relationship between each data and ROE. The result of this study is the ratio of return on assets to individual data. The purpose of this study is to give consumers an advantage in choosing funds after analysis. To be able to know the relationship between the various data and then make a choice about the fund. Due to the quality differences of the bond funds, operation philosophy, team professional level and capital, the face of bond funds may encounter various risks in the process of investment. Investors should treat it seriously. Before investing risk, using various methods and means. The analysis of various risk investment can bring, finding the causes of risks, and then the principle of risk management and strategy. Use all kinds of skills and means to avoid risks, transfer risks, reduce risk losses, and strive to obtain the maximum profit.

Keywords: Linear regression; bond market; relationship.

1. Introduction

The purpose of this paper is to determine the investment direction of bond fund through linear regression analysis. Fund broadly refers to a certain amount of funds set up for a certain purpose. It seeks stable returns by pooling the funds of many investors and investing in bonds in a portfolio. Bond funds have developed into a significant class of securities investment funds with a size that is second only to stock funds as a result of the growth of the bond market. [1].

The income of bond fund comes from interest income, market fluctuation return, stock return. Compared with direct investment in bonds, bond funds have the advantages of low risk, expert management and strong liquidity, and are well received by investors [2]. At present, there are 2,777 bond funds in China. Bond funds now make up a significant portion of most people's asset allocation plans. Through judicious asset allocation, investors can achieve the goals of distributing investment risks and balancing investment returns over various investment horizons. The fund mentioned in this paper mainly refers to the securities investment fund. There are many different types of funds, such as equity funds, mixed funds and so on. The research object of this paper is bond fund. Bond funds, also known as debt funds, are collective investment vehicles that invest mostly in bonds (government, municipal, corporate, convertible bonds) and other debt assets including mortgage-backed securities (MBS). Based on how a fund trading style reacts to signals of huge dealer inventories, this article distinguishes fund trading styles. [3]. It's important to classify the factors. Because it makes the research more meaningful.

The main goal of bond funds is usually to generate monthly income for investors. From the perspective of investors, this paper uses the method of combination of philosophy and empirical analysis to test the final yield of 15 indicators in different bond funds. In order to complete this paper, I looked up some articles on bond funds. People in the article use the liquidity of stock and bond markets is studied using vector autoregressive models, and it is pointed out that volatility and liquidity of the two markets are significantly correlated, which means that liquidity and volatility of both stock and bond markets are driven by large number of factors together [4]. Through the article, I learned about the classification of funds and the correlation between management costs and returns and most of the time you only have one non-variable (Y) but many different variables(X).

A scalar answer and one or more explanatory factors, usually referred to as dependent and independent variables in statistics, are modeled using the linear method of regression. Simple linear regression is the situation where there is only one explanatory factor.[5]. For multiple, the process is called multiple linear regression. In this paper, the author explores the relationship between multiple variables and a single invariant y value. So, the analysis here is multiple linear regression. The first regression analysis that calls for in-depth study and is frequently employed in real-world settings is linear regression [6]. This is because it is simpler to fit a model with unknown parameters that rely linearly than one with unknown parameters that depend non-linearly, and because it is also simpler to assess the statistical features of the resulting estimate. The influence link between X (quantitative or categorical) and Y is investigated using regression analysis (quantitative). Existing relationships between influences, their magnitude, and their direction.

Thousands of variables have been pro- posed to explain or describe the compels variety and interconnections of social and international relations. Same for the bond market, in order to complete this paper, there needs a lot of data on bond funds. Diverse data can make data more objective and more reliable [7]. Look online for factors that may affect fund changes. This paper selects the initial samples from the bond funds listed in 2020-2021 and divides them into several groups according to the situation of profit and loss, listing time and other aspects. Finally, 30 bond funds listed in China are selected as the final object, and a total of 450 samples are collected, which are divided into profit fund, loss fund, new fund and old fund in the current year [8]. Look online for factors that may affect fund changes. Then all the data are unified into Excel and uploaded to the analysis software for analysis. So, people had to look for all sorts of variables that might affect the stock. Seasonal change, Net asset value, Turnover rate, Asset liability ratio, net profit margin on sales, Income accounted ratio for stock, Last Season Change rate, Income accounted ratio for bond, and Income accounted ratio for dividend. All these data could find on the internet [9]. A fund may have at least hundred pieces of data. Do all the data presented relate to the changes in the fund and the risk of the investment? The answer is clearly no. According to the evidence in the article above, Writer analyzes a case, or something, from 147 random pieces of data, compared with a filtered set of 40 factors, which may be relatively few, but the factors with smaller errors and more connections provide better data. So according to these data and result of the analysis. The chart made by these data will show which fund seems better for invest. These variables are chosen because most empirical macroeconomic analyses are based on a few variables. And these are the variables that the authors screened for that might affect equity ratio. Graphs and tables are also a large part of the study. The figures and tables obtained after data analysis can show the research results to readers more clearly. For example, the relationship graph that each factor's effect on the y value. So, some of the data will be strongly related to the dependent variable, but some of the data will not be.

2. Methodology

Empirical findings demonstrate that diverse fractal patterns are evident in the cross-correlations between the markets at various time scales.

2.1 Data Source

Data were got from the Tiantian Jijin and was analyzed by the SPSS software. These 30 data are selected from the daily fund bond type plate in the list of daily funds. 15 different variables were chosen. Some of the 15 factors can be directly found in the fund analysis. There are some numbers that need to be answered by proper calculation. Such as:

Asset liability ratio= total liabilities/total assets. net profit margin on sales= net profit/total revenue. Return on equity is a measure of return.

Return on equity = net return on total assets × equity multiplier = Operating net profit margin × total asset turnover ratio × equity coefficient = (net profit ÷ main business income) × (main business income ÷ average total assets) × (1+ liabilities ÷ owner's equity).

Net profit = Operating income - costs and expenses + other profit - Income tax.

Average total assets = current assets + non-current assets.

2.2 Methods

Through linear regression analysis, it is found out how much the changes of 15 variables will affect the return on equity. What is the correlation factor between them? Regression analysis is used to examine the relationship between X (quantitative or categorical) and Y (quantitative), including the direction and strength of the association;

To start, examine model fitting, which entails analyzing the model fitting by R square value and the VIF value to see if the model had collinearity issues.

Next, jot out the sample formula.

Third, examine X's importance. If the result is significant (p 0.05 or 0.01), it demonstrates that X has an impact on Y, and the impact's direction is then carefully examined.

Fourth: This study compares and evaluates the regression coefficient B value along with the degree of X's influence on Y (optional);

Fifth, provide an analysis summary.

Examine the importance of X. Significant results (p value 0.05 or 0.01) indicate that X has an impact on Y. If the p value is bigger than 0.05 or 0.01, it indicates that the relationship between X and Y is not significant. Only after completing all these tasks and steps can we make a complete and effective multiple linear regression analysis.

3. Results and Discussion

3.1 Model Results

According to the Table 1, return on equity was used in the linear regression analysis as the dependent variable. The R^2 =0.998. Adjusted R^2 =0.995, F (15,11) =366.111, p=0.000.

The model's R square value is 0.998, which indicates that the combined effects of all variables can account for 99.8% of the change in return on equity. The model was determined to have passed the F-test (F=366.111, p=0.000–0.05), showing that at least one of all the variables have effect on return on equity. Additionally, it is discovered that the VIF value in the model is greater than 10, which indicates that there is a collinearity issue, in accordance with the multicollinearity test of the model. Seasonal change rate's regression coefficient was 0.204(t=3.358, p=0.006), indicating that it will significantly improve return on equity.

The formula can write as:

Return on equity=0.001 + 0.204*Season change rate + 0.0001*Net asset value-0.008*Turnover rate-0.012*Asset liability ratio-0.009*net profit margin on sales + 0.011*Income accounted ratio for stock + 0.111*Last Season Change rate + 0.006*Income accounted ratio for bond + 0.006*Income accounted ratio for dividend-0.000*Growth rate of sales revenue + 0.015*Growth rate of capital-0.014*Growth rate of total assets + 1.090*Rate of return on total assets + 0.100*equity ratio-0.000*number of times interest earned.

Then find out the variables that have effect on the the dependent variable. Seasonal change rate's regression coefficient was 0.204 (t=3.358, p=0.006), indicating that it will have a highly favorable effect on return on equity. The Turnover rate would have a significant negative impact on return on equity, according to the Turnover rate regression coefficient of -0.008 (t=-2.211, p=0.049). The rate of return on total assets' regression coefficient value was 1.090 (t=22.121, p=0.000), indicating that rate of return on total assets will significantly increase return on equity. The number of times interest was earned has a regression coefficient value of -0.000 (t=-3.286, p=0.007), which indicates that it significantly lowers return on equity.

Conclusion and analysis show that Season change rate and Rate of return on total assets will have a profoundly favorable effect on return on equity. And Turnover rate and number of times interest earned have significant negative influence on return on equity. But the Net asset value, Asset liability

ratio, net profit margin on sales, Income accounted ratio for stock, Last Season Change rate, Income accounted ratio for bond, Income accounted ratio for dividend, Growth rate of sales revenue, Growth rate of capital, Growth rate of total assets, equity ratio does not affect return on equity.

Table 1. Analysis result Parameter Estimates

	Unstandardized Coefficients		Standardized Coefficients	t	p
	B	S. E.	Beta		
Constant	0.001	0.012	-	0.067	0.948
Season change rate	0.204	0.061	0.139	3.358	0.006**
Net asset value	0	0.005	0.001	0.055	0.958
Turnover rate	-0.008	0.004	-0.053	-2.211	0.049*
Asset liability ratio	-0.012	0.076	-0.01	-0.157	0.878
net profit margin on sales	-0.009	0.013	-0.017	-0.709	0.493
Income accounted ratio for stock	0.011	0.006	0.039	1.812	0.097
Last Season Change rate	0.111	0.073	0.052	1.506	0.16
Income accounted ratio for bond	0.006	0.008	0.021	0.821	0.429
Income accounted ratio for dividend	0.006	0.01	0.013	0.62	0.548
Growth rate of sales revenue	0	0	-0.002	-0.088	0.932
Growth rate of capital	0.015	0.009	1.45	1.708	0.116
Growth rate of total assets	-0.014	0.008	-1.451	-1.7	0.117
Rate of return on total assets	1.09	0.049	0.981	22.121	0.000**
equity ratio	0.1	0.07	0.111	1.433	0.18
number of times interest earned	0	0	-0.128	-3.286	0.007**

Table 2 shows that the model passes the F-test, indicating that it was constructed meaningfully (F=366.111, p=0.000).

Table 2. AVOVA test results

	Sum of Squares	df	Mean Square	F	p value
Regression	0.181	15	0.012	366.111	0
Residual	0	11	0		
Total	0.181	26			

3.2 Data Source Discussion

According to the analyzed result, we can better help consumers choose more advantageous funds. Through observation, this paper found that Season change rate and Rate of return on total assets will have a highly favorable effect on return on equity. Turnover rate and number of times interest earned have significant negative influence on return on equity. If Season change rate and Rate of return on total assets become bigger, the return on equity will become bigger. If Turnover rate and number of times interest earned become bigger, the return on equity will become smaller. So, when choosing an investment fund. One can compare these values between funds to determine which fund to choose. But how do you choose when there are exact the same numbers or when different funds have different strengths in these numbers? This implies that the size of the regression coefficients can be used to evaluate the impact of independent variables on dependent variables. For example, the regression coefficient of Season change rate was 0.204 and the Turnover rate was -0.008. Then the Season change rate will have a greater impact on return in equity. Therefore, when one fund has more advantages in Season change rate and the other fund has more advantages in turnover rate, people should choose the fund with more advantages in season change rate. Here is an example on the data, as Table 3 shows.

Table 3. Example of the reasons

Season Change rate	Turnover rate	Rate of return on total assets	number of times interest earned
7.62%	122.22%	22.00%	165.23
6.13%	157.63%	18.31%	43.04

4. Conclusion

During the research, the following inspirations are obtained: The Rate of return on total assets will have the largest influence on return on equity. The first fund looks like it's worth more. Let's look at the second most influential value Season change rate. The first one still get more advantage. Same to the value of number of times interest earned. So even if the second fund have more advantage on turnover rate. The first fund should still be the first choice. And the actual return on equity is 23% and 21%. The first fund get 2% higher than the second fund. Multilinear regression is the name given to regression models with one dependent variable and multiple independent variables. After a series of studies and verification, multiple linear regression analysis is indeed very effective and efficient in selecting the variables that be able to affect the dependent variable from these 15 variables. This can be very good to help consumers in the investment fund to obtain greater benefits or more accurate judgment. It's not just the variables that I've collected. There's a lot of data on a fund or a stock. Including different years may also have different data trends. So multiple linear regression analysis can help investors analyze whether there is a connection between data that may not appear to be there. Very good help investors to maximize profits. Of course, this approach is essentially a statistical model. So it can be used in other areas as well. It can also be useful in disciplines like medicine, law, and sociology that require the analysis of large data relationships.

Taking data availability into account, the data selected in this experiment are from historical net value, stage increase, income analysis table, the balance sheets and income statements of listed bond funds. According to the actual situation of the expanding scale of bond funds in China, the follow-up research considers the use of case studies and questionnaires for in-depth analysis, and fully explores the new method of bond fund investment selection in the context of China, so as to make the research conclusion more convincing.

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