An Empirical Research on Influencing Factors of Stock Returns in the National Defense and Military Industry

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Abstract. The Chinese stock market has made remarkable strides after about 30 years of growth and development. Increasing levels of public involvement in the stock market contributed greatly to the growth of the nation's economy. As the majority of investors' financial knowledge continue to increase, people pay more and more attention to the stock return and its influencing factors. This paper chooses stock from 71 listed companies in the National Defense and Military sector of Shenyin Wanguo's primary industry as study object, constructing a multiple linear regression model for the company financial index and the stock return from 01/01/2021 to 31/12/2021, and performing F-test and T-test. Results show that Revenue Growth rate, Return on Equity, natural logarithm of Total Assets and Debt to Asset ratio will not impact the stock yield while Price-to-Earnings ratio have significant negative influence on it. Final investment decisions can be made by investors based on the interplay of the stock market, macroeconomic environment, and current circumstances.

Keywords: Stock Return; National Defense and Military; Multiple Linear Regression.

1. Introduction

China's stock market has achieved incredible progress after nearly 30 years of expansion and development. It has steadily grown to be a crucial tool for business finance, as well as household and corporate investment. Meanwhile, the participation of the whole society in the stock market was on the rise, which has significantly aided in fostering the expansion of the country's economy.

With the improvement of China's economic power and international standings, the development of national defense capability to match it has taken on more significance. The central government had released several pertinent planning documents since the beginning of the twenty-first century, providing clear instructions and in-depth talks on the growth of China's defense and military industries. All societal segments typically have high hopes for the reform of the military industry as a result of the ongoing progress of military-civilian integration, and investors have continued to pay attention to the stocks in the defense and military industry sector on the stock market [1].

It is of great importance to study the influencing factors of the stock returns of the national defense and military industry. From the perspective of enterprises, analyzing the variables that affect stock returns can assist companies in national defense and military industry in selecting the best financial management structure and model in accordance with reform initiatives and their own corporate strategies to achieve the objective of maximizing shareholders' equity. From investor's point of view, although risk and return go hand-in-hand, high risk means high rewards, investors always hope to achieve the greatest possible level of risk aversion and maximize investment returns. However, many individual investors lack expert knowledge, are susceptible to shifts in market mood, have a low tolerance for risk, and frequently fall short of their goals for returns. Therefore, being aware of these influencing elements can benefit in assisting investors in developing investment portfolios, lowering risks, increasing returns, and providing specific benchmarks for their investment selections.

Foreign study began earlier about stock returns, in other words, the pricing of assets. The capital asset pricing model (CAPM) is the most typical of early foreign analyzes of the variables influencing stock returns, although many of the model's presumptions cannot be realized in practice. Subsequently, Fama and French put forth a three-factor model, claiming that there were three factors could explain the stock return, namely the market risk, the size of firms, and book-to-market values. Companies with smaller caps and higher book-to-market ratios tend to generate higher returns on stock compare to other firms in the market [2]. The proposal of this model had attracted extensive

attention from academics, and soon emerged as a crucial reference for asset pricing research. Butt, Rehman, Khan and Safwan studied the effect of economic factors on stock return by constructing a multi-factor model, the data were selected from the Karachi Stock Exchange, from firms in banking and textile sectors [3]. Olweny and Omondi investigate the effect of macroeconomic factors such as foreign exchange rate and interest rate, on the stock return volatility on the Nairobi Securities Exchange, Kenya [4]. Olowoniyi and Ojenike selected panel data within 2000 to 2009 from 70 Nigeria listed firms, investigating the influencing factors of stock return in a panel econometric method [5]. Fama and French's five-factor model, which was based on the previous three-factor model, was expanded upon in 2015 with the addition of two additional factors: profitability and investment pattern [6].

As a result of the growth of the stock market and the maturation of investors' investing theories, the study on variables impacting stock returns has gradually shifted from single factor to multi-factor in recent years. Wang took 234 A shares, which has been included in the MSCI index system recently, as the research object, exploring the correlation between the return on equity (ROE), year-on-year revenue growth rate, asset size, leverage ratio, the quarterly CSI 300 Index and the stock quarterly return [7]. Xie conducted empirical research on the stock returns of 26 listed companies in the national defense and military industry. The results indicated that the return on equity and the revenue growth rate had a positive and significant impact on the stock return, whereas the growth rate of net increase in cash and cash equivalents, ownership concentration and trading volume have a negative and significant impact on stock returns [1]. You selected 302 A-share listed companies in the pharmaceutical sector of the Chinese Securities Industry as the research object, establishing a multiple linear regression equation for the quarterly company financial data and stock returns from the first quarter of 2015 to the first quarter of 2018, and conducts F-test and T-test [8]. Ma focused on the impact of macroeconomic factors such as China's Gross Domestic Product (GDP) from 1996 to 2015, the exchange rate of US dollar against RMB, and government fiscal expenditure on stock returns by constructing a multiple regression model, concluding that government fiscal spending, broad money supply, and China's GDP are highly correlated with stock returns, while other factors are excluded since they failed the t-test and significance test [9]. Chen, Chen studied the impact of the COVID-19 epidemic on the stock returns and financial performance of listed companies in the aquatic products industry, concluding that the epidemic had significantly adversely affected the stock returns [10].

2. Methodology

2.1 Data Description

This paper used data from 71 listed companies in the National Defense and Military sector of Shenyin Wanguo's primary industry. The data were all gathered from CSMAR, also known as China Stock Market & Accounting Research Database, and the sample period is from 1.1 to 12.31 in 2019. The five influencing factors are revenue growth rate, return on equity, price-to-earnings ratio, total assets, debt to asset ratio respectively, which are all numerical variables.

2.2 Selected Variables

In this study, the predicted variable (dependent variable) is the stock return (denoted by Y), which is calculated as:

$$stock\ return\ = \frac{total\ cash\ dividend}{price\ of\ stock\ in\ the\ market} \tag{1}$$

According to the literature study and the core characteristics of the national defense and military industry, the explanatory variables (independent variable) selected in this paper are as follows:

Revenue Growth Rate (denoted by X_1): Calculated by subtracting first year revenue from the second year, divide it by the first-year revenue and multiply 100 to convert the figure to a percentage.

It offers a reliable indication of how rapidly your firm is expanding, or more specifically, how successfully a business may increase sales income over a specific time frame. Generally speaking, companies who demonstrated a rising tendency in their revenue growth rate are often in the growth stage. The revenue growth rate can be chosen as an indicator to show how the firm is doing in terms of growth. For high-tech industries such as the military and national defense industry, the company's development prospects are more vital to investors than its size.

Return on Equity (denoted by X_2): The percentage of the company's net income to average shareholder's equity. It is a profitability statistic that evaluates a company's capacity to make profits using the capital invested by shareholders. Analyzing ROE could reflect how effectively the business uses its fund, so as to have a preliminary estimate about the investment and profit of the company.

Price-to-Earnings Ratio (denoted by X_3): The PE ratio not only relates the price of stock to the earnings per share, but also connects the ability of firms to make profits with the share price. Meanwhile it reflects the investors' confidence in the company's future prospects: higher ratio indicates that investors are more optimistic about the development of the enterprise.

Total Assets (denoted by X_4): This indicator is used to measure the overall size of the firm, and therefore investors can have a rough idea about the phases of growth of various businesses. The larger the asset size, the more funds available for distribution.

Debt to Asset ratio (denoted by X_5): This ratio is the percentage of a company's total debt to its total assets. It could show the business asset structure and measure the long-term debt-paying ability of the enterprise.

Table 1 shows the summary of five explanatory variables with their forms of expression respectively, and the corresponding ability of companies that can be reflected by these metrics.

Table 1. Summary of explanatory variables

Explanatory Variables	Form of expression	Indicator
Revenue Growth Rate	X_1	Growth ability
Return on Equity	X_2	Profitability
Price-to-Earnings ratio	X_3	Profitability
Total Assets	X_4	Size
Debt to Asset ratio	X_5	Debt-paying ability

2.3 Model Establishment

The multiple linear regression model is the model established in this study. This model uses a straight line to evaluate the connection between a predicted variable and two or more independent quantities. The multiple linear regression equation takes the following form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 \ln X_4 + \beta_5 X_5 + \epsilon \quad (2)$$

where Y is the dependent variable, X_1, X_2...X_5 are independent variables, β_0 is a constant term (the y-intercept), β_1, β_2...β_5 are regression coefficients, and ϵ is the model's error term, also referred to as the residuals. The purpose of taking natural logarithm of X_4 is to simplify extremely large data and reduce the skewness of original data.

3. Results and Discussion

Firstly, this paper does descriptive analysis of the five influencing factors using SPSSAU (Statistical Product and Service Software Automatically) in order to summarize the uninterpreted data set and gain deep insight into it. From the Table 2. below, it can be noticed that the maximum values of Revenue Growth rate, Price-to-Earnings ratio and Debt to Asset ratio exceed their mean by three standard deviations, indicating that the data fluctuate significantly and hence it is more suitable to use the median to describe the data level rather than using the mean. Meanwhile, the "normality" of a

distribution can also be roughly evaluated using the so called three-sigma rule. If there are a large number of data points are beyond the three standard deviation ranges, the distribution is likely not normal and may follow other distribution.

Table 2. Descriptive Analysis of five determinants

Determinants	Sample size	Minimum	Maximum	Mean	Standard Deviation	Median
X_1	71	-0.786	2.849	0.191	0.428	0.138
X_2	71	-0.774	0.286	0.064	0.123	0.069
X_3	71	8.11	362.56	106.612	73.753	87.64
$\ln(X_4)$	71	10.67	16.71	13.097	1.227	12.93
X_5	71	0.055	5.906	0.406	0.587	0.324

In a multiple linear regression model, the regression model estimation will be distorted if there is significant multicollinearity among variables. This exists when an independent variable is highly correlated with other independent quantities which may affect the accuracy of the regression coefficients. This study uses SPSSAU to analyze the correlation between the explanatory variables and the results are shown in Table 3.

Table 3. Spearman Correlation Results

	Mean	S.D.	X_1	X_2	X_3	$\ln X_4$	X_5
X_1	0.191	0.428	1				
X_2	0.064	0.123	0.458	1			
X_3	106.612	73.753	0.420	-0.042	1		
$\ln X_4$	13.097	1.227	0.109	0.11	0.031	1	
X_5	0.406	0.587	0.071	-0.077	0.106	0.525	1

From Table 3, there are low correlation (thus low relationship) between X1 and X2, X1 and X3, and lnX4 and X5, with correlation coefficients 0.458, 0.420 and 0.525 respectively. The three coefficients are all smaller than 0.8 which is acceptable when apply the model and analyze the findings. Meanwhile, all other coefficients are close to zero, indicating that there are no relationship between those variables. Therefore, a multiple linear regression model is a good fit. (VIF values in Table 4 further justifies the use of the model).

The following Table 4 gives results of the regression analysis. Since all five VIF values are less than 5, the model has no multicollinearity concerns and is correctly constructed. The R square value in the model is 0.248, which means revenue growth rate, return on equity, price-to-earnings ratio, natural logarithm of total assets and debt to asset ratio can explain 24.8% change in the stock return. The model passed the F-test ($F = 4.289$, $p = 0.002 < 0.05$), which suggests at least one quantities will have an impact on the stock yield.

Table 4. Linear Regression Result

	Unstandardized Coefficients		Standardized Coefficients	t	p	VIF	R^2
	B	Std.	Beta				
Constant	-0.199	0.506	-	-0.392	0.696	-	
X_1	-0.053	0.103	-0.067	-0.512	0.61	1.499	
X_2	0.583	0.63	0.116	0.926	0.358	1.348	0.248
X_3	-0.002	0.001	-0.433	-3.465	0.001**	1.352	
$\ln X_4$	0.06	0.042	0.216	1.422	0.16	1.996	
X_5	0.041	0.279	0.022	0.146	0.884	1.996	

The regression coefficient of X1 is -0.053 ($t = -0.512$, $p = 0.610 > 0.05$), which indicates that revenue growth rate does not affect the stock return; For X2, the coefficient is 0.583, with $t = 0.926$,

p = 0.358 > 0.05, suggesting return on equity does not impact the dividend yield; X3 has regression coefficient -0.002 and test statistics t = -3.465, p = 0.001 < 0.01. It implies that the stock yield would be significantly negatively impacted by the price-to-earnings ratio; According to the regression coefficient of lnX4 (0.060; t = 1.422, p = 0.160 > 0.05) , natural logarithm of total assets have no influence on the stock return; Finally, the regression coefficients of X5 is 0.041, with corresponding statistics t = 0.146 and p = 0.884 > 0.05, also fails the test. In conclusion, only the Price-to-Earnings Ratio will affect the stock return, while other four quantities have no impact on it. The relationship between stock return and five independent variables is established below:

$$Y = -0.199 - 0.053X_1 + 0.583X_2 - 0.002X_3 + 0.060 \ln X_4 + 0.041X_5 \quad (4)$$

Therefore, the predicted value of Y can be computed given the numerical values of X1 to X5. The difference between observed values and predicted values is called the residuals, they are also known as the realizations of the unobservable random error ϵ. A residual measures the accuracy of the estimation, i.e. how far the data point is vertically from the regression line. Analyzing the scatter plot of residuals can also help determine the fit of the model.

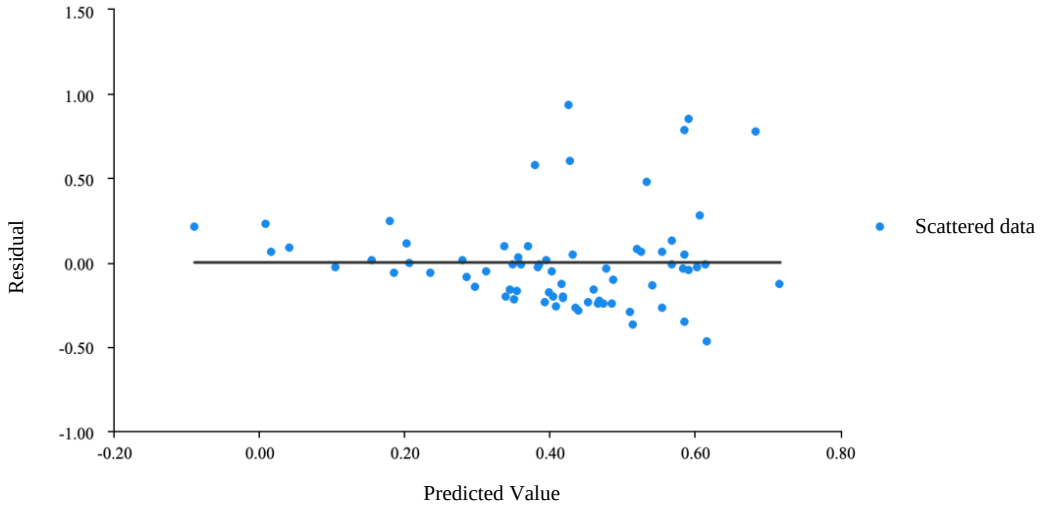

Fig. 1 Scatter plot of residuals

As shown in the Figure 1, the residuals are randomly distributed about the 0 line, there are no any clear patterns for the location of residuals. These evidences suggests that it is plausible to assume that the relationship is linear. However, it seems that the residuals have some large values that are dramatically deviate to the other data, these extreme values are known as outliers. A box plot is particularly useful in visualizing the spread of data and identifying values that are possible outliers. If a value x satisfies the following condition:

$$x \notin [q_{0.25} - 1.5 \times IQR, q_{0.75} + 1.5 \times IQR] \quad (5)$$

Where q0.25 denote the lower quartile, q0.75 represent the higher quartile and IQR is the interquartile range, computed as the difference between higher quartile and lower quartile, then x is considered as an outlier. The outliers are marked as circles in the box plot, always below or above the two whiskers.

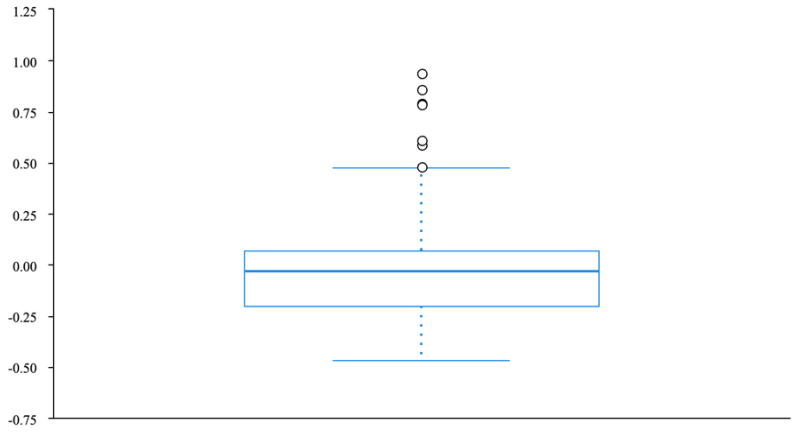

Fig. 2 Box plot of residuals

According to Figure 2, there are seven outliers identified around the value 0.50 to 1.00, while the other values are all between the top and bottom whiskers. Once identifying any outliers, the two whiskers show the smallest and largest values of data that are not outliers, in this case -0.50 and 0.50 respectively. The higher quartile is approximately 0.06, the lower quartile is approximately -0.20, and the median is approximately 0.

4. Conclusion

This paper selects stocks of 71 listed companies in the National Defense and Military industry as research object, choosing 5 potential determinants and taking natural logarithm of Total Assets, whose numerical values are large, in order to make the results more reliable. The study found that the Revenue Growth Rate, Return on Equity, natural logarithm of Total Assets and Debt to Asset ratio have no effect on the Stock Return, because they fail the t-test and the significance test, while the Price-to-Earnings ratio has significant negative impact on it. On the other hand, although the findings are more specific to the National Defense and Military industry, it also offers a guideline approach for evaluating the stock return in other industries.

In the research process, this paper only considers influencing factors related to the companies and therefore ignores the macro factors such as policies and unexpected events like war, which may lead to the discrepancy between the results and the stock market situation in reality. As the capital market is keep developing, investors should not only consider the macroeconomic factors, but also pay close attention to information such as the values of relevant indicators and the recent stock transactions declared by the firm, so as to achieve rational investment.

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