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Linear Regression Analysis of Stock Price Dynamics in China's Alcohol Industry

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Abstract:

This paper investigates the stock price dynamics of China's alcohol industry, with a particular focus on Maotai's stock performance during the COVID-19 pandemic. The multiple linear regression models to analyze 441 groups of data from 2018 to 2024 show the impact of six economic factors-National Housing Prosperity Index, Retail Sales of Consumer Goods, Insurance Asset Management Registration Size, Public Finance Revenue, Consumer Price Index (CPI), and Keqiang's Index-on Maotai's earnings per share (EPS). The results indicate a strong positive correlation between the National Housing Prosperity Index and EPS. A key finding was the pandemic-induced shift in consumer behavior, favoring stable investments in high-end liquor like Maotai over real estate. Maotai's role as a status symbol in Chinese society also increased demand, further driving its stock price growth. Overall, these predictions provide valuable guidance for investors seeking to understand market shifts in the alcohol industry and underscore the relevance of macroeconomic indicators in stock performance analysis.

Keywords: National housing prosperity index; Maotai's stock prices; linear regression; COVID-19 impact.

1. Introduction

As people all know, a company's share price is usually affected by several factors. From the perspective of the international situation, the world now is in a situation of significant change unprecedented in a century to study the stock prices of different companies such as securities and finance, biomedical, daily necessities, automotive, and military companies. The discussion about the correlation between their regional stock prices is widespread in society. People also hypothesize that the factors for this relationship are two different scenarios of strong correlation and weak correlation between the factors and the prices of the stocks. In addition, the reasons for the differences between the two companies include industry characteristics and macroeconomic indicators. Also, whether the relationship remains constant or changes during a given economic cycle, economists and mathematicians often use linear regression models to summarize or predict the relationship.

The prices of stocks for China's alcohol industry must be influenced directly or indirectly by COVID-19. Lu pointed out that a sector-wide structural change in stock market performance did occur during the epi-

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demic [1]. Duan stated that consumer spending trends and people influencing prices in China's alcohol industry tend to consume more alcohol products during periods of mood swings [2]. Because of COVID-19, there has been an escalation in mass consumption. With the rise of the middle class, consumer demand for high-end liquor has increased, which has helped boost sales and company valuation. Li proposed that the global spread of COVID-19 negatively influenced global economic activity, and China's real estate sector has inevitably been affected [3]. Since the decline of the states in China, people who need a house cannot afford a home, and house investors are losing confidence. As a relatively stable asset investment, wine investment will be more attractive to the masses speaking of capital investment; thus, it began to invest in Maotai to avoid risk. It will lead to a decline in the housing index and a rise in Maotai's earnings per share.

The purpose of this research study is to use data on two random variables that may be correlated. Wang's team stated that simple correlation and regression analyses are used to determine if a relationship exists between two variables [4]. Pashankar et al. believed that it was better to use linear regression to analyze stock prices [5]. The stock return of a company and the index of the region in which the company is located are performed by a linear regression analysis of these two variables. Based on Tao's research, analyzing the regression and model results using various models showed that the multiple linear regression model has higher accuracy and lower mean square error than long short-term memory and random forest regression [6]. Because of the project's primary purpose, finding the correlation between the factors and the stock prices is essential. Like Liang, he used linear regression to focus on the CPI, interest rates, and other influences [7]. Liang used the Maotai as a particular case of industry to analyze. Bai analyzes Maotai's profitability in terms of financial indicators, operating results, and market environment [8]. The stock will relate to the total Retail Sales of Consumer Goods, National Housing Prosperity Index, Insurance Asset Management Registration Size, Public Finance Revenue, CPI, and Keqiang's Index. It shows that there is a strong relativity between real estate and EPS. Umoro et al. pointed out that there is a fundamental short-run relationship between stock market prices and the depreciation of monetary items [9]. People prefer then to spend money on more stable Maotai purchase investments. Victor, Razali, and Ali pointed out that COVID-19 reduced consumer spending and lowered demand for all real estate types [10]. Thus, people prefer spending money on more stable Maotai purchase investments.

In conclusion, the study has attracted many scholars. This paper will analyze and explain the growth of Maotai's stock price mainly using a linear regression model and make valuable suggestions for future consumers and investors based on the results.

2. Methods

2.1 Data Source

The dataset used in this paper is fetched from the Wind application about stock prices in China. It covers the period from 2018 to 2024. Since the dataset during this period was too large, the paper chose 441 data groups as the samples to analyze. The raw dataset is in CSV Format.

2.2 Variable Selection

Since the raw dataset includes a vast amount of data, there are many nulls for variables such as the total retail sales of consumer goods, the national housing prosperity index, and some wrong values for Keqiang's Index. Though the period for the datasets covered is too long, it randomly selected 441 data groups as the sampling data to analyze. The data contains seven variables: the total Retail Sales of Consumer Goods, the National Housing Prosperity Index, Insurance Asset Management Registration Size, Public Finance Revenue, CPI, Keqiang's Index, and the EPS. The specific of the variables are shown in the table1 below:

Table 1. List of Variables

Variable	Symbols	Meaning
Real states	x_1	National Housing Prosperity Index
Retail Sales	x_2	The total Retail Sales of Consumer Goods
Insurance Size	x_3	Insurance Asset Management Registration Size
Finance revenue	x_4	Public Finance Revenue
CPI	x_5	Consumer Price Index
Keqiang's Index	x_6	Keqiang's Index

EPS	x_7	Earnings per share for the company

2.3 Method Introduction

In the project, linear regression is a good tool for comparing and finding which factor is essential for the increase and decrease of the company's and the market's stocks. This paper mainly aimed to compare the two main models and the accuracy of the results. Eventually, it will enable the optimized processing of models. The relationship between different variables will also be discussed below.

The paper used a multiple regression model with the company's stock price as the dependent variable and the regional stock price and other possible influencing factors (e.g., industry, economic indicators) as independent variables. The regression results were used to analyze the significance and influence of each factor. Using Python, R, and other software, it was convenient to integrate the data to draw the corresponding linear regression graphs and analyze them with a comparison slope between the independent variables and dependent variables.

2.4 Formula and Models

In the project, linear regression is a good tool for comparing and finding which factor is essential for increasing and decreasing the company's and market stocks. Linear regression is widely used in areas such as predictive analytics, trend analysis, and data modeling. It is a standard statistical analysis and machine learning method used to analyze the linear relationship between two or more variables. Its main goal is to find an optimal linear equation describing the relationship between the independent and dependent variables.

$$y = \beta_0 + \beta_1 x_1 + ?_0 \quad (1)$$

β_0 is the intercept, which indicates the predicted value of the dependent variable when all independent variables are zero. β_1 are the regression coefficients of the respective variables, representing the contribution of each independent variable to the dependent variable. x_1 is the dependent variable, which is the input variable. $?_0$ is the error term, which is used to capture the part of the model that cannot be explained.

3. Results and Discussion

3.1 Multiple Linear Regression

The analysis in this paper shows there are six factors relative to the share for the Maotai Company. The graph shows below:

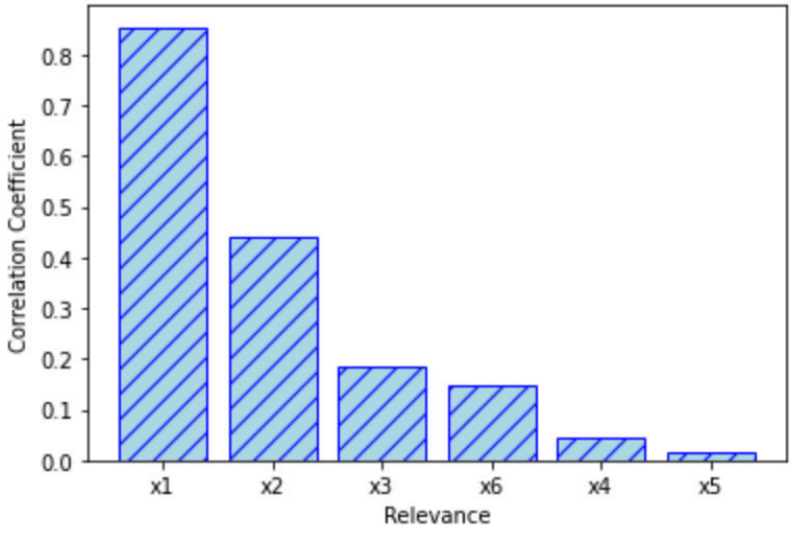

Fig. 1 Relevance Analysis Between Dependent and Independent Variables

Figure 1 shows the correlation coefficient between the six factors and the EPS. The research data about the National Housing Prosperity Index, the total retail sales of consumer goods, insurance asset management registration size, public finance revenue, and consumer price index showed a positive relationship between them and the company's share. In addition, the National Housing Prosperity Index will influence the EPS the most since there is a strong positive relationship between the actual states and EPS. The total Retail Sales of Consumer Goods, Insurance As-

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set Management Registration Size, Public Finance Revenue, and Consumer Price Index are also positively relative to the EPS. However, the correlation for the elements is small; they will not be a significant factor in the change in the share of Maotai company. Interestingly, there is no negative coefficient, and several factors are all relative to the influence of Maotai's company's share prices.

In conclusion, the factors that influenced the share are comprehensive. Analyzing the correlation between the shares of Maotai's company and several factors can help people surmise how to increase the share prices in the future. Then, by the prediction, it can reduce unnecessary investment and dilapidation. By the formula (1) introduced above, this paper can conclude Table 2 to summarize all the coefficients for the linear regression below:

Table 2. Regression coefficient table

constant	β	β_0	R^2
x1	-2.9343	327.64	0.8539
x2	0.0019	-27.692	0.4422
x3	0.0084	27.642	0.183
x4	0.0007	27.072	0.0457
x5	-2.7319	39.193	0.0158
x6	-1.3854	50.335	0.1468

Table 2 shows the regression coefficients of the multiple linear regression equation model. The six independent variables have a significant impact on the dependent Y. From the data above in the table, the relevant multiple linear regression equation can be shown as:

$$E(y) = -2.9343x_1 + 0.0019x_2 + 0.0084x_3 + 0.0007x_4 - 2.7319x_5 - 1.3854x_6 \quad (2)$$

The coefficient R-squared for the multiple linear regression is 0.9918. That states this is a good fit. The data from Table 2 are a normally straight line, which makes it easy to build a plot about the multiple linear regression equation shown in Figure 2.

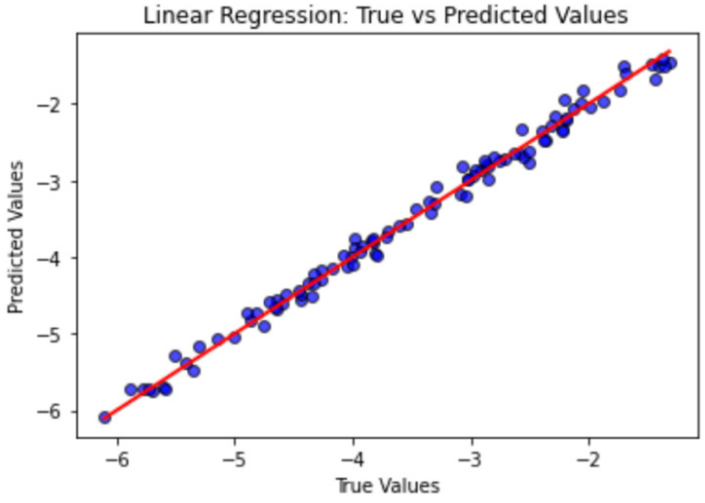

Fig. 2 Normalized plots of the multiple linear regression for standardized residuals

3.2 Case for Strong Relationship

The data in Table 2 shows that the coefficient R-squared for the actual states on EPS is 0.8539, which is much closer to 1. To conclude, the equation for data for the National Housing Prosperity Index and Earnings per share for the company will be shown below:

$$y = -2.9343x + 327.64 \quad (3)$$

Where x represents the national housing prosperity index, and y is the value for EPS. Moreover, to make the equation more direct to understand, the plot of the linear

regression for real states in Figure 3 will be shown below:

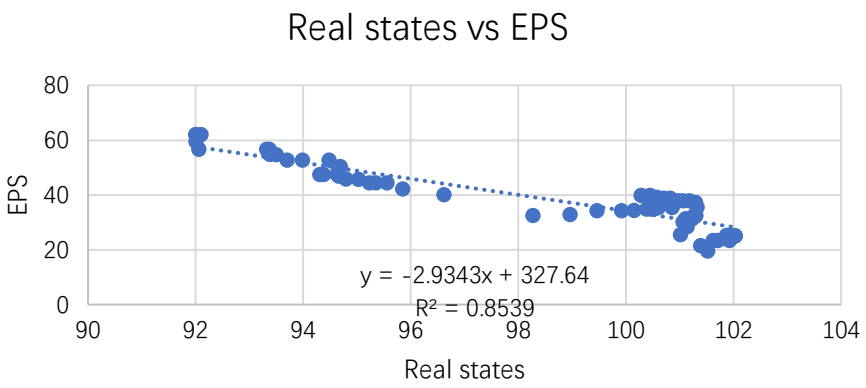

Fig. 3 The plot of the linear regression for real states vs EPS

Figure 3 shows an analytical graph of the housing index and Maotai's earnings per share. As the China Housing Index increases, Maotai's share price decreases.

3.3 Cases for Weak Relationship

Similarly, it shows that the coefficient R-squared for the real states on EPS is 0.4422. To conclude, the equation for data for the total Retail Sales of Consumer Goods and Earnings per share for the company will be shown below:

$$y = 0.0019x - 27.692 \quad (4)$$

Where x represents the total retail sales of consumer goods, and y represents the value of EPS. Moreover, to make the equation more direct to understand, the plot of the linear regression for real states in Figure 4 will be shown below:

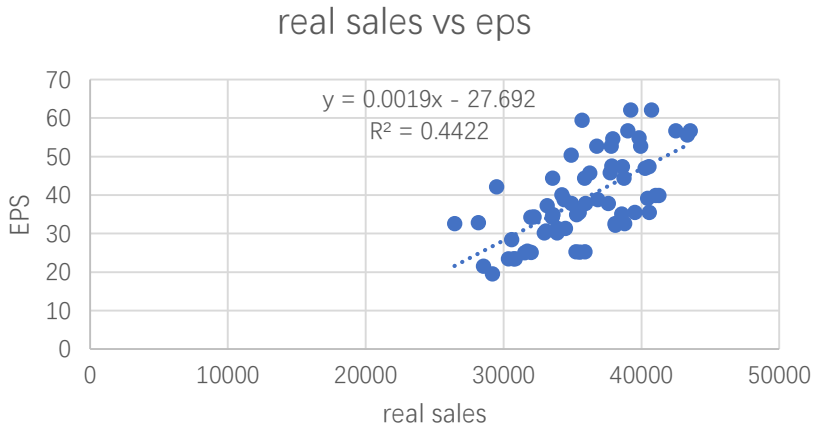

Fig. 4 the plot of the linear regression for real sales vs EPS

Figure 4 shows an analytical graph of real sales and Maotai's earnings per share. In addition, as real sales increase, share prices increase.

The coefficient R-squared for the insurance size on EPS is 0.183. To conclude, the equation for data for the insurance Asset Management Registration Size and Earnings per share for the company will be shown below:

$$y = 0.0084x + 27.642 \quad (5)$$

Where x represents the insurance Asset Management Registration Size and y represents EPS values. Moreover, to make the equation more direct to understand, the plot of the linear regression for real states in Figure 5 will be shown below:

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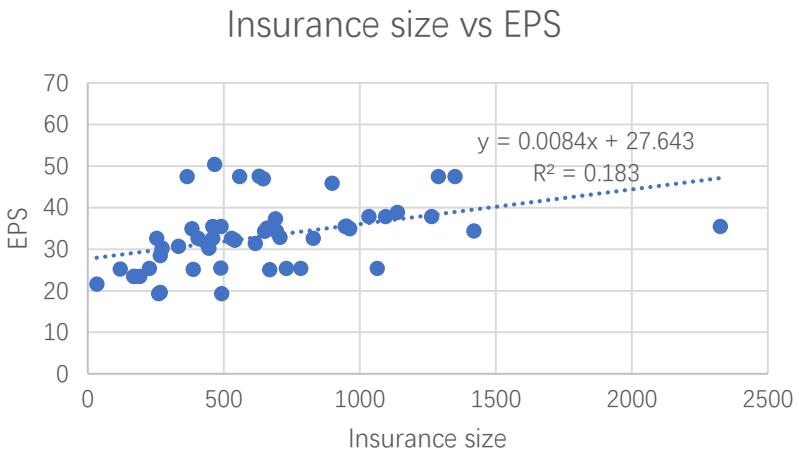

Fig. 5 the plot of the linear regression for real sales vs EPS

It shows an analytical graph of the insurance size and Maotai's earnings per share. In addition, as insurance size increases, the share prices increase in Figure 5. The coefficient R-squared for the finance revenue on EPS is 0.0457. To conclude, the equation for data for the Public Finance Revenue and Earnings per share for the company will be shown below:

$$y = 0.0007x + 27.072 \quad (6)$$

Where x represents the Public Finance Revenue and y is the values for EPS. Moreover, the plot of the linear regression for real states in Figure 6 will show below:

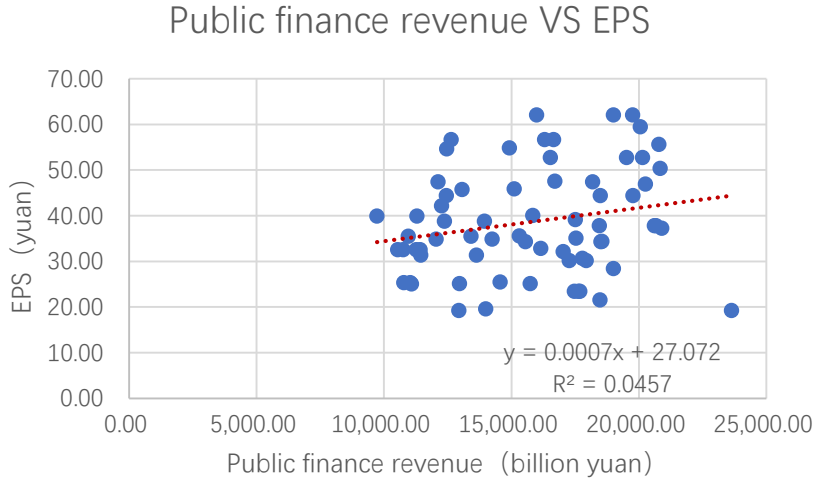

Fig. 6 the plot of the linear regression for finance revenue vs EPS

Figure 6 shows an analytical graph of finance revenue and Maotai's earnings per share. In addition, as finance revenue increases, share prices increase. The coefficient R-squared for CPI on EPS is 0.0158. To conclude, the equation for data for the Consumer Price Index and Earnings per share for the company will be shown below:

$$y = -2.7319x + 39.193 \quad (7)$$

Where x represents the Consumer Price Index, and y is the value for EPS. Moreover, to make the equation more direct to understand, the plot of the linear regression for real states in Figure 7 will be shown below:

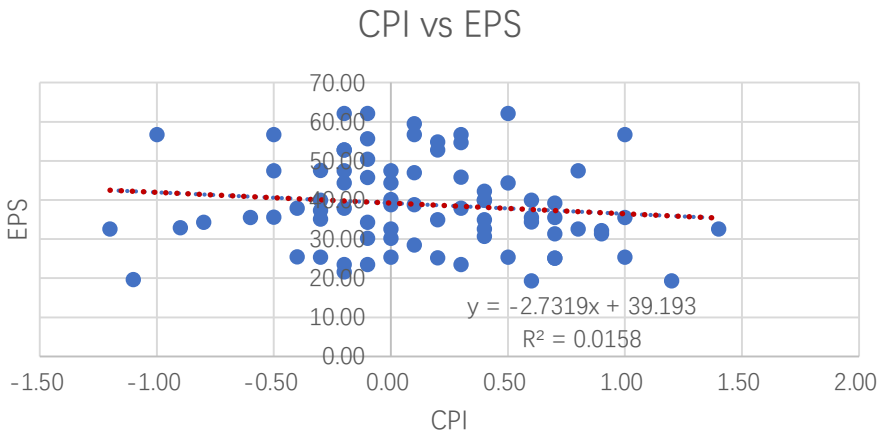

Fig. 7 the plot of the linear regression for CPI vs EPS

Figure 7 shows an analytical graph of Maotai's earnings per share. In addition, as CPI increases, share prices decrease. The coefficient R-squared for Keqiang's index on EPS is 0.1468. To conclude, the equation for data for Keqiang's index and Earnings per share for the company will be shown below:

$$y = -1.3854x + 50.335 \quad (8)$$

Where x represents Keqiang's index, and y represents the value of EPS. Moreover, to make the equation more direct to understand, the plot of the linear regression for real states in Figure 8 will be shown below:

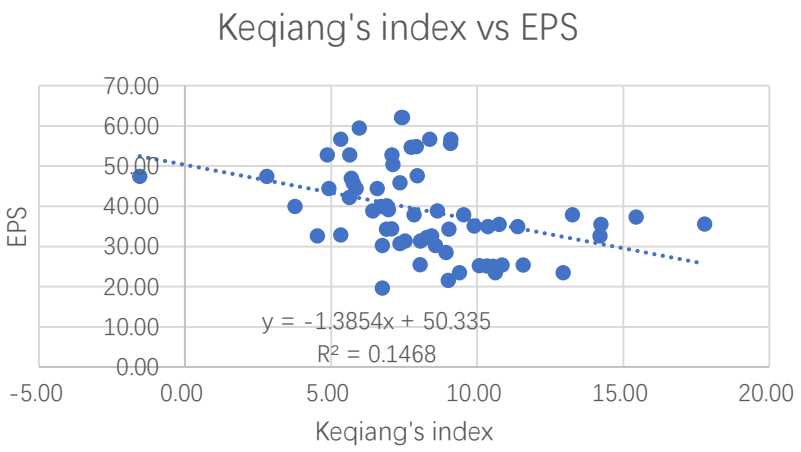

Fig. 8 the plot of the linear regression for Keqiang's index vs EPS

It shows an analytical graph of Keqiang's index and Maotai's earnings per share. As Keqiang's index increases, share prices decrease, as shown in Figure 8.

4. Conclusion

The data and the results from 2018 to 2024 above show how the six factors influence the share prices of Maotai's company. At first, the demand for and ability to buy houses has declined due to COVID-19. People who need a house cannot afford a house, and house investors are losing confidence. As a relatively stable asset investment, wine investment will be more attractive to the masses speaking of capital investment; thus, it began to invest in Maotai to avoid risk. This will lead to a decline in the housing index and a rise in Maotai's earnings per share. Secondly, as Maotai is a luxury product and has high visibility, people begin to use Maotai as a status symbol. As a result, the demand for Maotai increased. Previously, people used to use the number of houses as a status symbol, but now people's preference has changed.

Otherwise, several factors are still weak relative to the company's stock prices, mainly because the CPI reflects the price level of mass consumer goods. At the same time, Moutai belongs to high-end, non-essential consumer goods. Moutai is a high-end, non-essential consumer product usually used by middle- and high-income groups or enterprises for business receptions and gifts. The CPI mainly reflects changes in the prices of consumer goods and services in the daily lives of ordinary consumers, and

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covers a wide range of consumer items, including food, energy, housing, transportation, and medical care, and pays more attention to the price level of mass consumer goods and necessities.

In addition, public revenues cover a wide range of sources, such as value-added tax, corporate income tax, personal income tax, and customs duties. Although Maotai is a large enterprise with a significant tax revenue contribution, it is only one of thousands of enterprises. It cannot alone have a decisive impact on overall fiscal revenue. China's economy is enormous, and its fiscal revenues cover all sectors. As a wine company, Maotai contributes a relatively small percentage of the overall national fiscal revenue, even if its sales grow significantly. Fiscal revenues rely more on the combined tax contributions of other large-scale industries, such as manufacturing, science and technology, and services. Maotai's increased sales may increase tax revenues, but this growth is indirect.

Moreover, the government's fiscal revenues do not rely excessively on a single industry or company but rather achieve stability through distributing tax revenues across multiple industries and companies. Fiscal policy primarily aims to stabilize the country's economy through macroeconomic regulation. Fiscal policy depends more on global economic data and structural adjustment than on fluctuations in the sales of individual companies.

With the research, since only one factor was found in this paper that would strongly influence Moutai sales, looking up the relevant factors that would influence sales before looking for the corresponding data should result in more usable linear regression plots. To improve that, searching for more data about the other factors or using other better methods for analyzing is a good choice for future discussion.

References

[1] Lu Z, Zhu L, Li X, Li Z. The Impact of the COVID-19 Pandemic on Consumer Behavior-Evidence From China's Stock Market. Frontiers in Public Health, 2022, 10: 1-5.

[2] Duan S. MOUTAI Stock Price Prediction Based on ARIMA Model. Advances in Economics Management and Political Sciences, 2023, 14(1): 34-41.

[3] Li Y. The Impact of COVID-19 on China's Real Estate Industry and the Outlook for Industry Trends. BCP Business & Management, 2022, 34: 337-343.

[4] Wang L, Guan Y, Li X. Correlation and Simple Linear Regression. Textbook of Medical Statistics, 2024, 46: 157-170.

[5] Pashankar S S, Shendage J D, Pawar J. Machine Learning Techniques For Stock Price Prediction - A Comparative Analysis Of Linear Regression, Random Forest, And Support Vector Regression. Journal Of Advanced Zoology, 2024, 45(S4): 118-127.

[6] Tao S. Predicting BMW Stock Price Based on Linear Regression, LSTM, and Random Forest Regression. BCP Business & Management, 2023, 38: 335-340.

[7] Liang R. Research on the Influencing Factors of Shipping Industry Based on Linear Regression Model. Proceedings of the 6th International Conference on Economic Management and Green Development, 2023, 7.

[8] Bai X. The Comparative Analysis of Maotai Profitability. Highlights in Business Economics and Management, 2024, 24: 2577-2581.

[9] Umoro D, Omomoh O H. Devaluation and Stock Prices. The Central European Review of Economics and Management, 2023, 7(4).

[10] Victor E S, Razali M N, Ali H M. The Dynamics of the Impact of the Covid-19 Pandemic on Pan-Asia's Real Estate Investment Trusts. Real Estate Management and Valuation, 2023, 31(4): 11-22.