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Analysis of Factors Influencing Medical Stock Price Based on Multiple Regression Model

Shiyu Xu

University of Shanghai for Science and Technology, Shanghai 200093, China
23203290@qq.com

Abstract: *Medical stock prices have soared due to the new crown outbreak. This phenomenon makes stockholders pay extra attention to medical stocks. In order to reasonably predict the stock and thus gain profit, this paper uses a multiple regression model to regress the company's earnings data and closing price of Jiffy Bio, the leading medical sector, to determine the main factors affecting its stock price.*

Keywords: *Multiple regression; Medical stock*

1. Introduction

Since its creation, the A-share market has been sitting firmly at the top of the Chinese stock market. Both the number of listed companies and the total market capitalization of the market are sufficient to represent the Chinese stock market. As China's economy continues to develop, the country's stock prices have risen. With the improvement of people's living standard and the increasingly rational distribution of disposable income in the society, people's idea and demand for financial investment are becoming more and more prosperous.

The stock market has become the first choice of many people who are thirsty for high income as both risk and reward. However, high income is accompanied by high risk, and if you follow the crowd blindly, without professional knowledge, it is very easy to be stimulated by the volatility and large retracement of the stock market, and eventually you will be left with no money. Therefore, a reasonable analysis of the factors influencing the closing price of the stock, so as to predict the price of the stock is of great importance for the operation of buying and selling stocks.

Medical stocks in the pharmaceutical sector have been in high demand for medical equipment and epidemic prevention supplies, making them soar rapidly during the epidemic, bucking the market. As one of the leaders in the pharmaceutical sector, Jiffy Biologicals rose rapidly in the early stage of the epidemic development and has been in the financial hot news many times, becoming the new focus of stockholders. As one of the leading companies in the medical sector of the A-share market, such as Jiffy Biologicals, undoubtedly became the first choice for stockholders to buy, so analyzing the factors influencing the price of the stock and the forecast for the future became a necessary part of avoiding certain risks and obtaining higher returns.

2. Literature Review and Theoretical Analysis

2.1. Literature review

With the continuous development of the Chinese stock market, stock investment is also an option for many investors. In securities investment, the most important thing that investors should pay attention to is the volatility of stock prices, and thus its influencing factors are particularly important. Xiang Shuangshang and Dai Liang (2019)[1] used 50 stocks listed in Chinese A-shares from 2014-2017 as a sample and selected eight financial indicators to analyze the profitability, growth capacity, cash flow and operating capacity of Chinese A-share companies, respectively, and empirically analyzed the relationship between future earnings and abnormal stock returns. Li Xiaoning (2019)[2], on the other hand, argues that stock prices are affected by factors such as opening price, volume, and turnover, and conducts a multiple linear regression analysis with opening price, high price, low price, volume, and turnover as independent variables and closing price as dependent variables for the daily data of the above stocks. Qian Yilun (2019)[3] took Vanke as a typical example and conducted an in-depth study on various factors

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affecting the stock price changes of real estate enterprises in China, and found that the Shanghai Composite Index has a profound influence on it, and through empirical tests, it provides a reference for investors to make reasonable investment decisions.

2.2. Theoretical Analysis

A stock certificate is a certificate issued by a joint stock company to confirm its ownership of shares. The stock itself has no value and is sold because it provides a benefit to the shareholder. The pricing of stocks can usually be divided into two types: theoretical price and market price. What we generally call the market price is the price at which a stock is outstanding. The market price of a stock comes in various forms, such as the opening price, average price, high price, closing price and low price.

Profitability is the ability of a company to earn profits, also known as the ability to increase the value of money or capital, which is expressed in terms of how much revenue the company earns and its level over a certain period of time. In the case of outstanding actual operational performance of the company as well as growth in profits, the expected earnings of investors on the stock will also increase, which will lead to gradual purchases by investors and eventually an increase in the price of the company's stock. The profitability of a company is based on earnings per share, return on net assets and profit margin from main operations.

The growth capacity ratio, also known as the growth ratio, is used to measure the ability of a company to expand its business. It is usually used to reflect the ability of a company to expand and it has a strong relationship with the solvency of the company. Company growth capacity analysis is a method of analyzing a company's ability to expand its business. Funding sources to obtain capital to expand operations. This involves the expansion of the company, the improvement of profits and the interests of shareholders. The better the company grows, the more investors will expect and they will have higher expectations for the company's share price. The measures of a company's ability to grow are: asset growth rate, net profit growth rate, and profit growth rate.

Cash flow management of a company is an important function in the financial activities of a company. Therefore, how to effectively manage cash flow of a company is the key to ensure the survival and development of a company and improve its competitiveness in the market. If a company's cash flow statement is low, it indicates that there are problems with its operating income and accounts receivable. This will also have a certain impact on the operation and development of the invested company, causing investors to worry about its future development and thus reducing their enthusiasm for investment. The main indicator of cash flow is the ratio of net cash flow from operations to net income.

Operating capacity refers to a company's ability to operate, i.e., the company's ability to use its various assets to earn profits. In fact, the study of a company's operating capacity is essentially a study of the efficiency of its asset management. This is reflected, firstly, in the turnover rate and turnover of various assets; secondly, it plays an important role in the realization of the purpose of value creation. Operating capacity, as the key to corporate financial analysis, is in fact directly related to the company's solvency and profitability. The index of business capacity is mainly the total asset turnover.

3. Data source and description

3.1. Data source and sample selection

This paper selects five A-share listed companies in the medical sector in Shanghai and Shenzhen from 2011-2022 as the research sample to establish panel data, and selects Jiffy Bio (stock code 300122.SH) as the research sample for time series analysis to obtain all stock closing price data and financial report data from 2017-2022. The data were obtained from NetEase Finance and Guotaian database.

To avoid the influence of outliers, some samples with non-trading weekday values of 0 were excluded from the panel data. In the panel data, since the quarterly statements of companies are issued once a quarter, the closing value of stocks was selected on the last trading day of each quarter as the stock price of that quarter to ensure the integrity of data and reliability of results. After screening, a total of 220 samples of valid sample data of A-share listed companies were finally obtained to establish the data of the relevant linear regression model; a total of 1133 valid samples of time series data of stock prices of Jiffy Biology from 2017-2022 were obtained.

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3.2. Variable definitions

3.2.1. Explanatory variables

The explanatory variable selected is the stock closing price. Since the quarterly summary of financial statements of each A-share listed company is the last day of each quarter, however, the stock market is not a weekend but also a trading day, so the stock closing price in the panel data is selected as the value of the last effective trading day at the end of each quarter. The stock closing price is a good representative for the market price of stocks and also plays a good predictive role for future trading expectations.

3.2.2. Explanatory variables

Earnings per share is the net profit of the company or the net loss of the enterprise to be borne by common shareholders for each share held; return on net assets is the percentage of net profit to average shareholders' equity; and profitability of main business is the ratio of profit from main business to net income from main business of the enterprise in a certain period. They are presented in the form of percentages as profitability considerations, except for earnings per share, which is in dollars.

The growth rate of total assets is the ratio of the growth of total assets to the total assets at the beginning of the year; the growth rate of net profit is the growth rate of the net profit of the company in the current period compared to the net profit of the previous period; the growth rate of main business income is used to measure the life cycle of the company's products and to judge the stage of the company's development. They are indicators for the consideration of each company's growth ability, and are presented in the form of percentages.

The ratio of net operating cash flow to net profit is a measure of the cash flow of each company and is presented in the form of a percentage.

Total asset turnover ratio is the ratio of net operating income to average total assets of a company over a certain period of time, and is a measure of each company's operating capacity, presented as a percentage.

For the explanatory and explanatory variables are defined in the table shown in Table 1.

Table 1: Variable definition table.

Variable Type	Variable Name	Symbol	Variable unit
Explained variable	Closing price	C_t	yuan
Explanatory variables	Net profit growth rate	x_{1t}	%
	Growth rate of main business revenue	x_{2t}	%
	Total Assets Growth Rate	x_{3t}	%
	Total Assets Turnover Ratio	x_{4t}	%
	Basic earnings per share	x_{5t}	%
	Ratio of net cash flow from operations to net profit	x_{6t}	%
	Return on net assets	x_{7t}	%
	Profit margin from main business	x_{8t}	%

4. Multiple linear regression model construction and analysis

4.1. Co-linearity test

Firstly, stock closing price in the above variable definition table is selected as the explanatory variable, and earnings per share, return on net assets, profitability of main business, growth rate of total assets, growth rate of net profit, growth rate of income from main business, ratio of net cash flow from operations to net profit, and total asset turnover ratio are taken as explanatory variables. This chapter intends to empirically investigate the effects of the eight factors mentioned previously on stock closing prices by constructing a panel data model, and the explanatory variables are taken as natural logarithms in order to reduce the effects of indicator data units as well as heteroskedasticity. The following model is constructed.

$$\ln C_t = \beta_0 + \beta_1 \ln x_{1t} + \beta_2 \ln x_{2t} + \beta_3 \ln x_{3t} + \beta_4 \ln x_{4t} + \beta_5 \ln x_{5t} + \beta_6 \ln x_{6t} + \beta_7 \ln x_{7t} + \beta_8 \ln x_{8t} + \varepsilon_{it}$$

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The t denotes quarter $\ln x_{1t}$, $\ln x_{2t}$, $\ln x_{3t}$, $\ln x_{4t}$, $\ln x_{5t}$, $\ln x_{6t}$, $\ln x_{7t}$, denote the profitability of the company's main business, return on net assets, growth rate of net income, growth rate of revenue from main business, growth rate of total assets, turnover rate of total assets, earnings per share, and ratio of net cash flow from operations to net income in quarter t. Respectively, denotes the closing price of the stock in quarter t, is the residual term, and denotes the constant term.

Regressions are fitted to the above models using OLS least squares, and the relevant data are obtained and then tested for covariance based on the VIF variance inflation factor as shown in Table 2.

Table 2: VIF variance inflation factor test.

$\ln x_{1t}$	$\ln x_{2t}$	$\ln x_{3t}$	$\ln x_{4t}$	$\ln x_{5t}$	$\ln x_{6t}$	$\ln x_{7t}$	$\ln x_{8t}$
188.50	65.29	35.29	30.78	24.18	20.79	9.25	2.68

The scatter plot of the output correlation coefficient matrix is shown in Figure 1.

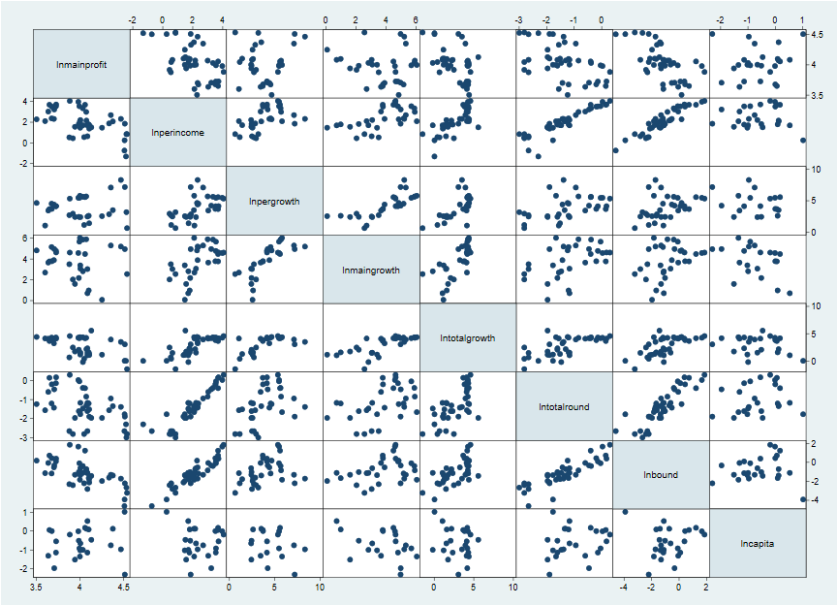

Figure 1: Scatter plot of correlation coefficient.

From Table 2, we know that the VIFs of profitability of main business, return on net assets, growth rate of net profit, growth rate of revenue from main business, growth rate of total assets, and turnover rate of total assets are all greater than 10. Also, referring to Figure 2, we can see that there may be linear correlation among them, and we think that the model has co-linearity, and the correlation problem among the explanatory variables should be eliminated to obtain the optimal model.

4.2. Selection of regression models

Stepwise regression analysis of the model is performed, and the optimal model under the AIC criterion is obtained by automatic screening of the program.

$$\ln C_t = \beta_0 + \beta_1 \ln x_{1t} + \beta_4 \ln x_{4t} + \beta_6 \ln x_{6t} + \beta_7 \ln x_{7t} + \beta_8 \ln x_{8t} + \varepsilon_{it}$$

That is, the explanatory variables are: profitability of main business, growth rate of revenue from main business, total asset turnover, earnings per share, and ratio of net cash flow from operations to net income.

4.3. Heteroskedasticity test

For the above model, if the variance of the random disturbance term is not constant, heteroskedasticity is considered to have occurred, and heteroskedasticity may cause the prediction error of the model. Therefore, in this paper, the BP test and White's test are applied to the model using *Stata* to verify whether there is heteroskedasticity in the model.

By BP test, we obtained the p-value of the model as 0.4144>0.05, indicating that the hypothesis that

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the random disturbance terms of the original model are the same is not rejected at the 5% significance level, i.e., there is no heteroskedasticity in the model disturbance terms.

By White's test, we obtain a p-value of 0.3971>0.05 for the model, indicating that the hypothesis that the original model random disturbance terms are identical is not rejected at the 5% significance level, i.e., there is no heteroskedasticity in the model perturbation terms.

4.4. Residual test

The normalized residuals of the model are shown in the normal Q-Q plot in Figure 2, and it can be seen from the plot that the points in the plot are approximately distributed on a straight line, so it can be assumed that the standardized residuals of the model satisfy the normality assumption.

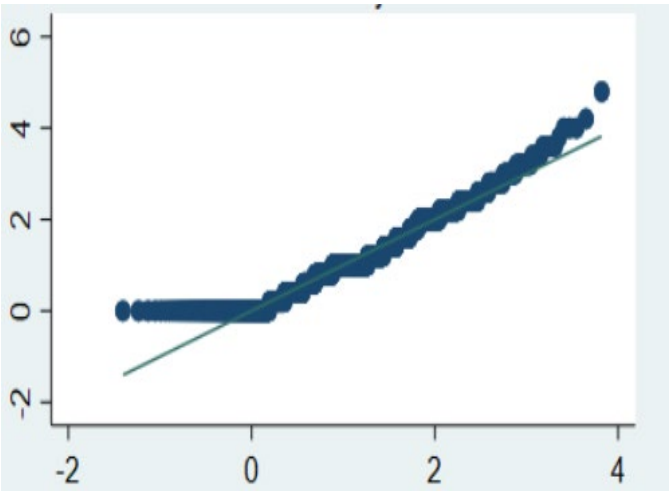

Figure 2: Normal QQ plot of normalized residuals.

From Table 3 we can know that the skewness of the sample residuals is small and the kurtosis is close to 3, which is in line with the requirements of normal distribution. At the same time, the D.W. test value is close to 2 and the p-value is 0.6764 which is greater than 0.05. The residuals are not serially correlated and the original hypothesis is accepted that the residuals obey a normal distribution and the sample data pass the residual test.

Table 3: Results of tests for skewness, kurtosis, D.W., etc.

Skewness	Kurtosis	D.W.	p-value
0.4318	3.7389	1.8613	0.6764

4.5. Model correction

The VIF variance inflation factor test for the optimal model under the AIC criterion is shown in Table 4 which shows that the VIFs of the screened models are all less than 10. This indicates that the model design passes the cointegration test, and there is basically no multicollinearity between the explanatory variables; the residual test also passes, obeying a normal distribution, and there is no serial correlation between the residuals, which is consistent with the basic assumption of the least squares method.

Table 4: VIF variance inflation factor test.

$\ln x_{1t}$	$\ln x_{4t}$	$\ln x_{6t}$	$\ln x_{7t}$	$\ln x_{8t}$
2.40	2.87	6.83	5.06	2.82

As can be seen from Table 5, the correlation coefficient between total asset turnover and earnings per share is relatively large, and corresponding to Table 3, it is found that the VIF of total asset turnover is closest to 10. Therefore, it is necessary to remove the separate variables to compare the AIC values to continue the analysis, so that the explanatory variables of the model can continue to be optimized.

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Table 5: Autocorrelation coefficient matrix.

	$\ln x_{1t}$	$\ln x_{4t}$	$\ln x_{6t}$	$\ln x_{7t}$	$\ln x_{8t}$
$\ln x_{1t}$	1	0.0690	-0.5815	-0.5842	-0.1643
$\ln x_{4t}$	0.0690	1	0.3638	0.2215	-0.3799
$\ln x_{6t}$	-0.5815	0.3638	1	0.8800	0.4233
$\ln x_{7t}$	-0.5842	0.2215	0.8800	1	0.4874
$\ln x_{8t}$	-0.1643	-0.3799	0.4233	0.4874	1

The value of the AIC was examined by excluding individual explanatory variables, and the final selected modified model is:

$$\ln C_t = \beta_0 + \beta_1 \ln x_{1t} + \beta_4 \ln x_{4t} + \beta_7 \ln x_{7t} + \beta_8 \ln x_{8t} + \varepsilon_{it}$$

That is, the explanatory variables are: profitability of main business, growth rate of income from main business, earnings per share, and the ratio of net cash flow from operations to net income.

4.6. Analysis of model results

The OLS results of the improved model are shown in Table 6.

Table 6: Model fitting results.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
_cons	5.5284	1.7318	3.19	0.006
$\ln x_{1t}$	-0.3563	0.4600	-0.77	0.050
$\ln x_{4t}$	0.3805	0.0757	0.50	0.022
$\ln x_{7t}$	0.4255	0.1267	3.36	0.004
$\ln x_{8t}$	0.1863	0.1696	1.10	0.288
R-squared	0.7907	Mean dependent var		0.592665
Adjusted R-squared	0.7371	S.D. dependent var		0.317075
S.E. of regression	0.084294	Akaike info criterion		-1.836797
F-statistic	206.4326	Durbin-Watson stat		1.916582

With the above parameter estimates, we obtain the following model.

$$\ln C_t = 5.5284 - 0.3563 \ln x_{1t} + 0.3805 \ln x_{4t} + 0.4255 \ln x_{7t} + 0.1863 \ln x_{8t}$$

The explanatory variables are, in order: profitability of main business, growth rate of income from main business, earnings per share, and the ratio of net cash flow from operations to net income.

From the model summary table, it can be seen that the decidable coefficient R^2 of the model is 0.7907, indicating that the explanatory variables in the model: profitability of the company's main business, return on net assets, growth rate of net profit, growth rate of income from main business, total asset turnover, earnings per share, and ratio of net cash flow from operations to net profit can explain the explanatory variable stock closing price to the extent of 79.07%.

Given a significance level of 10%, a critical value of 2.015 is found in the t-distribution table. from the results, it is obtained that the absolute values of the corresponding statistics are mostly greater than 2.015. this indicates that at the given significance level $\alpha = 0.10$, the original hypothesis H0 should be rejected respectively, i.e., the explanatory variables profitability of main business, growth rate of income from main business, earnings per share are guaranteed to be constant for the other variables respectively, have a significant effect on the closing price of the explanatory variables stock, while the ratio of net cash flow from operations to net profit does not have a significant effect on the closing price.

5. Conclusions and Recommendations

Earnings per share has a significant and positive impact on share price volatility individually. Earnings per share represents the investment value of the company, which indicates that the earnings per share of the enterprise has a greater impact on the share price volatility, and the greater the earnings per share of the enterprise, the greater the share price volatility. The growth rate of revenue from main business can be considered significant and positively correlated to share price volatility at 0.05 confidence level. The growth rate of revenue from main business represents the growth ability of the enterprise. This indicates that the growth ability of the enterprise has a greater impact on the stock price

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volatility, and the higher the growth ability of the enterprise, the higher the stock price volatility.

The multiple linear regression model is convenient to analyze, but the selection of specific factors is more subjective, which affects the diversity and unpredictability of the factors and makes the regression analysis limited.

The advice to investors is to pay more attention to the profitability and growth ability of companies when investing in stocks.

The financial indicators of profitability and growth ability of listed companies show a large correlation with stock prices, and the regression coefficients of the study are all greater than 1, reflecting a great value of financial information. While the operating capacity and cash flow indicators reflecting listed companies have less influence on stock price fluctuations, and investors pay little attention to these two types of indicators. Therefore, investors should pay more attention not only to profitability and growth capacity indicators, but also to financial indicators of operating capacity and cash flow.

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