

The Research on Influencing Factors of Stock Price Fluctuation of Listed Companies in China Based on PCA-Multiple Regression

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Abstract

Taking the transportation industry as an example, aiming at the research problem of influencing factors of stock price fluctuation of listed companies in China, this paper selects 70 listed companies from A-share companies of Shanghai Stock Exchange, eliminates ST companies and companies with incomplete data, and takes the average closing price of each trading day of the remaining 63 listed companies from May 1 to June 30, 2020 as the explanatory variable. After that, the principal component comprehensive evaluation method is used to calculate the main factors affecting the stock price fluctuation of listed companies in the transportation industry as the explanatory variable. Eviews9.0 was used to carry out multiple linear regression analysis on the data, and the analysis results showed that the index data related to debt paying ability, asset appreciation ability and profitability were important factors affecting the stock price fluctuations of the listed companies in the transportation industry.

Keywords

Stock Price, Financial Indicators, Panel Data, Principal Component Regression

1. Introduction

The capital market is complicated, and the public and transparent information disclosure is the premise of the effective operation of the capital market. The financial information contained in the enterprise annual report is the main source of the stock market information and the direct factor affecting the stock price. With the continuous improvement of residents' living standards and the increasing accumulation of wealth, more and more people begin to choose to in-

crease their own wealth through investment and financial management. Therefore, the study of the impact of financial indicators on stock prices is not only helpful for stock investors to make reasonable investment decisions, but also helpful to further improve the accounting information disclosure system. As the basic industry of China's economy, the transportation industry serves as the backbone of the development of the national economy and carries the task of human and material transportation throughout the country. Therefore, it is of practical significance to study the stock prices of listed companies in the transportation industry. From the perspective of finance, this paper takes the 63 transportation companies in Shanghai Stock Exchange as examples, explores the correlation between the historical financial information publicly disclosed by companies and stock prices, and analyzes the main factors affecting stock prices, so as to help stock investors make more reasonable investment decisions.

2. Literature Review

Since the emergence of empirical studies on the relationship between accounting information and stock prices in the 1960s, Chinese and Western scholars have shown great interest in this issue.

Xiang & Dai (2019) used multiple linear regression analysis, selected eight financial indicators such as return on equity and carried out linear regression analysis with stock price, and concluded that there was a great correlation between the profitability of listed companies and stock price. Nie Miaomiao (Nie, 2018) extracted 6 principal component factors from 16 financial factors in the New Third Board market by comprehensive use of principal component analysis, and analyzed the correlation between them and stock price. Finally, it was concluded that the factor of asset appreciation ability was equal to the stock price, showing a strong correlation. Jing Fangfang (Jing, 2017), based on the improved GARCH-MIDAS model and by comparing the multi-factor mixing model and the single-factor mixing model, analyzed the long-term components of China's stock market price fluctuations, and put forward policy suggestions accordingly.

According to the research of most scholars, it is found that the selection of financial factors affecting stock price fluctuation of listed companies is mainly based on subjective factors. Therefore, this paper will use literature research collection is generally accepted that a larger impact on stock price volatility of financial indicators, using principal component analysis (PCA) to extract principal component, multiple index finally combined with principal component reduction shares the company different ability index of the multivariate linear regression model, and combined with related financial background correlation analysis, provide a reference for investors make investment decisions.

3. Model Setting

3.1. Financial Factors that Affect Stock Prices

The selection of financial indicators is an important link in the study of stock

price fluctuations. Through literature review and considering many influencing factors, this paper selects 12 financial indicators data from the 2019 annual reports of Shanghai A-share market enterprises as explanatory variables, (Sha, 2018) which are as follows:

1) Net cash flow per share, which reflects the amount of cash created by the company using capital per share; 2) Return on equity, which reflects the income level of shareholders' equity, is used to measure the efficiency of using the company's own capital; 3) Operating profit margin, which can comprehensively reflect the operating efficiency of an enterprise or an industry; 4) Current ratio, which is used to measure the ability of the enterprise's current assets to be turned into cash for repayment of liabilities before the maturity of short-term debts; 5) Quick ratio, which is used to measure the ability of an enterprise's current assets to be immediately turned into cash for repaying current liabilities; 6) The growth rate of net profit refers to the growth rate of the net profit of the enterprise in the current period compared with the net profit of the previous period; 7) the growth rate of net assets, reflecting the expansion speed of the enterprise's capital scale; 8) The growth rate of total assets, reflecting the growth of the enterprise's current asset scale; 9) Inventory turnover, which reflects the turnover speed of inventory, namely whether the liquidity of inventory and the amount of inventory funds are reasonable; 10) Accounts receivable turnover rate, is to measure the enterprise accounts receivable turnover speed and management efficiency of the index; 11) Total asset turnover is an indicator to measure the ratio between asset investment scale and sales level; 12) Net profit cash content refers to the ratio of net cash flow generated in production and operation to net profit.

3.2. Selection of Variables

Due to the time of the disclosure of the annual report of listed companies in China for a year on January 1 solstice on April 30, and the financial information reflected in the annual report will have an impact on the second day of the reporting date of the next year's annual financial statement, this paper will choose the average closing price P of each trading day during May 1, 2020 solstice June 30 of listed companies as the explained variable, representing the stock price after the disclosure of the annual report in 2020.

This paper first selects 12 financial indicators from the 2019 annual reports of Shanghai A-share market enterprises, of which the specific meanings are shown in **Table 1** (Li, 2014).

Considering the correlation between different financial indicators, this paper uses principal component analysis to extract five principal components from the 12 financial indicators, which are respectively named as solvency factor, asset appreciation ability factor, profitability factor, operating ability factor and profit appreciation ability factor according to their correlation with financial indicators (Hao, 2018). These five principal components are taken as new explanatory

Table 1. Selection and distribution of financial indicators.

The variable name	symbol	Definition of variables
Net cash flow per share	X_1	Net cash inflow or net expenditure/Total equity
Return on equity	X_2	Net Profit/Net Assets
Operating profit margin	X_3	Operating profit/total business income \times 100%
Current ratio	X_4	Total current assets/Total current liabilities \times 100%
Quick ratio	X_5	Quick assets/Current liabilities
Growth rate of net profit	X_6	(Net profit of current period – Net profit of previous period)/Net profit of previous period \times 100%
Growth rate of net assets	X_7	(ending net assets – beginning net assets)/beginning net assets \times 100%
Growth rate of total assets	X_8	Growth of total assets this year/total assets at the beginning of the year \times 100%
The turnover rate of inventory	X_9	Operating costs/average balance of inventory
The turnover rate of accounts receivable	X_{10}	Current net sales revenue/(accounts receivable balance at the beginning + accounts receivable balance at the end)/2
The turnover rate of total assets	X_{11}	Net Operating Income/Average Total Assets

variables and are respectively represented by F_1 , F_2 , F_3 , F_4 and F_5 . The specific meanings are shown in the table below. See **Table 2**.

$$P = \beta_0 + \beta_1 F_1 + \beta_2 F_2 + \beta_3 F_3 + \beta_4 F_4 + \beta_5 F_5 + \mu$$

In the formula, the extracted five principal components are taken as explanatory variables, and the stock prices of listed transportation companies in Shanghai A-share market after the disclosure of their 2020 annual report are taken as explanatory variables to study the correlation between financial factors and the stock prices of listed transportation companies in Shanghai A-share market after the disclosure of their annual report.

4. Model Estimation

The principal component regression method is used to estimate the parameter model, (Yao & Wang, 2014) so as to reveal the main financial factors affecting the stock prices of listed companies in the transportation industry in Shanghai A-share market and their influence degree. The specific steps are as follows:

1) Due to the large number of explanatory variables selected, in order to avoid multicollinearity, principal component analysis was used to reduce the dimension of multiple explanatory variables, that is, five principal components were extracted from 12 correlated financial indicators; 2) With stock price data as explained variables and five principal components extracted as explanatory variables, the model parameters of the regression equation were estimated and tested; 3) Substitute the principal component function into the estimated regression equation that passes the test, and conduct structural analysis accordingly.

Table 2. Principal components extracted.

The main factor	Name of factor	The financial indicators included
F_1	Solvency factor	Current ratio, Quick ratio
F_2	Asset appreciation ability factor	Growth rate of total assets, Growth rate of total assets, Net cash flow per share
F_3	Profitability factor	Return on equity, Operating profit margin, Net profit cash content
F_4	Operational capacity factor	The turnover rate of inventory, The turnover rate of total assets
F_5	Developmental ability factor	The turnover rate of accounts receivable, Growth rate of net profit

5. The Empirical Analysis

5.1. Selection of Samples

This paper studies the stock price fluctuation of Shanghai A-share transportation companies. Transportation industry is the basic industry of our country and an important industry connecting various industries. In the selection of data samples, some ST companies and companies with incomplete data were excluded. Finally, 63 listed companies were selected from 70 listed companies. All index data were obtained from the Resset Financial Research Database.

5.2. Principal Component Analysis

This paper studies the stock price fluctuation of Shanghai A-share transportation companies. Transportation industry is the basic industry of our country and an important industry connecting various industries. In the selection of data samples, some ST companies and companies with incomplete data were excluded. Finally, 63 listed companies were selected from 70 listed companies. All index data were obtained from the Resset Financial Research Database.

It is generally believed that when KMO statistics are higher than 0.5, principal component analysis is appropriate. It can be seen from **Table 3** that KMO values of 12 financial indicators are 0.502, higher than 0.5 but lower than 0.6. In Bartlett sphericity test, statistical significance level is less than 0.01. According to the comprehensive analysis, it is feasible to carry out factor analysis on 12 individual financial indicators (Dong, 2011).

The data was imported into SPSS for dimensionality reduction to get the total variance explained. Based on the eigenvalue greater than 1, five common factors were extracted by default in principle. As shown in **Table 4**, the first five common factors accounted for 73.939% of the total information, so the extracted five principal components could better explain the information contained in the original variables. See **Table 3**.

Table 5 shows the rotated factor load matrix, in which the first common factor has the largest correlation coefficient with the current ratio and the quick ratio,

Table 3. KMO and bartlett tests.

Sampling the Kaiser-Meyer-Olkin measure of adequacy		0.502
The approximate chi-square		361.330
Bartlett's test for sphericity	df	66
	Sig.	0.000

Table 4. Total variance of the interpretation.

Composition	Initial Eigenvalue			The squared sum of the extracted loads			The sum of the squares of the rotating loads		
	totals	Percentage of variance	Cumulative %	totals	Percentage of variance	Cumulative %	totals	Percentage of variance	Cumulative %
1	2.467	20.561	20.561	2.467	20.561	20.561	2.102	17.516	17.516
2	2.113	17.611	38.172	2.113	17.611	38.172	2.100	17.499	35.015
3	1.853	15.440	53.612	1.853	15.440	53.612	1.880	15.665	50.680
4	1.282	10.681	64.294	1.282	10.681	64.294	1.597	13.306	63.986
5	1.157	9.645	73.939	1.157	9.645	73.939	1.194	9.953	73.939
6	0.881	7.342	81.280						
7	0.801	6.675	87.955						
8	0.552	4.596	92.551						
9	0.407	3.388	95.940						
10	0.258	2.147	98.087						
11	0.215	1.794	99.881						
12	0.014	0.119	100.000						

Table 5. Composition matrix after rotation.

	1	2	3	4	5
Net cash flow per share	0.312	0.573	0.102	-0.218	0.206
Return on equity	-0.017	0.438	0.748	0.009	0.271
Operating profit margin	-0.006	-0.191	0.750	-0.327	-0.288
Current ratio	0.975	0.011	0.088	0.036	-0.028
Quick ratio	0.976	0.022	0.036	0.077	-0.026
Growth rate of net profit	-0.247	0.161	0.176	-0.387	0.675
Growth rate of net assets	-0.054	0.854	0.130	0.096	0.058
Growth rate of total assets	-0.052	0.838	-0.060	0.151	-0.232
The turnover rate of inventory	0.047	-0.080	0.246	0.755	0.066
The turnover rate of accounts receivable	-0.102	0.141	0.181	-0.282	-0.690
The turnover rate of total assets	0.032	0.229	-0.198	0.753	-0.024
Net profit cash content	-0.147	-0.072	-0.745	-0.192	0.024

which are 0.975 and 0.976, respectively. Therefore, the first common factor can be named as the solvency factor. The second common factor has the largest cor-

relation coefficient with the growth rate of net assets, the growth rate of total assets and the net cash flow per share, which are 0.854, 0.838 and 0.573, respectively. Therefore, the second common factor can be named as the asset growth capacity factor. The correlation coefficient between the third common factor and return on equity, operating profit margin and net profit cash content is the largest, which is 0.784, 0.750 and -0.745 , respectively. Therefore, the third common factor can be named as profitability factor. See **Table 4**. The correlation coefficient between the fourth common factor and the turnover rate of inventory and the turnover rate of total assets is the largest, which is 0.755 and 0.753, respectively. Therefore, the fourth common factor can be named as operation capacity factor. The fifth common factor has the largest correlation coefficient with the turnover rate of accounts receivable and growth rate of net profit, which are -0.690 and 0.675, respectively. Therefore, the fifth common factor can be named as the development capacity factor. See **Table 5**.

According to the component scoring coefficient matrix, the expression between the five main factors and the 12 financial indicators can be established as follows:

$$F_1 = 0.170ZX_1 - 0.044ZX_2 - 0.027ZX_3 + 0.470ZX_4 + 0.470ZX_5 - 0.079ZX_6 - 0.043ZX_7 - 0.045ZX_8 - 0.049ZX_9 - 0.061ZX_{10} - 0.036ZX_{11} - 0.014ZX_{12} \quad (1)$$

$$F_2 = 0.279ZX_1 + 0.129ZX_2 - 0.131ZX_3 - 0.008ZX_4 + 0.000ZX_5 + 0.050ZX_6 + 0.407ZX_7 + 0.431ZX_8 - 0.119ZX_9 + 0.114ZX_{10} + 0.085ZX_{11} + 0.049ZX_{12} \quad (2)$$

$$F_3 = -0.036ZX_1 + 0.380ZX_2 + 0.414ZX_3 - 0.003ZX_4 - 0.030ZX_5 + 0.063ZX_6 + 0.000ZX_7 - 0.100ZX_8 + 0.210ZX_9 + 0.070ZX_{10} - 0.071ZX_{11} - 0.422ZX_{12} \quad (3)$$

$$F_4 = -0.195ZX_1 + 0.046ZX_2 - 0.140ZX_3 - 0.049ZX_4 - 0.027ZX_5 - 0.221ZX_6 + 0.022ZX_7 + 0.039ZX_8 + 0.520ZX_9 - 0.179ZX_{10} + 0.459ZX_{11} - 0.174ZX_{12} \quad (4)$$

$$F_5 = 0.147ZX_1 + 0.202ZX_2 - 0.237ZX_3 + 0.008ZX_4 + 0.010ZX_5 + 0.549ZX_6 - 0.003ZX_7 - 0.247ZX_8 + 0.071ZX_9 - 0.600ZX_{10} - 0.024ZX_{11} - 0.018ZX_{12} \quad (5)$$

5.3. Multiple Regression Analysis

This paper studies the stock price fluctuation of Shanghai A-share transportation companies. Transportation industry is the basic industry of our country and an important industry connecting various industries. In the selection of data samples, some ST companies and companies with incomplete data were excluded. Finally, 63 listed companies were selected from 70 listed companies. All index data were obtained from the Resset Financial Research Database.

The stock price of listed companies in the transportation industry in Shanghai

A-share market after the disclosure of their annual report in 2020 was taken as the explanatory variable, and the five principal components extracted were taken as explanatory variables. Using EVIEWS9.0, the regression equation was established through OLS method, and the following results were obtained (Ma & Xu, 2017):

$$\hat{P} = 8.8889 + 2.8943F_1 + 3.5679F_2 + 2.5808F_3 + 1.9757F_4 + 0.0015F_5 \quad (6)$$

$$(1.4685) (1.4681) (1.4695) (1.4675) (1.4689)$$

$$t = (1.9709) (2.4302) (1.9563) (2.3463) (2.0010)$$

$$R^2 = 0.2049, \hat{R}^2 = 0.1351, F = 2.9369, DW = 1.3562$$

At the same time, the following model tests were conducted on the principal component regression results.

5.3.1. Goodness of Fit Test

By multiple regression analysis result, the sample can be determined coefficient $R^2 = 0.2049$, the revised samples of determination coefficient $\hat{R}^2 = 0.1351$. The closer R^2 approaches 1, the better the fitting degree of the regression equation to the observed value is. The value of R^2 in this study is too small, so the fitting effect is not very good.

5.3.2. F Test

The null hypothesis is: $H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$, the alternative hypothesis for H_1 : at least one β_i is not equal to zero ($i = 1, 2, 3, 4, 5$). According to the results of multiple regression, $F = 2.9369$, under the significance $\alpha = 0.05$, the F statistic is greater than the critical value, so the null hypothesis is rejected and the alternative hypothesis is accepted, that is, the overall regression equation is significant.

5.3.3. t Test

Propose the null hypothesis for testing: $H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$, the alternative hypothesis for H_1 : at least one β_i is not equal to zero ($i = 1, 2, 3, 4, 5$). According to the results of multiple regression, the T statistics of β_1 , β_2 , β_3 , β_4 and β_5 are 1.9709, 2.4302, 1.9563, 2.3463 and 0.0010. Under the significant of $\alpha = 0.05$, t statistic the critical value of 1.96, $1.9709 > 1.96$, $2.4302 > 1.96$, $1.9563 > 1.96$, $2.3463 > 1.96$, $2.0010 > 1.96$, so reject the null hypothesis and accept the alternative hypothesis, namely the five variables are has a significant influence on stock prices.

5.3.4. White Inspection

In order to further enhance the model's persuasiveness and eliminate the possible autocorrelation between explanatory variables of the model, heteroscedasticity test is needed. According to the White test result output by Eviews9.0, Obs *R-squared = 26.9519, and the adjoint probability is 0.1366. When the significance level is 95%, $0.1366 > 0.05$ proves that there is no heteroscedasticity, that is, there is no autocorrelation between explanatory variables.

After the test of the model is passed, F_1 , F_2 , F_3 , F_4 and F_5 are respectively substituted to obtain the regression equation after reduction:

$$\begin{aligned} \hat{P} = & 8.8889 + 1.0095ZX_1 + 1.4048ZX_2 + 0.2460ZX_3 + 1.2272ZX_4 + 1.2296ZX_5 \\ & + 0.3235ZX_6 + 1.3711ZX_7 + 1.2261ZX_8 + 1.0030ZX_9 + 0.0563ZX_{10} \\ & + 0.9227ZX_{11} + 1.2986ZX_{12} \end{aligned} \quad (7)$$

6. Conclusion and Policy Recommendations

The analysis shows that the debt paying ability, asset growth ability and profitability of the listed companies in the transportation industry have a significant influence on the stock price fluctuations, and the influence degree is relatively high, followed by the operating capacity index. However, the index related to the company's profit growth ability has a low influence on the stock price fluctuation. Therefore, investors should consider the following factors when making financial investment.

6.1. Debt Paying Ability and Stock Price

At the significance level of 5%, both the liquidity ratio and the speed ratio are significantly positively correlated with the stock price, and the significance coefficients are 1.2272 and 1.2296, respectively, indicating that the stock price increases by 1.2272 and 1.2296 units for each increase of the current ratio and the quick ratio. Compared with the asset growth ability and profitability, the indexes related to debt paying ability have a higher impact on the stock price of the listed companies in the transportation industry, so the fluctuation of stock price is largely related to the index of debt paying ability.

6.2. Asset Growth Capacity and Stock Price

At the significance level of 5%, the growth rate of net assets, growth rate of total assets and net cash flow per share are significantly positively correlated with the stock price, and the significance coefficients are 1.3711, 1.2261 and 1.0095, respectively, indicating that when the growth rate of net assets, growth rate of total assets and net cash flow per share increase by one unit, the stock price will increase by 1.3711, 1.2261 and 1.0095 units, respectively. Generally speaking, the stock price of listed companies in the transportation industry is greatly affected by the company's asset growth ability. Therefore, investors need to focus on the index data related to the asset growth capacity of listed companies when making stock investment.

6.3. Profitability and Stock Price

At the significance level of 5%, financial indicators related to profitability are positively correlated with stock prices. The significance coefficient of return on equity is 1.4048, and the significance coefficient of operating profit margin and net profit cash content are 0.2460 and 1.2986 respectively. That is to say, among the selected profitability indicators, operating profit margin has the least impact

on stock price changes.

6.4. Operating Capacity and Stock Price

At the significance level of 5%, the correlation between relevant indexes of operating capacity and stock price is low. According to the significance coefficient, the significance coefficient of the turnover rate of inventory is 1.0030, that is, when the turnover rate of inventory increases by one unit, the stock price will fluctuate upward by 1.0030 units, while the significance coefficient of the turnover rate of total assets is 0.9227, indicating that the turnover rate of total assets has a low influence on the stock price. When the turnover rate of total assets increases by one unit, the stock price will only rise by 0.9227 units.

6.5. Development Ability and Stock Price

At the significance level of 5%, the turnover rate of accounts receivable is significantly positively correlated with the stock price, and the significance coefficient is 0.0563, that is, when the turnover rate of accounts receivable increases by one unit, the stock price will rise by 0.0563 units, and the significance coefficient of the growth rate of net profit is 0.3235, that is, when the growth rate of net profit increases by one unit, the stock price will rise by 0.3235 units. The financial indicators related to the development ability of listed companies in the transportation industry have a low influence on the stock price, but when conducting investment transactions, they are also important reference data reflecting the potential development ability of listed companies.

In conclusion, the most important factors affecting the stock price fluctuations of listed companies in the transportation industry are the indexes related to debt paying ability, asset growth ability and profitability, followed by the indexes related to operation ability, and the indicators related to development ability have a small force. Therefore, investors should pay more attention to the solvency, asset growth and profitability of listed companies when making relevant investment decisions.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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