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Validity of Capital Asset Pricing Model(CAPM)： Empirical Research on the Panel Industry in China

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Abstract: In recent years, the stock of the panel industry has developed well and the country has invested heavily in this industry, so investors are enthusiastic about the panel industry. Based on the investment potential of the panel industry, this paper selects the latest data of 12 stocks in Shenzhen Stock Exchange from January 1, 2007 to December 31, 2021, and uses the capital asset pricing model (CAPM) to conduct an empirical study on China's panel industry. The results show that the applicability of the ßcoefficient panel industry is not strong, and the applicability of the CAPM model in the panel industry is not good. At the same time, combined with the stock market environment of China's panel industry, this paper makes a further analysis of the CAPM model, and puts forward some investment suggestions for investors the following investment suggestions for reference: evaluating the risk of assets by using a number of indicators before investment; seizing the investment opportunities of upstream new materials and so on.

Keywords: CAPM Model, Panel Industry, Efficiency, Portfolio Return, Investment

1. Introduction

The 21st century is the information age. With the rapid development of 5G, artificial intelligence, Internet of Things, big data and other new technologies, telecommuting and online education have become normal in the post-epidemic period, new energy vehicles have risen rapidly, automobile intelligence has developed rapidly, and the display panel industry has seen a boom and investment scale has gradually expanded.

Combined with the rapid development trend of the display panel industry in recent years, the huge investment enthusiasm of investors and objective development prospects, this paper chooses the display panel industry for research and tests the applicability of capital asset pricing model to the display panel industry. This paper selects the latest data of 12 stocks listed on the Shenzhen Stock Exchange from January 1, 2007 to December 31, 2021, and uses Eviews to conduct regression to conduct empirical research on China's panel industry. Combined with the background of China's stock market, this paper will discuss the explanatory ability of the ß coefficient in the stock price analysis of the panel industry, analyze the investment value of the panel industry, and provide investors with relevant investment suggestions to improve the success rate of investment.

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2. Empirical analysis based on CAPM

2.1 Introduction to CAPM model

Capital Asset Pricing Model (CAPM), based on Markowitz's mean-variance theory in 1959, was deduced by Sharpe and Linter in 1964 and 1965, respectively, when there were risky assets in the market, and studied the relationship between expected return rate and risky assets in the security market under a series of assumptions.

Its hypothesis mainly includes the following six points: the market is completely efficient; investors in the market are rational, that is, to achieve the maximum return rate under the given risk level, and minimize the risk under the expected return rate; there is no institutional restriction on asset trading, such as no restriction on short selling; the market's risk-free rate is fixed and investors can borrow or lend at that rate; individual actions of investors do not affect market prices; there was no change in inflation or interest rates.

The basic form of the CAPM model is:

$$R_i = R_f + \beta(R_m - R_f) \quad (1)$$

Where, R_i represents the expected rate of return of specific asset i; R_f represents the return rate of risk-free assets; R_m stands for expected return rate of market portfolio; $R_m - R_f$ represents the excess return rate of investors taking excess risks under the market portfolio; β coefficient represents the multiple relationship between the risk degree of a specific asset and system risk, and is used to measure the sensitivity of a specific asset to market fluctuations.

2.2 Selection of sample data

2.2.1 Measurement of stock selection and stock return rate R_i

This paper selects 20 stocks from the panel industry of the Shenzhen Stock Exchange (000725 BOE A, 000100 TCLTechnology Group Corporation, 000050 Shentianma A, 000413 Dongxu Optoelectronics, 002387 Visionox, 300398 PhiChem Corporation, 300433 Lens Technology Corporation, 000045 Shenzhen Textile (Holdings) Corporation A, 000536 CPT Technology (group) Corporation, 002189 Costar Group Corporation, 002273 Crystal Optoelectronics, 002217 HOLITECH, 000151 China National Complete Plant Import & Export Corporation, 300088 Wuhu Token Sciences Corporation, 002106 Shenzhen Laibao Hi-Tech Corporation, 300567 Wuhan Jingce Electronic Technology Corporation, 002845 Tongxingda, 600707 Caihong Display Devices Corporation, 601865 Follett, 603920 Olympic Circuit Technology Corporation).

Among them, there are 8 companies (300398 PhiChem Corporation, 300433 Lens Technology Corporation, 000045 Shenzhen Textile (Holdings) Corporation A, 002273 Crystal Optoelectronics, 000151 China National Complete Plant Import & Export Corporation, 300567 Wuhan Jingce Electronic Technology Corporation, 601865 Follett, 603920 Olympic Circuit Technology Corporation) whose panel business occupies a relatively small share in the total business. The contribution of this business line to the yield rate is small, so it is removed. A sample of stock market closing prices of the remaining 12 companies for 15 years from January 1, 2007 to December 31, 2021 are retrieved from the Resset database [1].The data of these 12 stocks are comprehensive and true, with different volumes. The samples have good representativeness and difference, and the sample data is relatively new, which makes the verification results have great practical reference value.

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2.2.2 Measurement of the risk-free rate of return R_f

Xiao, Z., Yang, Y., Li, L., & Zhong, Y. (2019, December) [2] applied the yield to maturity of one-year Treasury bonds to measure the risk-free rate due to the no default risk on our government bonds. Therefore, this article also selects the yield to maturity on the one-year bonds as the risk-free interest rate from Information Memorandum [3] to get the data, take the average during the test and get 1.98%.

2.2.3 Measurement of market portfolio yield R_m

The 12 stock samples selected in this paper are all listed on the Shenzhen Stock Exchange. Therefore, the selection of Shenzhen A-share Index as A value weighting index of stocks [4] can be an appropriate representation of how the sample stock is affected by the market. Take the average test period and get about 2175.35.

2.3 Empirical test

2.3.1 Building a model

In this paper, the least square method is used to analyze sample data, and the risk-return model of each stock is established by using the data in the first part:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{it} \quad (2)$$

Where, R_{it} is the daily return rate of a single stock at time t; R_{mt} is the daily return rate of the market index at time t; R_{ft} is the risk-free rate of return at time t; ε_{it} is estimated residual; α_i and β_i are estimated parameters for individual stocks.

Then, on the basis of the regression of individual stock β coefficient in the first stage,β_i was taken as an independent variable, and the daily excess return rate (R_{it}) of individual stock i at time t was taken as dependent variable, and the second stage regression was conducted for further test.

2.3.2 Regression analysis and test

According to the regression results of the first stage, the paper obtained the β coefficient, the determinable coefficient R^2 and the standard error of the 12 stocks as shown in Table 1 (the regression tool used is Eviews).

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Table 1: β coefficient and R^2 of 12 stocks.

Corporation	Fitting equation	R^2
BOE A	$R_{it} - R_{ft} = 0.000070 + 1.163046(R_{mt} - R_{ft})$	0.555342
TCLTechnology Group Corporation	$R_{it} - R_{ft} = 0.000894 + 1.023212(R_{mt} - R_{ft})$	0.472989
Shentianma A	$R_{it} - R_{ft} = 0.000895 + 1.020399(R_{mt} - R_{ft})$	0.475453
Dongxu Optoelectronics	$R_{it} - R_{ft} = -0.000663 + 1.121313(R_{mt} - R_{ft})$	0.475071
Visionox	$R_{it} - R_{ft} = 0.000697 + 0.958868(R_{mt} - R_{ft})$	0.270616
CPT Technology (group) Corporation	$R_{it} - R_{ft} = 0.000497 + 1.367035(R_{mt} - R_{ft})$	0.354533
Costar Group Corporation	$R_{it} - R_{ft} = 0.002151 + 1.273233(R_{mt} - R_{ft})$	0.394054
HOLITECH	$R_{it} - R_{ft} = -0.000651 + 1.247019(R_{mt} - R_{ft})$	0.408205
Wuhu Token Sciences Corporation	$R_{it} - R_{ft} = 0.000056 + 1.255615(R_{mt} - R_{ft})$	0.541365
Shenzhen Laibao Hi-Tech Corporation	$R_{it} - R_{ft} = 0.000957 + 1.026787(R_{mt} - R_{ft})$	0.456449
Tongxingda	$R_{it} - R_{ft} = 0.000302 + 1.220201(R_{mt} - R_{ft})$	0.327054
Caihong Display Devices Corporation	$R_{it} - R_{ft} = -0.000994 + 1.233939(R_{mt} - R_{ft})$	0.322061

From the regression of the first stage, it can be seen that the β coefficients of the other 11 companies are all greater than 1, except Visionox's β coefficient is less than 1. When the market rate of return fluctuates by 1 unit, the rate of return of Visionox fluctuates by 0.96 units, which is less than the market fluctuation and has less investment risk. The price fluctuation of TCLTechnology Group Corporation, Shentianma A and Shenzhen Laibao Hi-Tech Corporation is close to the market average price fluctuation. And the price fluctuation range of other stocks is significantly higher than the

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market average stock price fluctuation, among which the biggest fluctuation of CPT Technology (group) Corporation is close to 1.4 times of the market, making it among the panel industry stocks with higher investment risks.

By calculating the average determination coefficient of the above stocks, it can be seen that only 42.10% of the change in the excess return rate of individual stocks can be explained by the market excess return rate, and the market portfolio has a general effect on the explanation of the return of individual stocks. The P values of β coefficient are all less than 0.05, and the test results are significant, so it can be concluded that the β coefficient tested in the first stage is basically effective.

The stock portfolio is divided according to the β coefficient of each stock. Alqisie, A., & Alqurran, T. [5] let the stock portfolio be divided by ordering the individual β coefficient of each stock in the sample, and each group contains the same number of stocks. In a similar way, we sorted the β coefficient of each stock from small to large, and divided the stock portfolio into a group of 4 stocks. These 12 stocks can be divided into three groups: Group 1 contains 002387 Visionox, 000050 Shentianma A, 000100 TCLTechnology Group Corporation and 002106 Shenzhen Laibao Hi-Tech Corporation. Group 2 contains 000413 Dongxu Optoelectronics, 000725 BOE A, 002845 Tongxingda and 600707 Caihong Display Devices Corporation.Group 3 comprises 002217 HOLITECH, 300088 Wuhu Token Sciences Corporation, 002189 Costar Group Corporation, and 000536 CPT Technology (group) Corporation.

In the second stage of regression, the β coefficient of 12 stocks was taken as an independent variable, and the regression was carried out with their daily excess average return rate R_i. The result was $R_{it} = 0.0341565\beta_i - 0.00370395$, and the adjusted R^2 is 0.1922. Specific regression results are shown in Table 2.

Table 2: Regression results of β coefficient and daily excess average return rate R_{it}.

Regression variables	regressor coefficient	SE	t-test value	P value
α	-0.0037	0.04718	0.72	0.470
β	0.0342	0.05490	-0.67	0.501

As can be seen from Table 2, the coefficient of individual stock risk premium is only 0.002228, and the determination coefficient is low, only about 20%, and the P value of the independent variable is 0.501, proving that the model fitting effect is poor and the relationship between stock return and β coefficient is not significant.

To sum up, it can be seen that there is a positive correlation between the company's stock return rate and the market return rate, but the applicability of the β coefficient to the panel industry is not high, and the systemic risk can not well explain the fluctuation of the stock return rate. The change in stock return rate is less affected by market indexes and non-system risk still plays a significant role in panel industry investment. Therefore, the CAPM model is not suitable for the forecast analysis of Chinese panel industry companies.

3. Discussion

3.1 Conclusion analysis based on Chinese panel market

As a rational model with extremely strict assumptions, the CAPM model still has many problems in practical application in China's stock market. We find the following facts inconsistent with the assumptions in 2.1.

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3.1.1 China's panel industry is not a perfectly competitive market.

The stake of the government in the panel industry is large, the subsidy of the government given to the penal industry is huge, and the market is relatively concentrated, where the market share and profitability of BOE A, TCLTechnology Group Corporation, and some leading enterprises are much higher than other enterprises. So the panel industry of China is not a perfect competitive market, and it does not meet the assumptions of the CAPM model.

3.1.2 Stock investors in China are highly speculative.

Most of the stock investors in China are retail investors, so there are a large number of frequent speculative transactions, which worsens the competitive environment of the market. At the same time, transaction fees will also affect the market profit, which further interferes with the effectiveness of the CAPM model.

3.1.3 Policy implications cannot be ignored.

China's stock market is a policy market, which is obviously affected by government policies. For example, the law provides different rates of tax burden for different forms of investment, and the time to share cash is also different. The sudden promulgation of laws in response to emergencies will also cause great fluctuations in the stock market.

3.2 Investment suggestions

Since the Chinese stock market is a weak and efficient market, and securities prices can only reflect historical information, which does not conform to the perfectly efficient market hypothesis, we provide the following suggestions for investors.

3.2.1 Assessing the risk of assets by using multiple indicators

Investors should pay attention to the effectiveness of different investment tools in different market backgrounds and apply a number of indicators for comprehensive evaluation, such as the standard deviation coefficient, the total value at risk of the project under the analytic hierarchy process and other joint evaluation of risk coefficient, so as to improve the robustness of evaluation.

3.2.2 Seizing the investment opportunities in upstream new materials

The applications of the panel industry in the midstream and downstream of China are developing rapidly, the development of the upstream raw materials is also relatively large. With the continuous development of the panel industry and the country's strong support, driving panel industry for the future development of new materials and related technology will be the development direction of the future. Investors can pay attention to the application field of new materials to the panel industry.

3.2.3 Paying attention to policies and conduct adequate background checks on investment projects

The panel industry as members of the downstream products such as mobile phones, has an important influence on its price. So, in recent years, countries' support in the panel industry has grown, which means some foam panel industry. As a result, when investing the the technology-intensive industry, investors should respond to a background investigation and risk assessment of the investment projects fully. Don't have a herd mentality.

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4. Conclusion

This paper uses the modern classical financial theory of CAPM to have a quantitative analysis of the panel industry, and verify the validity of the CAPM model of the panel industry in China. From explaining and analyzing the test results, we found that from January 1,2007 to December 31, 2021, β coefficient did not have a fully explain ability and other non-systemic risk factors had a certain ability to explain the stock return rate. The CAPM failed to pass the validity test for China's panel industry.

Due to the limitations of the author's knowledge level and the difficulty of data collection in empirical research, the research of this paper still has some limitations. First of all, the number of listed companies in China's panel industry is small, and only 12 listed companies that meet the research conditions can be selected, so there is a defect of too few samples. Secondly, the Shenzhen Stock Index is used in the study to replace the market return rate, but the stock types included in the Shenzhen Stock Index are not limited to the panel industry, so there is some deviation in the market return rate of the panel industry. Finally, due to the limitation of my analytical ability, there are omissions and incompleteness in the cause analysis of the final test results, which need to be improved.

References

[1] *Data Source, Resset. Retrieved from: http://www.resset.cn.*

[2] *Xiao, Z., Yang, Y., Li, L., & Zhong, Y. (2019, December). Empirical Test of the Effectiveness of CAPM for Shanghai Stock Market-Based on Industry Grouping. In Fourth International Conference on Economic and Business Management (FEBM 2019) Atlantis Press, 2019, pp. 63-68.*

[3] *Information Memorandum. Retrieved from: https://www.chinabond.com.cn.*

[4] *Data Source, SINA-Finance. Retrieved from: https://finance.sina.com.cn.*

[5] *Alqisie, A., & Alqurran, T., Validity of Capital Assets Pricing Model (CAPM) (Empirical Evidences from Amman Stock Exchange). Journal of Management Research, vol. 8(1), 2016, pp. 207-223.*

[6] *Alhabeeb M J. On the Validity of the Capital Asset Pricing Model (CAPM). International Journal of Marketing Studies, vol. 12(4), 2020, p. 1.*

[7] *Brown P, Walter T S. The CAPM: Theoretical validity, empirical intractability and practical applications. vol. 49(s1), 2013, pp. 44-50.*

[8] *Wei D. The Practicability Test of CAPM Model in China Security Market. The Frontiers of Society, Science and Technology, vol. 2(9), 2020.*

[9] *Zubairi H J, Farooq S. Testing the validity of CAPM and APT in the oil, gas and fertilizer companies listed on the Karachi Stock Exchange/2012 Financial Markets & Corporate Governance Conference, 2011.*

[10] *Li Huiqin. Empirical Analysis of CAPM model of Shanghai A-share bank stocks after the financial crisis. Business information, 2012 (7) : 4-5.*

[11] *Mao Yiyu. Empirical research and suggestions based on CAPM applicability to China's semiconductor industry. Investment and Entrepreneurship, vol. 32(01), 2021, pp. 35-37.*

[12] *Wang Yiduo, Wang Xuecong, Wang Qingqing. Empirical research on Chinese liquor listed companies based on CAPM model. Times Finance, (03), 2019, pp. 38-40.*