

Research on the Applicability of CAPM Model in The New Energy Sector of China 'S A-share Market

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Abstract: This paper explores the applicability of the risk-return relationship of the traditional CAPM model in China 's A-share new energy sector. The sample selects the monthly frequency rate of return of 10 listed companies of different sizes as the dependent variable, and the csi 300 as the independent variable to carry out regression analysis. The research content: calculation of β , T-test and coefficient of determination. Experimental conclusion: Systemic risk is not the only influencing factor, and CAPM model is not suitable for China 's new energy sector.

Keywords: CAPM model, China A-share market, New energy sector, Applicability.

1. Introduction

At present, China 's capital market is in a stage of rapid development and gradually moving towards standardization. At the same time, China is experiencing the green industrial revolution. As a high-tech industry, the new energy industry has an important impact on the sustainable development of the economy. Under the background of " double carbon " goal and accelerated economic transformation, the new energy industry has set off a boom in China. In order to promote the development of the new energy industry, the government has implemented an active government subsidy policy, which promotes the continuous inflow of government and social funds into the industry, alleviates the financial pressure of enterprises, stimulates the continuous R & D investment of the new energy industry, enhances the ability of independent innovation, and brings great benefits.

In the past ten years, the market value of new energy enterprises has been increasing, forming a relatively complete industrial chain. At present, the new energy industry is still in the early stage of development, and the development opportunities and potential are constantly released. However, there is a lack of investment confidence in the market, and there are high risks and high returns. The related investment in the upstream and downstream industries of new energy has entered a golden period, and the leading enterprises have cross-border cooperation. The prospect of the new energy industry is considerable, and the future development trend is far greater than other traditional industries.

Capital asset pricing has always been one of the hot spots in the field of modern finance. Academic circles have a wide range of research on asset pricing, and there are different empirical analysis and empirical tests for different capital asset pricing models. Among them, the CAPM model is widely applicable in the stock market, but more and more research conclusions do not support the CAPM model. Among them, the author Fan Dening wrote ' In recent years, Chinese scholars have made a lot of research results on the effectiveness of CAPM model in the domestic stock market. Scholars Wang Wei, Tao Sha and others randomly selected 43 companies distributed in 7 industries for empirical analysis in 'Empirical Test of the Effectiveness of Capital Asset Pricing Model Based on Chinese Enterprises '. It is found that

the CAPM model has a great difference in the effectiveness of different companies, but when 43 listed companies are regarded as a portfolio, the fitting effect is better. In Fan Shicheng 's " Empirical Research Based on CAPM Model in Traditional Chinese Medicine Industry [1] , " the asset portfolio is selected from the traditional Chinese medicine industry, and the market portfolio is selected from the Shanghai Composite Index. The conclusion is that the CAPM fitting effect is not good, but it puts forward an important discussion on the relationship between risks and benefits of the traditional Chinese medicine industry and the development of the traditional Chinese medicine industry. In the empirical study of the CAPM model on China 's liquor industry by Chen Shaohua, the asset portfolio is the liquor industry, and the market portfolio is the csi 300 index. It is concluded that the CAPM model is obviously not applicable to the stock of Chinese liquor industry companies. "

There is a certain gap between the development of China 's financial market and foreign capital market. Therefore, studying the pricing problem of China 's capital market can help investors make better investment decisions and maintain the stability and sound development of the capital market. In recent years, domestic and foreign scholars have tested whether CAPM model, Fama-French three-factor model and arbitrage pricing model can be applied to China 's stock market more comprehensively. For example, CAPM model is used to study the pharmaceutical industry, high-end manufacturing industry, liquor industry and other fields in China 's A-share market. Due to the relatively late development path of the new energy industry, there are few empirical tests of CAPM model for the new energy sector of China 's A-share market, and the research literature on whether CAPM model is applicable to the new energy sector is relatively scarce.

Therefore, based on the above analysis, this paper focuses on the applicability of the CAPM model to the new energy industry in China 's A-share market, and analyzes the relationship between market returns and real risks, so as to help market investors develop more adaptable and more specific investment strategies.

2. Related Theories and Research Methods

2.1. CAPM theory

2.1.1. Presumption

CAPM (capital asset pricing model) is based on Markowitz model. The Capital Asset Pricing Model (CAPM) was developed by American scholars William Sharpe, John Lintner, Jack Treynor and Jan Mossin in 1964 on the basis of portfolio theory and capital market theory. It mainly studies the relationship between the expected return rate of assets and risk assets in the securities market, and how the equilibrium price is formed. It is the pillar of modern financial market price theory, widely used in the field of investment decision-making and corporate finance.

CAPM assumptions which include; Investors are risk averse, utility-maximizing, rational individuals; Investors plan for the same single holding period; Investors have homogeneous expectations or beliefs, the estimates of expected return, variance and covariance are exactly the same; Investors can borrow and lend at a common risk-free rate; Investors are price takers; Information is costless, freely available and instantly absorbed; Markets are frictionless, including no cost and no taxes; All investments are infinitely divisible; All assets, including human capital, are tradable.

2.1.2. Computing formula

When the capital market reaches equilibrium, the marginal price of risk is constant, and the marginal effect of any investment that changes the market portfolio is the same, that is, the compensation for adding a unit of risk is the same. According to the definition of β , the capital asset pricing model is obtained under the condition of balanced capital market:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f] \quad (1)$$

Among them;

R_i The expected rate of return on investment in the i th asset
 R_f Risk-free interest rate, usually expressed as the interest rate on treasury bonds with a maturity of one year.

β_i The β coefficient of the i th asset. The β coefficient can indicate the size of the systemic risk of investing in an asset. In the CAPM model, it is used to express the relationship between the return rate of investing in a certain type of asset and the return rate of the market portfolio.

R_m The expected rate of return of the portfolio in the market

$E[RM-R_f]$ market risk premium

2.2. Research methods

Regression analysis: Using the statistical software SPSS, the regression equation was calculated by the least square method, the significance test was carried out by t-test, and the fitting degree was calculated by R square to analyze whether it has universal applicability.

3. Research on the Applicability of CAPM Model in China's A-share New Energy Sector

3.1. Selection and processing of sample data

The sample selects the effective monthly frequency trading data of 10 new energy stocks in the A-share plate from June 30, 2015 to June 30, 2020, covering different sizes (large, small and medium-sized) new energy listed companies, in order to reflect a long-term average level of the new energy stock market, making the experimental conclusions more effective. The data comes from the Oriental Wealth Network. Methods Referring to the empirical test of the applicability of Yang Shuanghui and Zheng Zhikai's CAPM model in the A-share market [2].

3.1.1. The calculation of the monthly yield of a single stock

$$R_t = (P_t - P_{t-1}) / P_{t-1}$$

Among them:

R_t represents the stock yield at the end of the t month;

p_t represents the closing price of the stock at the end of the t month;

p_{t-1} represents the closing price of the stock at the end of the $t-1$ month.

3.1.2. On the calculation of the market rate of return

Select the Shanghai and Shenzhen 300 Index as a market index

$$R_{mt} = (P_{mt} - P_{mt-1}) / P_{mt-1}$$

Among them:

R_{mt} represents the market portfolio yield at the end of the t month;

P_{mt} represents the closing price of the market portfolio at the end of the t th month;

p_{mt-1} represents the closing price of the market portfolio at the end of the $t-1$ month.

Table 1. Monthly return on 10 stocks R_t

stocks	2015	2016	2017	2018	2019	2020
BYD	-0.0827	0.0187	0.0053	0.0964	0.0865	0.2622
Zhongneng Electric	0.0972	0.1677	0.0028	-0.3333	-0.0186	0.0737
Ningde era				0.0015	0.0312	0.2243
Longji Green Energy	-0.2315	0.1131	0.0893	-0.2010	0.0249	0.3563
Chang 'an Automobile	0.0058	-0.0182	0.0764	-0.1141	-0.0520	-0.0579
Wanma shares	-0.0740	0.0377	0.0165	-0.1337	-0.0523	0.0115
Zhongyeda	0.3076	0.0749	0.1115	-0.1509	-0.0184	-0.0654
Huicheng Technology	-0.1850	0.0814	-0.1593	0.0216	0.0652	0.1760
Dahua shares	-0.2608	-0.0068	0.2392	-0.0702	0.01821	0.6449
Kyung Yi Wisdom	0.2930	-0.0709		-0.1801	-0.0451	0.1870

3.1.3. About the selection of risk-free rate of return

Select the three-month fixed deposit annualized interest rate to represent the risk-free rate of return R_f .

3.2. Applicability research process and analysis

Through SPSS software, the least square method is used for

regression analysis. The average monthly return rate of ten companies in the past five years is taken as the dependent variable Y, and the average market return rate in the past five years is taken as the independent variable X.

Table 2. csi 300 index market rate of return R_m

stocks	2015	2016	2017	2018	2019	2020
csi 300 index	-0.0570	-0.0073	0.0491	-0.0761	0.0519	0.0756

Table 3. Regression data of 10 companies

Stocks	β	T	R square
BYD	0.856	3.307	0.732
Zhongneng Electric	0.424	0.937	0.180
Ningde era	0.712	1.014	0.507
Longji Green Energy	0.866	3.476	0.750
Chang 'an Automobile	0.301	0.632	0.091
Wanma shares	0.691	1.911	0.477
Enterprise up	-0.170	-0.346	0.029
Huicheng Technology	0.383	0.830	0.147
Dahua shares	0.794	2.615	0.631
Kyung Yi Wisdom	0.189	0.334	0.036

3.2.1. Calculation of β coefficient

If $\beta < 0$, it indicates that the two are negatively correlated ; if $\beta = 0$, it shows that there is no relationship between stock returns and market portfolio returns ; if $0 < \beta < 1$, the stock return rate is lower than the market portfolio return rate, and the system risk is lower than the market risk ; if $\beta > 1$, the stock yield is greater than the market yield portfolio ; system risk is higher than market risk ;

from the table, it can be seen that the β value of the ten new energy companies is negative, the β value of the other nine companies is between 0-1, the stock return rate is lower than the market return rate level, and the system risk is lower than the market risk.

3.2.2. T-test

Assuming that the significance level is 0.01 and the degree of freedom is 60, the corresponding T distribution table shows that the critical value $T(0.005) = 2.660$.

Among them, only two new energy companies, BYD and Longji Green Energy, have significantly higher T values than the critical values, while the remaining eight companies have significantly lower T values than the critical values. The relationship between independent variables and dependent variables is not significant.

3.2.3. Analysis of the coefficient of determination

The coefficient of determination is between 0-1. The greater the coefficient of determination, the better the model fitting degree and the reproduction, indicating that the worse the model fitting degree.

According to the regression results, the R side of Longji Green Energy is the largest, indicating that the company 's stock price changes are greatly affected by changes in the market index. Among them, only 4 stocks have a coefficient of determination > 0.5 , and the remaining 6 stocks have a coefficient of determination < 0.5 . The proportion of systemic risk to total risk is small, and most of the stock price changes are caused by non-systemic risk. Reference Li Kaixuan 's capital asset pricing model (CAPM) in the applicability of

China 's stock market ' [3] .

4. Conclusion

In conclusion ,through regression analysis, it is found that the applicability of CAPM model to China 's A-share new energy market is not high, and the β values of 10 new energy companies are mostly between 0-1. The relationship between stock returns and market returns is not significant ; through the analysis of the coefficient of determination, the R-square majority of the 10 sample companies is less than 0.5, and the fitting degree of Ling Yi Zhi Zao is the worst. Therefore, it can be seen that the company risk of China 's new energy sector not only depends on market risk, but also other influencing factors, such as policies, asymmetric information disclosure and other influencing factors. The CAPM model only considers the system risk, and assumes that the market is effective, which is a completely idealized market and simplifies the complex situation. However, in practice, China 's new energy capital market is in a weak effective market, and the market will appear various situations and fluctuations.

5. Outlook

There are some shortcomings in this paper, which can be improved from the following aspects :

1.Adjust the original model, build a three-factor model, starting from the reasons not applicable. Since systemic risk is not the only factor, consider other factors such as the size of the company 's equity, false information and so on.

2.Adjust the time dimension and increase the number of samples. Make the experimental results more accurate and effective, and improve the correlation between variables.

3.Study the relationship between portfolio and market portfolio. On the basis of expanding the sample size, the original single stock is packaged into an asset portfolio, and regression analysis is used for research.

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