

CAPM Model Testing and Factor Analysis

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Abstract. The relationship between the risk and return of stocks has always been a hot topic of research by scholars from various countries. This paper uses daily data from six stocks in the Chinese market from January 1, 2020 to December 31, 2021 to calculate individual stock returns and conduct CAPM testing. In order to avoid the non-synchronous trading problem, this paper also conducted conditional CAPM testing and compared the results with traditional CAPM testing. In addition, this paper constructed a single group and a double group investment portfolio for 42 stocks in China, with the single group based on the return on equity, size, and market risk of the stocks, while the double group based on the return on equity and size of the stocks. It was found that the portfolio was difficult to achieve stable positive returns. Finally, this paper also analyzes the corresponding risk factor, profit factors and scale factors, and finds that these factors can not reflect the returns of individual stocks well.

Keywords: Capital asset pricing model; stock return; group regression; factor analysis.

1. Introduction

In 1952, Markowitz [1] proposed the mean-variance model to demonstrate the advantages of diversified investment, laying the foundation of modern asset portfolio theory. However, this model uses variance to measure risk and requires a symmetrical distribution of returns. The assumptions are too strict, and when solving large-scale investment portfolios, the computational burden is too large. After the Markowitz portfolio theory, Sharpe [2] characterized the generation of equilibrium prices for financial assets based on a series of assumptions, abandoned computational accuracy to simplify related operations, and used the fitting relationship between stock returns and market returns to obtain effective asset portfolios. Finally, he developed a classic Capital Asset Pricing Model (CAPM), proving that market portfolios are effective investment portfolios in equilibrium markets.

After the traditional CAPM model was proposed, a large number of scholars began to conduct empirical tests on it. Lintner [3] and Douglas [4] were the first to use the excess return rate of individual stocks to empirically test the CAPM model. The results showed that the value of the intercept term in the regression model was far greater than the risk-free rate, the coefficient β was statistically significant but the value was very small, and the residual risk would affect the return rate of assets, which was obviously contrary to the assumptions and conclusions of the traditional CAPM model. Subsequently, Black et al.[5] used portfolio returns to test the CAPM model. Fama and MacBeth[6] added two new explanatory variables to the regression based on Black et al., tested the fit of the CAPM model between 1935 and 1968 using 20 portfolio samples, and conducted cross-sectional regression on data from each month. The results showed that the CAPM model was not valid in practical problems.

Since the birth of the CAPM model in the 1960s, western scholars have conducted a series of empirical tests and improvements on it. The initial test results were mostly in support of the model, such as Fama and French [7], who believed that there was a positive relationship between stock returns and their risk, and that asset portfolios were mean-variance efficient. Subsequently, they provided the most classic test results and obtained a three factor model. They used data from the United States from 1961 to 1989 for empirical testing and found that CAPM was not applicable under the premise that β was the only regression coefficient. They then added scale factor, book-to-market value as explanatory variables to the model, resulting in the famous three factor model.

A number of domestic scholars have conducted empirical research on the risk characteristics of China's securities market using various models and methods.

Early CAPM models only used the β as the only factor affecting the difference in stock returns, and it was widely used in investment decision-making and corporate finance due to its simplified formula and convenient operation. Wu [8] selected over 400 stocks (funds) from the Shanghai stock market as research samples, and based on the principle of β coefficient measurement risk, divided the investment portfolio according to the calculated β value. He proposed a β coefficient-based investment portfolio strategy, which is a good application and expansion of the CAPM model.

In addition, Chen and Qu [9] used Shanghai stock market data from January 1994 to December 1998 as the research subject, and the empirical results showed that the β coefficient in the CAPM model can better measure market risk, but can not determine the correlation between β and the return rate. Chen et al. [10] used data from the domestic stock market before 2000 to analyze and found that the traditional CAPM model cannot provide a reasonable explanation for the differences in stock returns. Yang [11], Du [12], and others have conducted research on the Shenzhen stock market and found that the CAPM model cannot fully explain the return volatility of Chinese stocks, and is not applicable to the domestic market.

2. CAPM Testing

2.1. Theoretical Assumptions

The Capital Asset Pricing Model implies a series of assumptions about the market and investors. The specific assumptions are as follows:

- (1) Investors are rational and pursue mean variance optimization.
- (2) Investors are risk averse and seek to maximize the utility of their wealth.
- (3) Only consider the single investment period.
- (4) Investors have consistent expectations over the same period.
- (5) All assets are publicly traded on the exchange and short selling is allowed, and investors can access or lend funds at risk-free rate.
- (6) All information is publicly available.
- (7) There is no friction in the market, and there is no transaction cost or income tax.

2.2. Data

This article selects six stocks from the Shanghai Main Board, Shenzhen Main Board, SME Board, and ChiNext Board to test the CAPM model. Data on daily stock prices, risk-free returns, net asset returns, and other data for 24 months from January 1, 2020, to December 31, 2021, were downloaded from the RESSET database. Among them, the risk-free rate of return is selected from the 6-month short-term treasury rate, and the market rate of return is calculated based on the CSI 300 index. To ensure the accuracy of the results, the total closing time for each stock shall not exceed 15 days, and the monthly closing time shall not exceed 3 days. The specific information of the 6 stocks selected is shown in Table 1.

Table 1. Stock Selection

Stock code	Industry	Market
000006	Real estate	Shenzhen Stock Exchange
002006	Machinery	Shenzhen Stock Exchange
300006	Biopharmaceuticals	ChiNext
600006	Automobile making	Shanghai Stock Exchange
601006	Transportation	Shanghai Stock Exchange
603016	Component manufacturing	Shanghai Stock Exchange

The daily return calculated based on the daily closing price is the logarithmic return, and the specific calculation formula is as follows:

$$r_t = \ln \frac{P_t}{P_{t-1}} \quad (1)$$

P_t is the price of the stock at moment t . The descriptive statistics of the obtained returns are shown in Table 2. The results in the table show that the mean values of all six stocks are small, with four stocks having negative mean values of returns and two stocks having positive mean values of returns. The standard deviation is also less than 0.1. Since the stock prices after ex-rights and ex-dividends were not downloaded when the data was downloaded, the factor will show that the minimum and maximum values of the returns exceed the limit of increase and decrease. In terms of skewness and kurtosis, the returns of all six stocks do not conform to a normal distribution, and most of the stocks show a spike right skew in their returns.

Table 2. Descriptive Statistics

Stock code	Mean value	Standard deviation	Minimum	Maximum	Skewness	Kurtosis
000006	-0.0004	0.0237	-0.1058	0.0956	0.0593	6.2845
002006	0.0037	0.0384	-0.1056	0.0962	0.2306	0.8176
300006	-0.0028	0.0785	-1.5668	0.1821	-16.2453	321.4697
600006	-0.0000	0.0357	-0.3830	0.0959	-2.2706	27.0241
601006	-0.0001	0.0133	-0.0850	0.1820	4.4462	76.6537
603016	0.0026	0.0588	-0.1055	1.0663	12.1926	217.5082

Note: The sample period for the data in the table is from January 1, 2020, to December 31, 2021. ± 0.0000 indicates that the absolute value of the value is less than 0.00005.

2.3. Traditional CAPM

The formula for the CAPM model is shown below:

$$r_i - r_f = \alpha_i + \beta_i(r_m - r_f) + \varepsilon \quad (2)$$

Among them, r_i is the individual stock return, r_f is the risk-free return, r_m is the market return, and ε is the residual. First, a full-sample regression is conducted for six stocks, and the regression results obtained are shown in Table 3. From the constant term, only one stock, 002006, has a significantly positive α . The remaining stocks have positive and negative α , but none of them pass the significance test. From the regression coefficients, the coefficients of all stocks are significantly positive at the 1% level of significance. Overall, the results obtained from the full sample regression cannot verify the CAPM, but the positive correlation between stock returns and market returns can be basically determined.

Table 3. Traditional CAPM Full Sample Regression Results

Stock code	α	t value	β	t value	Idiosyncratic Volatility	R^2
000006	-0.0007	-0.6717	0.7020***	9.3126	0.0005	0.1520
002006	0.0034**	2.0212	0.6619***	5.1096	0.0014	0.0512
300006	-0.0031	-0.8778	0.7444***	2.7619	0.0061	0.0155
600006	-0.0003	-0.1894	0.7724***	6.5195	0.0012	0.0807
601006	-0.0003	-0.5133	0.3348***	7.7161	0.0002	0.1095
603016	0.0024	0.9077	0.6251***	3.1018	0.0034	0.0195

Note: The table shows the results of CAPM full-sample regressions conducted on six stocks for the sample period January 1, 2020 to December 31, 2021. The values of t correspond to the results of the variables in their preceding column. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant.

In addition to the full-sample regression, this paper also performs a single-month regression for each stock. Due to space limitation, only the means of the single-month regressions are shown in Table 4 in this paper. From the table, we can see that the mean values of the constant terms of the single-month regressions are positive and negative, but they are not significant. Half of the coefficient means of the single-month regressions are significantly positive, while the other half are positive but insignificant. Therefore, the results of single month regression cannot validate CAPM. In addition, the positive correlation between stock returns and market returns that can be obtained in the full sample regression is not fully verified in the single-month regression.

Table 4. Traditional CAPM Single-month Regression Mean

Stock code	α	t value	β	t value
000006	-0.0007	-0.3077	0.6637**	2.1518
002006	0.0033	0.3467	0.7836	1.3564
300006	-0.0047	-0.0732	0.6119	1.3070
600006	-0.0005	-0.0630	0.7926*	1.6775
601006	-0.0002	-0.1670	0.3005**	1.9650
603016	0.0035	-0.0924	0.6113	1.1463

Note: The table shows the results of CAPM single-month regressions conducted on six stocks for the sample period January 1, 2020, to December 31, 2021. The values of t correspond to the results of the variables in their preceding column. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant.

2.4. Conditional CAPM

In order to avoid the non-synchronous trading problem, this article also introduces the conditional CAPM model, which adds an excess market return rate with a lag of one period to the traditional CAPM model. The model formula is as follows:

$$\begin{cases} R_t = a + b \cdot RM_t + c \cdot RM_{t-1} + \varepsilon_t \\ \hat{\beta} = \hat{b} + \hat{c} \end{cases} \quad (3)$$

R_t represents the excess return of individual stocks at moment t , RM_t represents the excess return of the market at moment t , RM_{t-1} represents the excess return of the market at moment $t - 1$ (i.e., lagged first order), and ε_t is the residual. In this paper, we first run a full-sample regression on six stocks, and the results obtained are shown in Table 5. From the regression results, although the constant term of each stock is close to 0, the constant term of only one stock is significantly 0. From the regression coefficients at time t , all coefficients are significantly positive. From the lagged order regression coefficients, there are positive and negative coefficients, and most of them are insignificant. Adding the coefficients obtained at time t to those obtained at time $t - 1$, the resulting $\hat{\beta}$ is significantly positive. It is noteworthy that stock 002006 is the only stock with significant positive results in all regressions, which indicates that this stock fits well into the conditional CAPM model. Overall, the conditional CAPM model is basically not validated in the full sample regression.

Table 5. Conditional CAPM Full Sample Regression Results

Stock code	a	t value	b	t value	c	t value	$\hat{\beta}$	t value
000006	0.00	-0.70	0.70***	9.28	0.11	1.48	0.81***	10.76
002006	0.00*	1.91	0.66***	5.08	0.28**	2.21	0.94***	7.29
300006	0.00	0.07	0.74***	6.66	0.06	0.51	0.79***	7.17
600006	0.00	0.36	0.77***	7.53	0.02	0.21	0.79***	7.74
601006	0.00	-1.53	0.34***	10.35	-0.05*	-1.66	0.28***	8.69
603016	0.00	0.11	0.63***	5.57	0.14	1.21	0.76***	6.78

Note: The table shows the results of conditional CAPM full sample regressions for six stocks for the sample period January 1, 2020, to December 31, 2021. The values of t correspond to the results of the variables in their preceding column. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant. ± 0.00 indicates that the absolute value of the value is less than 0.005.

In addition to full sample regression, this section also conducted single-month regression. Consistent with the previous content, this section only displays the mean results of single-month regression, as shown in Table 6. From the results in the table, it can be seen that the constant terms are all close to 0, but not significant, and the obtained coefficient terms are also basically not significant. This indicates that in the case of single-month regression, conditional CAPM cannot be verified.

Table 6. Conditional CAPM Single-month Regression Mean

Stock code	a	t value	b	t value	c	t value	$\hat{\beta}$	t value
000006	0.00	-0.35	0.56*	1.75	-0.06	0.06	0.50*	1.81
002006	0.00	0.26	0.80	1.29	0.15	0.11	0.95	1.40
300006	0.00	-0.10	0.71	1.24	0.14	0.14	0.84	1.37
600006	0.00	-0.14	0.82*	1.72	0.20	0.13	1.02*	1.85
601006	0.00	-0.26	0.30*	1.88	-0.04	-0.32	0.26	1.56
603016	0.00	-0.11	0.51	0.98	0.12	0.24	0.63	1.23

Note: The table shows the mean values of the results of conditional CAPM single-month regressions performed on six stocks, with the sample period from January 1, 2020, to December 31, 2021. The values of t correspond to the results of the variables in their previous column. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant. ± 0.00 indicates that the absolute value of the value is less than 0.005.

In order to compare the results of the traditional CAPM with those of the conditional CAPM, the coefficient values of the two models are also summarized and compared in this paper, as shown in Table 7. From the summary results, the $\hat{\beta}$ obtained from the conditional CAPM is basically consistent in sign with the β obtained from the traditional CAPM. From the single-month regression results, the $\hat{\beta}$ obtained from the conditional CAPM and the β obtained from the traditional CAPM for stocks 000006 and 600006 are both significantly positive, while the results for the rest of the stocks are largely insignificant. It can be seen that the positive correlation between stock returns and market returns cannot be confirmed in any of the single-month regression cases. From the full-sample regression results, the $\hat{\beta}$ obtained from the conditional CAPM and the β obtained from the traditional CAPM are both positive and significant at the 1% level of significance, indicating that the positive correlation between stock returns and market returns can be basically identified.

Table 7. Summary Comparison of Traditional CAPM and Conditional CAPM Regression Results

	Panel A: Single-month regression mean		Panel B: Full sample regression	
Stock code	$\hat{\beta}$	β	$\hat{\beta}$	β
000006	0.50*	0.66**	0.81***	0.70***
002006	0.95	0.78	0.94***	0.66***
300006	0.84	0.61	0.79***	0.74***
600006	1.02*	0.79*	0.79***	0.77***
601006	0.26	0.30**	0.28***	0.33***
603016	0.63	0.61	0.76***	0.63***

Note: Panel A shows the mean of the results of single-month regressions conducted on six stocks, and Panel B shows the results obtained from full-sample regressions on six stocks, where $\hat{\beta}$ corresponds to the conditional CAPM and β corresponds to the traditional CAPM. The sample

period is from January 1, 2020, to December 31, 2021. *, **, *** denote significant at 10%, 5%, and 1% significant levels, respectively. Bolded font indicates that the value is statistically significant.

3. Portfolio Approach

This paper further performs grouped portfolio analysis using size factor, return factor and risk factor, and this section contains 42 stocks in the Chinese market.

3.1. *SIZE* Single Group Analysis

The company size (the logarithm of the company's market capitalization) of the 42 stocks obtained for each month is arranged in descending order, where the top 30% of the largest *SIZE* values are the *High group*, whose corresponding returns (weighted by market capitalization or equal weights) are r_H ; those with *SIZE* values in the 30%-70% range are the *Median group*, whose corresponding returns (weighted by market capitalization or equal weights) are r_M ; the lowest *SIZE* values in the last 30% are the *Low group*, whose corresponding returns (weighted by market value or equal weight) are r_L . The return corresponding to the *High – Low* group is also calculated as $r_H - r_L$.

Firstly, group the *SIZE* using market capitalization weighting, and the results are shown in Table 8. From the results in the table, it can be found that, when the *SIZE* is in the bottom 30%, the average value of the corresponding stock return is greater than the corresponding value in the top 30%, but less than the average value of the returns where the *SIZE* is in the 30%-70% range. Therefore, the relationship between *SIZE* and stock returns cannot be determined on the premise of grouping *SIZE* using market capitalization weighting. r_L , r_M , r_H , $r_H - r_L$ are not significant, so one cannot earn excess returns by shorting stocks with large *SIZE* and going long stocks with small *SIZE* or shorting stocks with small *SIZE* and going long stocks with large *SIZE*. This again shows that the size factor of a stock has no significant correlation with the stock's return.

Table 8. Weighted Grouping with Market Value of *SIZE*

Year and month	<i>Low SIZE</i>	<i>Median SIZE</i>	<i>High SIZE</i>	<i>High – Low</i>
202002	0.1203	-0.1815	0.0342	-0.0861
202003	-0.0065	-0.0271	-0.0453	-0.0389
202004	0.0112	0.0058	0.0356	<u>0.0244</u>
202005	-0.0031	-0.0230	0.0031	<u>0.0061</u>
202006	-0.0032	0.0880	0.0727	<u>0.0758</u>
202007	0.0614	0.1347	0.0683	<u>0.0069</u>
202008	0.0517	0.0660	0.0061	-0.0456
202009	-0.0681	-0.0848	-0.0337	<u>0.0344</u>
202010	-0.0204	0.0002	0.0006	<u>0.0209</u>
202011	0.0128	0.0307	0.0361	<u>0.0233</u>
202012	-0.1061	-0.0298	0.0214	<u>0.1275</u>
202101	-0.1613	-0.0781	0.0669	<u>0.2282</u>
202102	0.0944	0.0078	-0.0345	-0.1289
202103	0.0351	0.0613	-0.0005	-0.0356
202104	-0.0058	0.0213	0.0313	<u>0.0371</u>
202105	0.06031	0.0691	0.0339	-0.0265
202106	0.0374	-0.0042	-0.0168	-0.0542
202107	-0.0205	-0.0145	-0.1068	-0.0863
202108	0.0109	0.1200	-0.0448	-0.0557
202109	-0.0116	0.0204	0.0813	<u>0.0929</u>
202110	-0.0687	-0.0356	-0.0594	<u>0.0093</u>
202111	0.0654	0.0605	-0.0291	-0.0945
202112	0.0692	0.0549	0.0481	-0.0211
Mean value	0.0067	0.0114	0.0073	0.0006
<i>t</i> value	0.5103	0.7959	0.7463	0.0360

Note: The table shows the results obtained after the *SIZE* market capitalization weighted single grouping of 42 stocks. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive.

The results obtained by also grouping *SIZE* using equal weighting weights are shown in Table 9. From the regression results, grouping *SIZE* with equal weighting weights and observing the mean and significance results of returns, it can be found that the conclusion reached is similar to that of market capitalization weighting, i.e., there is no significant correlation between the size factor of the stock and the return of the stock.

Table 9. Weighted Grouping with Equal Weights of *SIZE*

Year and month	<i>Low SIZE</i>	<i>Median SIZE</i>	<i>High SIZE</i>	<i>High – Low</i>
202002	0.1161	-0.1397	0.0159	-0.1002
202003	-0.0062	-0.0306	-0.0496	-0.0434
202004	0.0205	0.0135	0.0542	<u>0.0336</u>
202005	-0.0012	-0.0371	-0.0009	<u>0.0003</u>
202006	-0.0037	0.0822	0.0448	<u>0.0485</u>
202007	0.0585	0.1510	0.0805	<u>0.0220</u>
202008	0.0426	0.0307	0.0395	-0.0031
202009	-0.0762	-0.0875	0.0044	<u>0.0806</u>
202010	-0.0263	-0.0094	0.0592	<u>0.0855</u>
202011	0.0083	0.0453	0.0538	<u>0.0456</u>
202012	-0.1156	-0.0247	0.0604	<u>0.1760</u>
202101	-0.1474	-0.0660	0.1032	<u>0.2506</u>
202102	0.0728	-0.0056	-0.0403	-0.1131
202103	0.0480	0.0577	-0.0532	-0.1012
202104	0.0065	0.0547	0.0463	<u>0.0398</u>
202105	0.0665	0.0650	0.0336	-0.0329
202106	0.0244	-0.0024	-0.0042	-0.0286
202107	-0.0118	-0.0271	-0.1542	-0.1424
202108	0.0049	0.1099	-0.0743	-0.0792
202109	-0.0150	0.0077	0.0828	<u>0.0978</u>
202110	-0.0711	-0.0515	-0.0463	<u>0.0248</u>
202111	0.0505	0.0784	-0.0511	-0.1017
202112	0.0693	0.0612	0.0449	-0.0244
Mean value	0.0050	0.0120	0.0108	0.0059
<i>t</i> value	0.3904	0.8730	0.8582	0.3025

Note: The table shows the results obtained after weighting a single grouping of 42 stocks with equal weights of *SIZE*. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive.

3.2. ROE Single Group Analysis

The return on equity (*ROE*) of the 42 stocks obtained for each month is arranged in descending order, where the top 30% of the largest *ROE* values are the *High group*, whose corresponding returns (weighted by market capitalization or equal weights) are r_H ; those with *ROE* values in the 30%-70% range are the *Median group*, whose corresponding returns (weighted by market capitalization or equal weights) are r_M ; the lowest *ROE* values in the last 30% are the *Low group*, whose corresponding returns (weighted by market value or equal weight) are r_L . The return corresponding to the *High – Low* group is also calculated as $r_H - r_L$.

Firstly, the *ROE* is grouped using market capitalization weighting and the results obtained are shown in Table 10. From the regression results, grouping *ROE* by market capitalization weighting, it is found that the mean value of return increases as the value of the group in which *ROE* is located increases, so it can be concluded that there is a positive relationship between stock returns and *ROE*. In particular, the mean value of return of r_H is significantly positive and the return of $r_H - r_L$ is significantly positive, which indicates that investors are able to earn excess returns by going long stocks with high *ROE* and shorting stocks with low *ROE*. This again indicates that there is a positive relationship between the earnings factor of a stock and the stock return.

Table 10. Weighted Grouping with Market Value of *ROE*

Year and month	Low <i>ROE</i>	Median <i>ROE</i>	High <i>ROE</i>	High – Low
202002	-0.0901	-0.0378	0.0678	<u>0.1579</u>
202003	-0.0123	-0.0261	-0.0406	-0.0283
202004	0.0162	0.0150	0.0194	<u>0.0033</u>
202005	-0.0041	-0.0057	-0.0170	-0.0129
202006	0.0190	0.0272	0.1252	<u>0.1062</u>
202007	0.0609	0.1073	0.1025	<u>0.0415</u>
202008	0.0297	0.0548	0.0418	<u>0.0121</u>
202009	-0.0458	-0.0981	-0.0395	<u>0.0062</u>
202010	-0.0629	0.0355	-0.0003	<u>0.0627</u>
202011	0.0357	0.0686	-0.0334	-0.0692
202012	-0.0633	-0.0454	-0.0023	<u>0.0610</u>
202101	-0.1626	0.0296	-0.0643	<u>0.0983</u>
202102	0.0589	-0.0108	0.0240	-0.0349
202103	0.0145	0.0341	0.0536	<u>0.0391</u>
202104	-0.0151	-0.0151	0.0853	<u>0.1004</u>
202105	0.0437	0.0481	0.0763	<u>0.0326</u>
202106	0.0486	-0.0241	-0.0034	-0.0520
202107	-0.0495	-0.0529	-0.0305	<u>0.0191</u>
202108	0.0564	0.0031	0.0536	-0.0028
202109	0.0117	0.0403	0.0335	<u>0.0218</u>
202110	-0.0342	-0.0620	-0.0615	-0.0274
202111	0.0038	0.0543	0.0400	<u>0.0362</u>
202112	0.0445	0.0345	0.0981	<u>0.0535</u>
Mean value	-0.0042	0.0076	0.0230**	0.0272**
<i>t</i> value	-0.3694	0.7667	2.0555	2.4196

Note: The table shows the results obtained after a single grouping of 42 stocks with market capitalization weighted by *ROE*. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive. *, **, *** indicate significant at 10%, 5%, and 1% significant levels, respectively. Bolded font indicates that the value is statistically significant.

The results obtained by also grouping *ROE* using equal weighting weights are shown in Table 11. From the regression results, it can be observed that the increasing trend in the mean value of the returns no longer exists, and the results obtained are no longer significant. The possible explanation is that companies with high *ROE* tend to be large companies, and the share of large companies weighted by market capitalization would be larger and the effect more pronounced.

Table 11. Weighted Grouping with Equal Weights of *ROE*

Year and month	<i>Low ROE</i>	<i>Median ROE</i>	<i>High ROE</i>	<i>High – Low</i>
202002	-0.1260	-0.0094	0.0402	<u>0.1662</u>
202003	-0.0082	-0.0457	-0.0533	-0.0452
202004	0.0523	0.0648	0.0424	-0.0099
202005	0.0102	0.0576	-0.0299	-0.0401
202006	0.0244	0.0686	0.0426	<u>0.0182</u>
202007	0.0383	0.1298	0.0946	<u>0.0563</u>
202008	0.1085	-0.0214	0.0308	-0.0777
202009	-0.0126	-0.0534	0.0179	<u>0.0304</u>
202010	-0.0760	0.0990	0.0134	<u>0.0893</u>
202011	0.0840	0.1318	-0.0453	-0.1293
202012	-0.0586	0.0342	0.0810	<u>0.1396</u>
202101	0.0028	0.1348	-0.0299	-0.0327
202102	-0.0282	-0.0481	0.0021	<u>0.0303</u>
202103	0.1091	-0.0873	0.0189	-0.0902
202104	-0.0053	0.0350	0.0691	<u>0.0744</u>
202105	-0.0173	0.0333	0.0530	<u>0.0703</u>
202106	0.0557	-0.0447	0.0179	-0.0378
202107	-0.1931	-0.0569	-0.1427	<u>0.0504</u>
202108	0.0222	-0.0065	-0.1167	-0.1389
202109	0.0007	0.1700	0.0695	<u>0.0688</u>
202110	-0.0199	-0.0310	-0.0826	-0.0628
202111	-0.0147	-0.0612	0.0044	<u>0.0191</u>
202112	0.0563	0.0033	0.1226	<u>0.0663</u>
Mean value	0.0002	0.0216	0.0096	0.0094
<i>t</i> value	0.0143	1.4247	0.7104	0.5722

Note: The table shows the results obtained after weighting a single grouping of 42 stocks with equal weights of *ROE*. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive.

3.3. β Single Group Analysis

The market risk (β) of the 42 stocks obtained for each month is arranged in descending order, where the top 30% of the largest β values are the *High group*, whose corresponding returns (weighted by market capitalization or equal weights) are r_H ; those with β values in the 30%-70% range are the *Median group*, whose corresponding returns (weighted by market capitalization or equal weights) are r_M ; the lowest β values in the last 30% are the *Low group*, whose corresponding returns (weighted by market value or equal weight) are r_L . The return corresponding to the High-Low group is also calculated as $r_H - r_L$.

Firstly, the β is grouped using market capitalization weighting and the results obtained are shown in Table 12. From the regression results, grouping β by market capitalization weighting, it is found that the mean value of return increases as the value of the group in which β is located increases. In this case, the mean of the returns of r_H is significantly positive, but the returns of $r_H - r_L$ are not significant, which indicates that it is not possible to earn excess returns by going long stocks with high β and short stocks with low β or short stocks with high β and long stocks with low β . In general, the relationship between the risk factor of the stock and the return of the stock cannot be fully recognized.

Table 12. Weighted Grouping with Market Value of β

Year and month	<i>Low β</i>	<i>Median β</i>	<i>High β</i>	<i>High – Low</i>
202002	-0.1798	-0.0393	0.1593	<u>0.3391</u>
202003	-0.0010	-0.0131	-0.0681	-0.0671
202004	0.0021	-0.0052	0.0583	<u>0.0561</u>
202005	0.0114	-0.0352	0.0037	-0.0077
202006	0.0337	0.0214	0.1178	<u>0.0841</u>
202007	0.0777	0.1166	0.0743	-0.0034
202008	0.0658	0.0368	0.0279	-0.0379
202009	-0.0248	-0.0883	-0.0726	-0.0478
202010	-0.0363	-0.0189	0.0400	<u>0.0764</u>
202011	0.0507	0.0439	-0.0180	-0.0687
202012	-0.0812	-0.0130	-0.0242	<u>0.0570</u>
202101	-0.1573	-0.0544	0.0337	<u>0.1910</u>
202102	0.0781	-0.0148	0.0096	-0.0685
202103	0.0314	0.0902	-0.0323	-0.0637
202104	0.0505	-0.0021	0.0038	-0.0467
202105	0.0803	0.0636	0.0206	-0.0597
202106	-0.0381	0.0241	0.0239	<u>0.0621</u>
202107	-0.0469	-0.0727	-0.0087	<u>0.0382</u>
202108	0.0511	0.0301	0.0257	-0.0254
202109	0.0066	0.0696	0.0026	-0.0041
202110	-0.0605	-0.0651	-0.0314	<u>0.0292</u>
202111	0.0393	0.0153	0.0526	<u>0.0132</u>
202112	0.0114	0.0591	0.1009	<u>0.0895</u>
Mean value	-0.0016	0.0065	0.0217*	0.0233
<i>t</i> value	-0.1090	0.5931	1.9084	1.1943

Note: The table shows the results obtained from a single grouping of 42 stocks with β market capitalization weighting. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant.

The results obtained by also grouping β using equal weighting weights are shown in Table 13. From the regression results, it is found that there is no significant trend relationship between the mean value of return and the value of the group in which β is located under the premise of grouping β using equal weighting weights, where the mean value of return for $r_H - r_L$ is significantly positive and the rest are not significant.

Table 13. Weighted Grouping with Equal Weights of β

Year and month	<i>Low</i> β	<i>Median</i> β	<i>High</i> β	<i>High</i> – <i>Low</i>
202002	-0.0567	-0.0296	0.0741	<u>0.1308</u>
202003	-0.0721	-0.0016	-0.0347	<u>0.0374</u>
202004	0.0032	0.0155	0.1184	<u>0.1152</u>
202005	-0.0206	0.0101	-0.0070	<u>0.0136</u>
202006	0.0015	0.1086	0.0852	<u>0.0837</u>
202007	0.1182	0.0900	0.0465	-0.0717
202008	0.0302	0.0509	0.0310	<u>0.0008</u>
202009	-0.0267	0.0072	-0.0512	-0.0246
202010	-0.0321	0.0774	0.0463	<u>0.0784</u>
202011	0.0635	0.0637	0.0367	-0.0268
202012	-0.0202	0.0730	0.1436	<u>0.1638</u>
202101	0.1042	-0.0164	0.1017	-0.0025
202102	0.0406	-0.0320	-0.0478	-0.0884
202103	0.0270	0.1204	-0.1452	-0.1722
202104	0.0672	-0.0051	0.0549	-0.0123
202105	0.0166	0.0432	0.0431	<u>0.0266</u>
202106	-0.0463	-0.0297	0.0316	<u>0.0779</u>
202107	-0.1625	-0.0739	-0.1394	<u>0.0232</u>
202108	0.0191	-0.0727	-0.0769	-0.0960
202109	0.0400	0.1977	0.0427	<u>0.0027</u>
202110	-0.1070	-0.0439	-0.0176	<u>0.0894</u>
202111	-0.0238	-0.0765	-0.0069	<u>0.0169</u>
202112	-0.0162	0.0469	0.0629	<u>0.0791</u>
Mean value	-0.0023	0.0227	0.0170	0.0193
<i>t</i> value	-0.1760	1.6094	1.1211	1.1958

Note: The table shows the results obtained by weighting a single grouping of 42 stocks with equal weights of β . The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive.

3.4. Double Group Analysis

In addition to single-group analysis, this paper also conducts a two-group analysis based on size (*SIZE*) and return on net assets (*ROE*). Since this paper uses a dependent grouping analysis, the order of grouping will have an impact. In this paper, *SIZE* is firstly divided into *Low group*, *Median group* and *High group* according to market capitalization weighting or equal weighting, and then *ROE* in each *SIZE* grouping is divided into *Low group*, *Median group* and *High group* according to market capitalization weighting or equal weighting, which is a 3×3 grouping pattern. Then *ROE* is grouped first and then *SIZE* is grouped in the same way as before, which is also a 3×3 grouping pattern. Since there is not much difference between the results obtained by market value weighting and by equal weighting, only the double-group results obtained by market value weighting are reported in the main text.

The first is the weighted grouping of the market value of *SIZE* followed by *ROE*, and the results are shown in Table 14. From the results, it can be seen that under the weighted market value of *Low SIZE*, there is an increasing trend in the average *ROE* group return, but the effect is not significant. Under the weighted market value of *Median SIZE*, there is also an increasing trend in the average *ROE* group return, where r_H and $r_H - r_L$ is significantly positive. Under the weighted market value of *High SIZE*, there is no significant trend in the average *ROE* group return, and none of them are significant. This indicates that in the *SIZE* before *ROE* market capitalization weighted group, only in the *Median SIZE* market capitalization weighted group can investments obtain excess returns by long selling high *ROE* stocks and short selling low *ROE* stocks.

Table 14. *SIZE* Followed by *ROE* Market Capitalization Weighted Grouping

<i>SIZE</i> groupi ng	<i>Low SIZE</i>				<i>Median SIZE</i>				<i>High SIZE</i>			
<i>ROE</i> groupi ng	<i>Low ROE</i>	<i>Median ROE</i>	<i>High ROE</i>	<i>High -Low</i>	<i>Low ROE</i>	<i>Median ROE</i>	<i>High ROE</i>	<i>High -Low</i>	<i>Low ROE</i>	<i>Median ROE</i>	<i>High ROE</i>	<i>High -Low</i>
202002	-0.0311	0.1450	0.2408	<u>0.2719</u>	-0.3682	-0.0591	-0.1417	<u>0.2265</u>	-0.0859	0.1240	0.0420	<u>0.1279</u>
202003	0.0473	-0.0242	-0.0382	-0.0855	-0.0206	-0.0370	-0.0215	-0.0010	-0.0585	-0.0447	-0.0330	<u>0.0254</u>
202004	0.0067	0.0128	0.0138	<u>0.0071</u>	0.0048	-0.0155	0.0325	<u>0.0277</u>	0.0624	0.0633	-0.0257	-0.0881
202005	0.0376	-0.0155	-0.0282	-0.0658	-0.0270	-0.0282	-0.0127	<u>0.0143</u>	0.0155	0.0020	-0.0080	-0.0236
202006	0.0165	-0.0091	-0.0155	-0.0321	0.0529	0.0061	0.2214	<u>0.1686</u>	0.0273	0.0517	0.1442	<u>0.1169</u>
202007	0.0168	0.0891	0.0714	<u>0.0545</u>	0.1021	0.1832	0.1091	<u>0.0070</u>	-0.0036	0.0862	0.1179	<u>0.1215</u>
202008	-0.0312	0.0530	0.1328	<u>0.1640</u>	0.1027	0.0497	0.0489	-0.0538	0.0606	-0.0495	0.0210	-0.0396
202009	-0.0646	-0.0787	-0.0583	<u>0.0064</u>	-0.0570	-0.1164	-0.0747	-0.0176	-0.0563	-0.0385	-0.0050	<u>0.0513</u>
202010	-0.0641	-0.0108	0.0113	<u>0.0754</u>	-0.0796	0.0283	0.0464	<u>0.1260</u>	0.0674	-0.0140	-0.0480	-0.1154
202011	0.0170	0.0313	-0.0146	-0.0316	0.0331	0.0184	0.0432	<u>0.0101</u>	0.1300	0.0408	-0.0637	-0.1937
202012	-0.1373	-0.1098	-0.0703	<u>0.0669</u>	-0.0381	-0.0225	-0.0303	<u>0.0078</u>	0.0040	0.0068	0.0569	<u>0.0529</u>
202101	-0.4183	-0.0629	-0.0273	<u>0.3910</u>	-0.0951	-0.0662	-0.0754	<u>0.0198</u>	0.1023	0.1278	-0.0446	-0.1469
202102	0.2049	0.0848	-0.0040	-0.2090	0.0347	-0.0454	0.0449	<u>0.0101</u>	-0.0570	-0.0444	0.0003	<u>0.0573</u>
202103	-0.0097	0.0751	0.0299	<u>0.0396</u>	0.0254	0.1032	0.0468	<u>0.0214</u>	0.0693	-0.0860	0.0366	-0.0327
202104	-0.0804	0.0755	-0.0329	<u>0.0475</u>	-0.0025	0.0266	0.0386	<u>0.0411</u>	-0.0463	0.0666	0.0648	<u>0.1112</u>
202105	0.0292	0.0155	0.1474	<u>0.1183</u>	0.0843	0.0169	0.1165	<u>0.0322</u>	0.0028	0.0720	0.0173	<u>0.0145</u>
202106	0.0335	0.0785	-0.0099	-0.0434	-0.0417	-0.0070	0.0367	<u>0.0784</u>	0.0332	-0.0150	-0.0689	-0.1021
202107	0.0001	-0.0880	0.0432	<u>0.0430</u>	0.0100	-0.0917	0.0538	<u>0.0439</u>	-0.1161	-0.0762	-0.1358	-0.0196

202108	0.058 2	- 0.0066	- 0.014 5	- 0.072 7	0.140 5	0.0882	0.1378	-0.0028	- 0.014 4	- 0.0906	- 0.017 9	- 0.003 4
202109	0.007 2	0.0162	- 0.065 1	- 0.072 3	- 0.006 1	0.0034	0.0674	<u>0.0735</u>	0.110 4	0.1315	- 0.010 5	- 0.120 9
202110	- 0.065 8	- 0.0551	- 0.088 6	- 0.022 7	- 0.001 7	- 0.0534	-0.0483	-0.0466	- 0.021 0	- 0.0521	- 0.107 0	- 0.086 0
202111	0.124 0	0.0305	0.050 3	- 0.073 7	0.070 1	0.0321	0.0849	<u>0.0148</u>	- 0.046 6	- 0.0643	0.032 3	<u>0.078 9</u>
202112	0.040 2	0.0731	0.093 5	<u>0.053 2</u>	- 0.017 5	0.0994	0.0740	<u>0.0915</u>	0.044 1	0.0307	0.074 0	<u>0.029 9</u>
Mean value	- 0.011 4	0.0139	0.016 0	0.027 4	- 0.004 1	0.0049	0.0347 **	0.0388* **	0.009 7	0.0099	0.001 7	- 0.008 0
<i>t</i> value	- 0.496 4	1.0430	0.994 3	1.068 4	- 0.202 6	0.3488	2.1683	2.9244	0.728 7	0.6882	0.124 9	- 0.424 6

Note: This table shows market capitalization-weighted portfolio returns for the 42 stocks grouped first by *SIZE* and then by *ROE*. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant.

Next is the weighted grouping of *ROE* followed by *SIZE* market value, as shown in Table 15. From the results, it can be seen that under the weighted market capitalization of *Low ROE* and *Median ROE*, there is no trend in the average return rate of the *SIZE* group, and neither is significant. Under the weighted market value of *High ROE*, there is a decreasing trend in the average return rate of the *SIZE* group, where r_L is significantly positive, $r_H - r_L$ is significantly negative. This indicates that in the *ROE* followed by *SIZE* market capitalization weighted group, only in the *High ROE* market capitalization weighted group can investments obtain excess returns by long selling small *SIZE* stocks and short selling large *SIZE* stocks.

Table 15. *ROE* Followed by *SIZE* Market Capitalization Weighted Grouping

<i>ROE</i> groupi ng	<i>Low ROE</i>				<i>Median ROE</i>				<i>High ROE</i>			
	<i>Low SIZE</i>	<i>Median SIZE</i>	<i>High SIZE</i>	<i>High -Low</i>	<i>Low SIZE</i>	<i>Median SIZE</i>	<i>High SIZE</i>	<i>High -Low</i>	<i>Low SIZE</i>	<i>Median SIZE</i>	<i>High SIZE</i>	<i>High -Low</i>
202002	0.112 7	0.0099	- 0.418 0	- 0.530 7	- 0.045 5	- 0.0877	0.029 8	<u>0.075 3</u>	0.2408	- 0.0286	0.015 3	-0.2255
202003	- 0.032 8	- 0.0117	0.007 4	<u>0.040 2</u>	- 0.002 9	- 0.0767	0.011 2	<u>0.014 1</u>	-0.0382	- 0.0105	- 0.080 8	-0.0426
202004	- 0.039 5	0.0319	0.052 1	<u>0.091 6</u>	0.035 8	- 0.0226	0.039 2	<u>0.003 4</u>	0.0206	0.0391	- 0.006 4	-0.0270
202005	- 0.013 1	- 0.0055	0.006 5	<u>0.019 7</u>	- 0.004 5	- 0.0001	- 0.013 8	- 0.009 3	0.0151	- 0.0552	- 0.001 5	-0.0167
202006	0.010 8	0.0189	0.027 4	<u>0.016 5</u>	- 0.005 0	0.0293	0.057 0	<u>0.061 9</u>	0.2228	0.1167	0.038 2	-0.1846

202007	0.023 8	0.0478	0.114 4	<u>0.090</u> 6	0.058 4	0.1789	0.070 5	<u>0.012</u> 1	0.0714	0.1330	0.095 4	<u>0.0241</u>
202008	0.002 1	0.0358	0.049 7	<u>0.047</u> 6	0.176 9	0.0126	- 0.016 5	- 0.193 4	0.1328	0.0016	0.000 9	-0.1319
202009	- 0.029 9	- 0.0165	- 0.098 2	- 0.068 3	- 0.145 7	- 0.0855	- 0.065 8	<u>0.079</u> 9	-0.0583	- 0.0550	- 0.001 6	<u>0.0567</u>
202010	- 0.027 1	- 0.0479	- 0.117 6	- 0.090 5	0.032 3	- 0.0112	0.094 8	<u>0.062</u> 5	0.0639	- 0.0427	- 0.011 4	-0.0753
202011	0.009 9	0.0239	0.076 3	<u>0.066</u> 4	0.037 2	0.0400	0.134 4	<u>0.097</u> 2	-0.0198	- 0.0217	- 0.061 7	-0.0419
202012	- 0.096 5	- 0.0632	- 0.030 2	<u>0.066</u> 3	- 0.126 7	- 0.0347	0.023 2	<u>0.149</u> 9	-0.0295	- 0.0226	0.050 3	<u>0.0798</u>
202101	- 0.370 5	- 0.1603	0.042 3	<u>0.412</u> 8	- 0.016 7	- 0.0540	0.176 2	<u>0.193</u> 0	-0.1034	- 0.0825	- 0.002 5	<u>0.1009</u>
202102	0.187 1	0.0491	- 0.057 0	- 0.244 0	0.056 6	0.0190	- 0.114 1	- 0.170 8	0.0590	- 0.0011	0.020 5	-0.0385
202103	- 0.014 2	- 0.0064	0.069 3	<u>0.083</u> 5	0.071 6	0.0971	- 0.079 2	- 0.150 8	0.1009	0.0597	- 0.001 3	-0.1021
202104	- 0.067 4	0.0226	- 0.010 0	<u>0.057</u> 4	- 0.008 1	- 0.0156	- 0.021 4	- 0.013 4	-0.0202	0.1819	0.070 1	<u>0.0904</u>
202105	0.065 3	0.0480	0.016 7	- 0.048 6	0.105 1	0.0458	- 0.006 1	- 0.111 1	0.0515	0.1380	0.023 8	-0.0277
202106	0.067 4	0.0777	- 0.006 6	- 0.074 0	- 0.022 0	- 0.0314	- 0.017 6	<u>0.004</u> 4	0.0464	- 0.0359	- 0.012 6	-0.0590
202107	0.027 3	- 0.0417	- 0.136 1	- 0.163 4	- 0.025 7	- 0.0675	- 0.062 7	- 0.037 0	0.0647	- 0.0117	- 0.149 1	-0.2138
202108	0.039 2	0.0179	0.121 8	<u>0.082</u> 6	- 0.015 0	0.0472	- 0.031 7	- 0.016 7	0.2237	0.0373	- 0.096 0	-0.3197
202109	- 0.004 0	0.0487	- 0.018 8	- 0.014 9	- 0.038 5	- 0.0332	0.207 2	<u>0.245</u> 8	-0.0224	0.0501	0.068 9	<u>0.0913</u>
202110	- 0.041 9	- 0.0385	- 0.021 0	<u>0.020</u> 9	- 0.095 4	- 0.0424	- 0.052 1	<u>0.043</u> 3	0.0089	- 0.0816	- 0.107 0	-0.1160
202111	0.088 5	- 0.0236	- 0.046 6	- 0.135 1	0.063 1	0.1458	- 0.064 3	- 0.127 4	0.0945	0.0026	0.032 3	-0.0621
202112	0.058 6	0.0137	0.068 8	<u>0.010</u> 2	0.081 1	- 0.0045	0.034 7	- 0.046 4	0.0248	0.1759	0.074 0	<u>0.0492</u>
Mean value	- 0.001 9	0.0013	- 0.013 4	- 0.011 4	0.007 2	0.0021	0.014 5	0.007 2	0.0500 **	0.0212	- 0.001 8	- 0.0518 **
t value	- 0.092 5	0.1301	- 0.590 1	- 0.333 7	0.482 5	0.1507	0.873 2	0.319 3	2.7284	1.3118	- 0.144 9	-2.2878

Note: This table shows market capitalization-weighted portfolio returns for the 42 stocks grouped first by *ROE* and then by *SIZE*. The values in the table are all return values, and the underline highlights the results where $r_H - r_L$ is positive. *, **, and *** indicate significant at the 10%, 5%, and 1% significance levels, respectively. Bolded font indicates that the value is statistically significant.

4. Factor Regression

At the end of this article, factor regression was also conducted. First by running a two-factor regression of *SIZE* and *ROE* separately with the market return portfolio, and then putting the three together in a three-factor regression. This section includes 6 stocks in the Chinese market, and specific stock information is shown in Table 1.

4.1. Two-factor Regression

A two-factor regression of *SIZE* was first performed and the regression model is shown below:

$$r_i - r_f = \alpha_i + \beta_1 MKT_t + \beta_2 SIZE_t + \varepsilon \quad (4)$$

Among them, r_i represents the individual stock yield; r_f is the risk-free return rate; MKT_t represents the market excess return rate, i.e. the value of $r_m - r_f$; $SIZE_t$ is the regression factor constructed by grouping according to *SIZE* (weighted by market value or equal weight), i.e. the value of $r_H - r_L$. The obtained regression results are shown in Table 16, and it can be seen from the results that whether weighted by market value or equal weight, the constant terms of the model are basically not significant. The coefficients of market excess returns and *SIZE* are positive and negative, but they are basically not significant. Overall, the scale factor *SIZE* does not reflect individual stock returns well.

Table 16. *SIZE* Factor Regression Results

Panel A:Market capitalization weighting						
Stock code	α	t value	β_1	t value	β_2	t value
000006	-0.0223	-0.9624	1.3390**	2.4599	-0.1715	-0.5304
002006	0.0929**	2.5080	-0.9329	-1.0712	0.1040	0.2012
300006	-0.0715	-0.9254	0.7014	0.3862	1.0291	0.9541
600006	0.0036	0.1104	-0.2403	-0.3111	1.2252**	2.6701
601006	-0.0049	-0.3975	0.0045	0.0156	0.0352	0.2037
603016	0.0531	1.0235	-0.0183	-0.0150	-0.8483	-1.1698
Panel B:Equal weight weighting						
Stock code	α	t value	β_1	t value	β_2	t value
000006	-0.0218	-0.9501	1.4233**	2.5570	-0.2151	-0.7772
002006	0.0922**	2.4956	-0.7754	-0.8638	-0.0859	-0.1924
300006	-0.0750	-0.9797	0.4624	0.2487	1.0143	1.0973
600006	-0.0009	-0.0272	-0.2952	-0.3606	0.9694**	2.3815
601006	-0.0050	-0.4085	-0.0002	-0.0008	0.0311	0.2090
603016	0.0559	1.0981	0.2333	0.1885	-0.8926	-1.4508

Note: The table shows the results of *SIZE* factor regressions for six stocks. Panel A corresponds to the results of *SIZE* weighted by market capitalization and Panel B corresponds to the results of *SIZE* weighted by equal weights. The values of t correspond to the results of the variables in their previous column. *, **, *** indicate significant at 10%, 5%, and 1% significant levels, respectively. Bolded font indicates that the value is statistically significant.

Next, perform a two-factor regression on *ROE*, and the regression model is as follows:

$$r_i - r_f = \alpha_i + \beta_1 MKT_t + \beta_2 ROE_t + \varepsilon \quad (5)$$

Among them, ROE_t is the regression factor constructed based on ROE grouping (weighted by market value or equal weight), i.e. the value of $r_H - r_L$. The other variables are consistent with the definition of formula (4). The obtained regression results are shown in Table 17, and it can be seen from the results that whether weighted by market value or equal weight, the constant terms of the model are basically not significant. The coefficients of market excess returns and ROE are positive and negative, but they are basically not significant. Overall, the profit factor ROE does not reflect individual stock returns well.

Table 17. ROE Factor Regression Results

Panel A:Market capitalization weighting						
Stock code	α	t value	β_1	t value	β_2	t value
000006	-0.0265	-1.0371	1.1710**	2.3311	0.2016	0.4671
002006	0.0911**	2.2254	-0.8693	-1.0824	0.0502	0.0727
300006	0.0231	0.3298	2.3121*	1.6829	-3.9211***	-3.3211
600006	0.0154	0.3726	0.7956	0.9835	-0.7020	-1.0099
601006	-0.0132	-1.0113	-0.0407	-0.1595	0.3171	1.4457
603016	0.0026	0.0494	-1.1067	-1.0863	2.1559**	2.4624
Panel B:Equal weight weighting						
Stock code	α	t value	β_1	t value	β_2	t value
000006	-0.0215	-0.9190	1.2145**	2.4285	0.0061	0.0206
002006	0.0921**	2.4793	-0.8656	-1.0885	0.0336	0.0716
300006	-0.0618	-0.8669	1.8739	1.2285	-1.9476**	-2.1641
600006	0.0062	0.1887	0.8921	1.2756	-1.1351**	-2.7507
601006	-0.0078	-0.7249	-0.0486	-0.2115	0.3521**	2.5991
603016	0.0529	1.0025	-0.7580	-0.6708	0.5865	0.8797

Note: The table shows the results of ROE factor regressions for six stocks. Panel A corresponds to the results of ROE weighted by market capitalization and Panel B corresponds to the results of ROE weighted by equal weights. The values of t correspond to the results of the variables in their previous column. *, **, *** indicate significant at 10%, 5%, and 1% significant levels, respectively. Bolded font indicates that the value is statistically significant.

4.2. Three-factor Regression

Finally, considering the impact of scale factor $SIZE$ and profit factor ROE on individual stock returns, the regression model established is as follows:

$$r_i - r_f = \alpha_i + \beta_1 MKT_t + \beta_2 SIZE_t + \beta_3 ROE_t + \varepsilon \quad (6)$$

The definition of variables in the equation is consistent with the above. The results of the three-factor regression are shown in Table 18, and it can be found that the constant terms are basically not significant. The coefficients of each factor are positive and negative, but most of them are not significant. Compared to the scale factor $SIZE$, the coefficient of the profit factor ROE has a higher frequency of significance, which may indicate to some extent that the profit factor ROE has a stronger explanatory power on individual stock returns. However, due to the relatively small number of selected samples, there is a high degree of randomness.

Table 18. Three-factor Regression Results

Panel A:Market capitalization weighting								
Stock code	α	t value	β_1	t value	β_2	t value	β_3	t value
000006	-0.0296	- 1.1222	1.3152**	2.3724	-0.2243	- 0.6605	0.2775	0.6130
002006	0.0924**	2.1697	-0.9342	- 1.0431	0.1010	0.1841	0.0160	0.0219
300006	0.0489	0.7562	1.0922	0.8038	1.8975**	2.2801	- 4.5631***	- 4.1121
600006	0.0351	1.0241	-0.1381	- 0.1917	1.4523***	3.2911	-1.1933**	- 2.0281
601006	-0.0135	- 0.9981	-0.0234	- 0.0822	-0.0269	- 0.1543	0.3262	1.4030
603016	-0.0157	- 0.3243	-0.2419	- 0.2373	-1.3452**	- 2.1545	2.6111***	3.1363
Panel B:Equal weight weighting								
Stock code	α	t value	β_1	t value	β_2	t value	β_3	t value
000006	-0.0219	- 0.9283	1.4199**	2.4774	-0.2163	- 0.7603	0.0200	0.0671
002006	0.0919**	2.4132	-0.7819	- 0.8460	-0.0882	- 0.1922	0.0393	0.0815
300006	-0.0594	- 0.8498	0.7982	0.4708	1.1324	1.3458	-2.0207**	- 2.2861
600006	0.0084	0.3091	-0.0955	- 0.1454	1.0396***	3.1910	- 1.2021***	- 3.5124
601006	-0.0078	- 0.7044	-0.0586	- 0.2196	0.0106	0.0799	0.3515**	2.5240
603016	0.0509	0.9952	0.1259	0.1013	-0.9304	- 1.5093	0.6465	0.9983

Note: The table shows the results of a three-factor regression for six stocks. Panel A corresponds to the results weighted by market capitalization and Panel B corresponds to the results weighted by equal weights. The values of t correspond to the results of the variables in their preceding column. *, **, *** indicate significant at 10%, 5%, and 1% significant levels, respectively. Bolded font indicates that the value is statistically significant.

5. Conclusion

This paper selects the data of six stocks in the Chinese market from January 1, 2020 to December 31, 2021 to verify the capital asset pricing model, that is, the traditional CAPM. To avoid non-synchronous trading problem, this paper also introduces conditional CAPM. From the regression results, although the coefficients of both models are significantly positive across the entire sample range, the constant terms are not significantly 0, and from the single-month regression results, the coefficients are basically not significant. In general, the capital asset pricing model does not conform to the characteristics of Chinese stock market.

In addition, 42 stocks in the Chinese market were randomly selected in this paper and analyzed for *SIZE*, *ROE*, and β single grouping and *SIZE*, *ROE* double grouping respectively. The regression results reveal that there is no significant correlation between the scale factor *SIZE* and stock returns.

In the equal-weighted grouping, there is a significant positive relationship between the earnings factor *ROE* and stock returns, but this relationship disappears in the market capitalization-weighted grouping. The possible explanation is that companies with high *ROE* tend to be large companies, and the share of large companies will be larger and the effect will be more pronounced after weighting by market capitalization. The relationship between a stock's risk factor β and the stock's return is also not fully confirmed.

Finally, this paper also performs factor regressions on the scale factor *SIZE* and the profitability factor *ROE*, and the regressions show mostly insignificant results.

Taken together, the results show that, in general, stocks in the Chinese market do not satisfy the basic assumptions of the capital asset pricing model, but since the sample period chosen in this paper is only 2 years and the number of stocks chosen is relatively small, the results in this paper do not reflect the long-term situation and are subject to a high degree of chance.

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