The Effectiveness Analysis of CAPM Model and Fama French Three Factor Model on China's Growth Enterprise Market

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Abstract

As an emerging sector in China, gem has become an important part of China's securities market after more than ten years of reform and development. Based on camp model and Fama French three factor model, this paper takes the three factor indicators of market factor, scale factor and company book value as the basic explanatory variables of the model, and uses the monthly data of China's GEM listed companies from January 2019 to June 2021. To test the effectiveness of CAPM model and Fama French three factor model in China's gem, and compare them. The results show that the scale effect, book value and market value of FF three factor model are not significant.In the current trend of China's GEM market, investors are more likely to choose small and medium-sized gem enterprises with high market capitalization, which has the advantage of "small company effect". The scale effect of large-scale enterprises with large market capitalization is negative. During the research period, CAPM model is effective in China's market, but Fama French model is not obviously effective in China's market. FF three factor model does not give sufficient explanation to China's GEM market at this stage and is not better than CAPM model.

Keywords

Fama French Model; CAPM Model; Effectiveness.

1. Introduction

Capital asset pricing has always been one of the hot topics in the field of modern finance, which has produced many related theories.Among them, the CAPM model proposed by William sharp et al. In 1964, the APT model proposed by Stephen rose in 1976 and the three factor model proposed by Fama French in 1992.Especially on the basis of CAPM model, Fama French creatively found that the company size and book to market ratio are also important factors affecting the return of portfolio. Since the establishment of the growth enterprise market in 2009, it has provided a platform for many innovative enterprises such as new entrepreneurial, small and medium-sized high-tech companies that have not yet met the conditions for successful circulation and listing on the domestic main board exchanges. Gem is a unique and important member of the national market system structure.On the main board, the classical CAPM model and Fama French three factor model have been widely recognized, but few in-depth studies have been conducted in the GEM market.

The research on securities financial market in China started relatively late.Its development path and formation characteristics are different from those of foreign capital markets. If we simply use CAPM model to systematically study and analyze the historical average stock return rate formed in the operation of gem, it is not comprehensive enough.Therefore, we need to improve this. We need to use Fama French's three factor model for an effectiveness test to see if it is applicable to China's stock market.

This paper tests the effectiveness of CAPM model and Fama French three factor model on China's gem, and compares whether the two models can be effectively used in China's gem and whether they can effectively price capital assets.

2. Literature Review

Under normal conditions, the average return of venture capital asset projects such as stock, futures and bond repurchase is relatively uncertain for a certain period of time.Capital asset pricing model analysis (CAPM) reflects the correlation between a specific risk level in an asset and its return, that is, high risk is usually accompanied by higher return.Moreover, the asset pricing model is based on some assumptions.Haoxiaoyan (2002) believes that the theory is reflected in the following contents: (1) each investor effectively avoids its market risk and pursues the maximization of everyone's wealth appreciation;(2) Investors are the recipients of market price information. They have the same expectation of return on asset cost and interest under a normal equilibrium interest rate distribution;(3) For financial assets with risk-free return, investors can freely, flexibly and effectively choose to borrow a sum of cash, bonds and stocks at any time by using a risk-free return interest rate;(4) Financial asset portfolios can be listed on the stock exchange separately, making them effectively combined and split separately;(5) In the whole capital market trading system, the various effective capital market transactions obtained are a form of free trading service (or the transaction cost of investment operation is relatively small). On the asset information platform, investors can obtain various asset information other than their own asset information.Although the basic assumptions of these theories may be inconsistent with people's objective reality to some extent, the various forms of economic states formed by using these theoretical assumptions help people understand the theories of various asset pricing models.

Li Yang (2013) compared and analyzed the applicability of CAPM and FF three factor models in China's growth enterprise market.Through time series regression and cross-sectional regression, it is found that FF three factor model is more suitable for gem.Zhaotiantian (2017) took the GEM stocks from 2010 to 2016 as the research object, used the three factor model to analyze, and found that the FF three factor model could not fully explain the changes in the gem stock returns.Lizhibing (2017) analyzed the A-share data before and after the share reform based on the FF three factor and five factor models, and found that the market risk before the share reform was dominant, and the profitability, investment style and momentum factors were "redundant". After the share reform, the risk premium of these three factors was significant.Wenyi (2019) used the FF three factor model to conduct regression analysis on the GEM market. The empirical results show that there is an obvious market premium and scale effect in China's GEM market.However, the book to market ratio effect is not obvious.Zhang Bing (2017) tested the effect of low-cost stocks under the framework of the three factor model.The addition of price factor can significantly improve the forecasting ability of the pricing model.Zhaoshengmin (2016) found that the market value effect and value effect of China's stock market are obvious. The three factor model is more suitable for China. The effectiveness of the factor pricing model varies with the level of market development and investment philosophy.

To sum up, the existing literature on the effectiveness of the asset pricing model of the GEM market is not much, and the conclusions are not the same. Most of the time series studied are in the early development of the GEM market, and the three factor model is not unified in terms of analysis caliber. Most of the data intercepted by scholars are divided into weeks, and few studies are based on months.Therefore, based on the CAPM model and the three factor model, this paper studies and analyzes the GEM market with the month as the cycle, and explores the effectiveness of the CAPM model and the three factor model on the GEM market in China.

3. Data Source and Model Construction

(1) Selection of sample data

The data in this paper only comes from CSMAR database, and the listed companies whose shares are closed, there are obvious statistical errors in the data, and there are major deficiencies in historical data will not be taken into account temporarily (Li Yang, 2013).Therefore, the data only selected in this paper refers to all sample data of more than 100 Chinese gem stock indexes covering more than 30 natural months from late January 2019 to early June 2021.

(2) Model construction

Asset pricing model system risk (CAPM) pricing model is a theoretical model in the financial field. It was first proposed by johnwilliams SharpMan to systematically reflect the company's systematic risk status.At the same time, camp model is actually based on a series of assumptions. These assumptions include: (1) most investors are extremely averse to this kind of market risk. How to balance the relationship between risk premium rate and risk reward, and how to maximize the return of this kind of risk wealth;(2) In the capital market, all assets can be split without transaction costs or income taxes;(3) There are risk-free assets in the market, and accordingly such assets have a risk-free rate of return;(4) Investors can borrow without restriction, and the interest rate of borrowing is the same.The formula in CAPM model is as follows:

$$R_{it} - R_{Ft} = a_i + \beta_i(R_{Mt} - R_{Ft}) + e_{it} \qquad (1)$$

The coefficient isβ, The risk index used to measure the price fluctuation of individual stocks or stock funds relative to the whole stock market.

Fama and French added the market value factor and book to market ratio factor to the above model, and proposed the three factor model as follows:

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + e_{it} \qquad (2)$$

Where R_{it} is the yield of portfolio I in the T period, R_{Ft} is the risk-free interest rate, and Mn is equal to the difference between R_{it} and R_{Ft}.$R_{Mt}$is the weighted average market portfolio yield of the current market value, $R_{Mt} - R_{Ft}$ reflecting the market risk premium of Risk Premium.SMB_t is the market value factor, the difference between the yield of small market value and large market value stock portfolio.HML_t is the book to market ratio factor, and the difference between the yield of stock portfolio with high book to market ratio and low book to market ratio.Factor data is from CSMAR database, and the portfolio method is 2×3 method.

4. Analysis of Empirical Results

In order to ensure the validity and accuracy of the research results, it is necessary to test and analyze the data.

(1) Descriptive statistical analysis can be seen from the results of descriptive statistics,

The average scale of the market risk premium factor is -1%, the average scale factor is -0.2%, and the average book value ratio to the scale factor is -0.1%, indicating that the gem did not make profits during the study period.The yield of small market value companies is lower than that of large market value companies, and the effect of high book value ratio is not obvious.According to the calculation method of book value ratio factor and the mean value is negative.It can be seen that the low book value is higher than the company's income.From the perspective of kurtosis and skewness, the kurtosis is large, and all factors generally have a right

skew distribution, that is, the numerical mode < median < average.For a financial asset, if its expected rate of return has a high kurtosis, it indicates that the expected rate of return of the asset has a relatively high probability to take the extreme value, and the probability of sharp fluctuations in the future market of the asset is relatively high

(2) Correlation and unit root test

Through the analysis of Stata indicators, it can be seen that the correlation coefficient between the market risk premium factor and the book market value factor is about 0.158, the correlation coefficient between the market risk premium factor and the book market value ratio factor is about -0.286, and the correlation coefficient between the book market value factor and the book market value factor is about -0.5544.Each factor showed weak correlation.The nonstationary time factor series will cause some false relationships between the two time variable series. In order to further prevent the occurrence of false regression in the pseudo regression test method, we need to re verify the stationarity of the time series in the strategy combination.It can be seen from the analysis of the results of Stata test that whether it is the result of LLC test or IPS test, the original hypothesis is rejected. After adding the first-order lag term sequence and re testing, it is found that the sequence is still shown as a stable time series. Therefore, we can still re test and analyze the regression.

(3) Single factor regression analysis based on CAPM model

Table 1 shows the empirical analysis results of six groups of stocks (SL, SM, SH, BL, BM, BH) formed in the gem according to the cross grouping method as representative samples to verify whether the relationship between market factors and returns meets the expectations of CAPM model.

Table 1. Single factor regression analysis results of 6 groups of stocks

scale	Book to market ratio BM					
M	L	M	H	L	M	H
	Constant term			P value		
S	– 0.013 ***	– 0.017 *****	– 0.015 *****	0.016	0.000	0.000
B	0.000	– 0.011 *****	– 0.020 *****	0.972	0.007	0.000
	Market factor coefficient			P value		
S	0.901 *****	0.843 *****	1.034 *****	0.000	0.000	0.000
B	1.047 *****	0.938 *****	1.082 *****	0.000	0.000	0.000
	Adjust R2			F value		
S	0.301	0.225	0.304	141.513	153.179	369.820
B	0.301	0.313	0.426	270.183	244.924	221.300

Note: the data in the table are reserved to 3 decimal places, and * * *, ** *, * represent the statistical significance of 1%, 5% and 10% respectively.

It can be seen from the table that: first, the P values corresponding to the regression coefficients of each stock portfolio are all 0, indicating that the market factors are significant at the level of 1%;And the regression coefficient is about 1, that is, the stock premium return on the gem is positively related to the market risk premium, and the stock can quickly respond to changes in the market environment, which is in line with the expectations of the model.The second is to observe the constant items. Except that the large market value and low book value are significantly not 0 than the stock portfolio, the constant items of other portfolios are significant at the level of 5%, indicating that CAPM model has a relatively good explanation for the gem.Third, observe the overall significance, adjust the goodness of fit to about 0.3 and the F statistic is greater than its critical value. CAPM model has certain applicability, but it can not

fully explain the fluctuation of stock return.Therefore, we will introduce a three factor model for analysis.

(4) Multivariate regression analysis based on FF three factor model

The following is a three factor model empirical analysis using six stock portfolios as representative samples, as shown in Table 2.

Table 2. Three factor regression results of each group of stocks

scale	Book to market ratio BM					
M	L	M	H	L	M	H
	Constant term a			P value		
S	− 0.015 *****	− 0.017 *****	− 0.015 *****	0.007	0.000	0.000
B	0.000	− 0.012 *****	− 0.020 *****	0.958	0.006	0.000
	Market factor coefficient b			P value		
S	0.837 *****	0.838 *****	1.015 *****	0.000	0.000	0.000
B	1.076 *****	0.949 *****	1.115 *****	0.000	0.000	0.000
	Market factor coefficient s			P value		
S	0.032	0.090	0.320 *	0.898	0.692	0.073
B	− 0.437 ***	− 0.250	− 0.339	0.039	0.210	0.160
	Book to market ratio factor H			P value		
S	− 0.820 ***	− 0.003	− 0.008	0.019	0.993	0.976
B	0.062	− 0.048	0.175	0.834	0.864	0.604
	Adjust R2			F value		
S	0.319	0.255	0.344	50.818	50.933	125.256
B	0.308	0.315	0.434	92.992	82.276	75.758

Note: the data in the table are reserved to 3 decimal places, and * * *, ** *, * represent the statistical significance of 1%, 5% and 10% respectively.

From the observation of regression, we can see that: first, the market factor and CAPM model, the P values corresponding to the regression coefficients of all combined market factors are significant and positively correlated, indicating that the market factor is an important factor leading to the changes of the stock market.Compared with table 1, after adding the market value factor and book value ratio factor, the market risk premium factor coefficient of small market value enterprises will decrease slightly, while that of large market value enterprises will increase slightly.Second, by observing the market value factor coefficient s, it is found that large market value enterprises are negative, while small market value enterprises are positive.At the level of 5%, only the stocks of companies with large market capitalization and low book to market value ratio have a significant negative impact on the volatility of stock returns, and the absolute value of the coefficient of the portfolio of stocks with small market value is small but not significant.It shows that the overall market is not ideal, and large market value enterprises show a negative impact.When the book to market ratio is the same, investors will choose small-scale enterprises, which shows that there is also a "small company effect" in China.The third is to observe the regression coefficient h of book value ratio and find that it has almost no value effect on the fluctuation of stock return.Except for small market value and low book value stock portfolio, the others are not significant.And small-scale enterprises with low market capitalization and low book value ratio have an obvious negative effect on the volatility of stock return.On the whole, the constant term is still significant and the value is very small, and the adjustment of R2 has not been greatly improved.

5. Summary

The practical experience of the stock market has promoted the further enrichment and expansion of the whole social capital asset pricing theoretical system in China. From the beginning, the single CAPM single factor model has been gradually moving towards the multi factor model.For China's stock market system at the present stage, the vast majority of individual investors in the investment market may consider the greatest risk. The high historical average valuation level and valuation level of the stock price of listed companies often make some domestic emerging market investors ignore the potential huge development opportunities of Companies in this market in the future.

Through the comparative analysis of CAPM and FF three factor models on China's gem, the main findings are as follows: first, CAPM model is valid in explaining the stock return of China's gem, and the market premium factor has a strong explanation.Second, the goodness of fit of the three factor model is slightly better than the CAPM model, which is effective in the GEM market, but the impact of each factor on the gem stock returns is not significant. The volatility of stock returns of enterprises with different market capitalization and different book value ratios is different.Third, among the three factors, the explanatory power of market value factor and book to market value ratio factor is relatively weak and basically not significant.The intercept terms of the two models are almost significantly close to 0, which is consistent with the ideal state of the three factors, but the adjusted goodness of fit is about 0.3, which shows that although the three factor model can explain the GEM market, its explanatory power is not high, and it can not well explain the fluctuation of stock return. There are other factors that affect stock return.

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