Research on the investment efficiency of each factor in A-share market——Take CAPM, FF three factor and FF five factor models as examples

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Abstract. This paper mainly studies the effectiveness of factor investment represented by CAPM, FF three factor model and FF five factor model in A-share market. Since the birth of factor investment in the middle of the last century, it is fashionable and short. When focusing on China, the superiority of each model is controversial. In this paper, we took the stock reform limit board as the boundary, we selected the data from 1997 to 2020 to study the significance of CAPM, FF three factor, FF three factor and profit factor (RMW) or investment factor (CMA), FF five factor models. Through the redundancy factor test, it is concluded that each factor plays an important role, and the role of investment factor (CMA) is relatively small. In addition, in the case of univariate grouping and bivariate grouping, different factor models are used to adjust the excess return. It is found that CAPM, FF three factor model and FF five factor model are applicable to China's A-share market. FF three factor model and FF five factor model are continuous supplements to CAPM model, making it more comprehensive and effective. And the market factor is the most significant, representative and dominant. Compared with the FF three factor model, the addition of the profit factor (RMW) and the investment factor (CMA) in the FF five factor model will weaken the significance of the market value factor (SMB) in the original FF three factor model.

Keywords: factor model; quantitative investment; CAPM; FF three factors; FF five factors.

1. Background and literature review

In 1980, China issued shares for the first time, which became the beginning of the contemporary Chinese stock market after the reform and opening up. The period from 1980 to 1991 was the period of revival and start-up, the period from 1992 to 1999 was the period of expansion and growth, and the period from 2000 to now is the period of standardization and development. With the continuous development of China's stock market, investment methods have gradually increased. As a new investment method, quantitative investment has gradually entered China's vision.

Quantitative investment is to practice the investment idea through computer technology and mathematical model. Quantitative investment can scientifically and accurately predict the future earnings of stocks. Compared with traditional investment, it requires investors to have rich experience and be vulnerable to subjective influence, which has greater advantages. At the same time, quantitative investment can control risks, strictly follow the program design, timely reflect market changes and complete transactions in a short time, and ensure the quality of investment. The development of foreign quantitative investment can be divided into three stages: the first stage is from 1970 to 1977. Barclays international investment management company issued the world's first passive quantitative fund in 1971 and the world's first active quantitative fund in 1977. Simmons' annualized return exceeded Buffett's value investment by 21% in the same period. The second stage was from 1977 to 1995. Limited by many factors, quantitative investment developed slowly overseas. The third stage is from 1995 to now, with the strong support of computer technology, quantitative investment has developed at a high speed. With the deepening development of economic reform, although quantitative investment in China started relatively late, it has also received widespread attention and achieved good results in China. In 2004, China's first quantitative investment fund - Everbright Prudential quantitative fund was born, and the second quantitative investment fund, Shangtou alpha fund, was established the following year. In 2011, quantitative investment developed rapidly and was gradually widely used in private investment management institutions. In China, the

number of private placement products adopting quantitative investment strategies is increasing, but the market efficiency is relatively low, the effect is not significant, the hedging tools are relatively single, and the energy targets are less. Affected by the trading rules, it is difficult to give full play to its role. Therefore, it is imperative to find a quantitative investment method suitable for China.

Factor investment, as an important form of quantitative investment, can be traced back to the middle of the last century. Makowitz (1952) and Tobin (1958) successively put forward modern portfolio theory and the separation theorem of two funds, which laid the foundation for the proposition of asset pricing theory and pioneered quantitative research in the financial sector. Since then, Sharpe (1964), Lintner (1965) and Mossin (1966) have successively studied, introduced market portfolio to study the equilibrium pricing structure of assets, and obtained the classic CAPM model with market factor as a single factor. It is the first time to describe the relationship between expected return and market risk from the perspective of market equilibrium. Black, Jensen, Scholes and others (1972), Fama and Macbeth (1973) successively confirmed this view.

On this basis, Merton (1973) expanded it and introduced other issues concerned by investors as state variables to obtain the ICAPM model, trying to form an ideological leap from single factor model to multi factor model. Rose (1976) continued to explore, referred to the complete no arbitrage principle, proposed the ATP multi factor arbitrage pricing theoretical model, and tried to introduce other effective factors on the basis of the ICAPM model. Ross (1985) discussed APT and CAPM and questioned the CAPM model. In addition, Banz (1981) found that small market value companies are higher than large market value companies in terms of return rate through research on NYSE stocks. Basu (1983) found through empirical test that, under a certain scale, the return rate of companies with high P/E ratio is higher than that of companies with low P/E ratio. Bhandari (1988) found that the debt equity ratio of listed companies is positively related to the stock return. These great discoveries have promoted the process of multi factor model exploration. Until Fama French (1993) introduced the market value to book value ratio factor into the ICAPM model as a state variable, the interpretation effect was significantly enhanced, forming the famous Fama French three factor model.

However, the process of exploration is not over. Jegadeesh and Titman (1993) found that there was a significant momentum effect in the US stock market, which could not be explained by the FF three factor model. Carhart (1997) added momentum factor on the basis of FF three factors to explain the momentum effect. Cooper, Gulen and Schill (2008) obtained that the annual asset growth rate of a company has an important impact on the return rate of the US stock market by studying the cross-sectional relationship between asset growth and stock returns. Cooper and Priestley (2011) found that the investment level was negatively correlated with the return rate of the stock portfolio, and the role of investment factors was significant. Novy and Marx (2013) found that the expected profit factor is strongly related to the average return rate of stocks. Aharoni, Grundy and Zeng (2013) concluded that the investment factor is negatively related to the stock return rate, and the profit factor has a significant impact than the investment factor. Faced with new anomalies that cannot be explained, Fama French (2015) combined the dividend discount model, added profitability factors and investment growth factors, and formed the cutting-edge Fama French five factor model.

Fama French five factor model better explains the financial anomalies of the three factor model, but its robustness needs further exploration because of its short history. And the model was born for the US financial market, and whether it is universal in other countries still needs to be confirmed.

Since the model came out, Foye and James (2018) found that neither the three factor model nor the five factor model is applicable to the UK stock market. Cox, Shaun, Britten, James (2019) found that the five factor model is more applicable to the Johannesburg Stock Exchange in Africa than the three factor model. Focusing on China, Huang Xingwang et al. (2002) found that there was no book to market ratio effect. Wu Shinong et al. (2004) found that the FF three factor model can better explain the changes in stock returns than the CAPM model. Pan Li and Xu Jianguo (2011) found that the stock market value and P/E ratio on the A-share market have a significant impact on their earnings, while the book to market ratio and the ratio of tradable shares have no significant impact. Tian Lihui et al. (2014) found that the book to market ratio effect was not significant. Gao Chunting and Zhou

Xiaohua (2016) found that the five factor model was better than the three factor model. Liu Lanlan et al. (2016) found that only the scale factor and investment growth factor had a relatively significant impact on stock returns, while the other three factors had no significant impact; Zhao Shengmin and others (2016) found that the FF three factor model is more suitable for China's stock market. Li Zhibing, Yang Guangyi, Feng Yongchang and Jing Liang (2017) believed that the five factor model had very strong explanatory power, which was better than the three factor model. Du Weiwang and Xiao Shuguang (2018) found that the five factor model is applicable in China's stock market. Ma Yong and He Shun (2019) found that in the empirical study of China's stock market, the two factors of profit and investment are redundant variables, and they believe that the three factors are more adaptive. Fu Xiaoqian, Qiu Feng and Zhang Qian (2022) believed that the FF five factor model was more general. On the whole, scholars generally agree with the three factor model, but there is much controversy on the five factor model.

With the limit of the trading limit of the stock reform as the boundary, this paper selects the data from 1997 to 2020, through redundant factor test, univariate grouping, bivariate grouping and other ways, respectively, to adjust the excess return by CAPM, FF three factor, FF three factor+profit factor (RMW), or investment factor (CMA), FF five factor model, to explore its significance.

The rest of this paper is arranged as follows: The second part is data selection and factor construction, the third part is empirical test, and the fourth part is summary and suggestions.

2. Data selection and factor construction

The data in this paper are from China Asset Research and Management Center and Oriental Fortune Choice database. Considering that since December 16, 1996, Shanghai and Shenzhen Stock Exchanges have simultaneously restored the price limit system to stabilize the stock market, and uniformly implemented a 10% price limit, that is, the trading price of securities on the same day should be within ± 10% of the closing price of the previous day, except for the stocks listed and traded on the first day, the monthly data from 1997 to 2020 is selected in this paper.

This paper tests CAPM, FF three factor, FF three factor+profit factor (RMW) or investment factor (CMA), FF five factor model in A-share market. The formula of CAPM, FF three factor and FF five factor models is as follows:

$$R_{it} - R_{Ft} = \alpha_i + b_i(R_{Mt} - R_{Ft}) \tag{1}$$

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

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

$$+ r_i RMW_t + c_i CMA_t + e_{it} \tag{3}$$

Among them, Rit is the return rate of the portfolio in the period, RFt is the risk-free interest rate, RMt is the return rate of the market portfolio, and $RMt - RFt$ reflects the market risk premium. $SMBt$ refers to the difference between the return rate of the company portfolio with low circulating market value and that of the company portfolio with high circulating market value in the t period, $HMLt$ refers to the difference between the return rate of the value company portfolio with high book to market value ratio and the growth company portfolio with low book to market value ratio, $RMWt$ refers to the difference between the return rate of the company portfolio with strong profitability and the company portfolio with poor profitability in the t period, and $CMAt$ refers to the difference between the return rate of the company portfolio with low investment level and the company portfolio with high investment level in the t period. αi refers to the additional rate of return of the portfolio or individual stock beyond the return brought by the fluctuation of the market. eit is the residual. Specific methods for constructing factors are as follows:

Firstly, the shares are divided into 1:1 large market value (B) and small market value (S) shares according to the circulating market value; Then divide the stocks into high, medium and low (H/M/L) according to the book to market ratio data, and get 2×3 A total of 6 portfolios (SL/SM/SH/BL/BM/BH). On this basis, the profitability of each group is obtained by weighted average of market value, and SMB and HML are obtained. Similarly, according to the profitability from strong to weak, they are divided into R, N, W groups, and according to the investment scale from low to high, they are divided into C, N, A groups. The formula is:

$$SMB = 1/3(SL + SM + SH) - 1/3(BL + BM + BH) \quad (4)$$

$$HML = 1/2(SH + BH) - 1/2(SL + BL) \quad (5)$$

$$RMW = 1/2(SR + BR) - 1/2(SW + BW) \quad (6)$$

$$CMA=1/2(SC+BC)-1/2(SA+BA) \quad (7)$$

3. Empirical test

3.1 Regression analysis of A-share market factors

Using the data from January 1997 to December 2020, this paper conducts regression analysis on each factor through CAPM, FF three factor, FF three factor+profit factor (RMW)/investment factor (CMA), FF five factor models. The results are shown in Table 1.

Table 1. Regression Results of A-share Market Factors

	alpha	Mkt-rf	smb	hml	cma	rmw
CAPM	-0.002	1.094				
t-Value	-0.310	7.911***				
FF-3	-0.004	0.975	0.782	-0.189		
t-Value	-0.576	7.431***	2.359**	-0.247		
FF-3+CMA	-0.004	0.970	0.800	-0.155	-0.042	
t-Value	-0.570	7.2932***	1.802*	-0.117	-0.047	
FF-3+RMW	-0.003	0.967	0.707	-0.208		-0.086
t-Value	-0.468	6.885***	1.036	-0.307		-0.197
FF-5	-0.004	0.960	0.733	-0.157	-0.080	-0.098
t-Value	-0.482	6.571***	1.044	-0.114	-0.131	-0.215

Note: All are reserved to three decimal places; *, * *, * * They are significant at 10%, 5% and 1% levels respectively.

It can be seen from the regression results that the market factor plays an important role in the interpretation of excess returns at the level of 1% significance. With the addition of profit factor (RMW) and investment factor (CMA), the significance of market value factor (SMB) has weakened. Other factors were not significant.

3.2 Redundancy test of factors in A-share market

In order to explore whether each factor plays a role in the prediction of excess returns, this paper uses Fama French (2016) for reference to further test the redundancy of each factor. That is to say, one of the factors is selected in turn, and the other four factors are used to represent the factor, and the least squares regression model is established for analysis. See Table .2 for the results.

Table 2. Redundancy test of factors in A-share market

	mkt-rf	smb	hml	rmw	cma
alpha	0.012	0.009	0.006	0.006	-0.002
t-value	2.535**	7.316***	3.280***	4.999***	-1.497

Note: All are reserved to three decimal places; *, * *, * * They are significant at 10%, 5% and 1% levels respectively.

It can be seen from the data that all factors play an important role. Among them, the market factor plays the most important role in excess return, and the investment factor (CMA) plays the least role in excess return. Except that the investment factor is negatively correlated with the excess return, the other four factors are positively correlated with the excess return.

3.3 Regression analysis of single variable grouped returns in A-share market

In the face of large changes in the significance of the market value factor (SMB) in the prediction of each model, this paper further groups the single variable according to the market value. Each time, the market value was divided into five groups from small to large, and the least squares regression model was established for analysis. Due to space limitation, some important results are shown in Table 3, and details are shown in the appendix.

Table 3. Regression Results of Univariate Grouping Yield in A-share Market

Size	low	2	3	4	high	low	2	3	4	high
alpha						t-value				
CAPM	-0.007	-0.006	-0.003	-0.001	0.004	-0.613	-0.553	-0.357	-0.213	0.177
FF3	-0.008	-0.007	-0.005	-0.002	0.003	-0.935	-0.872	-0.682	-0.455	0.102
FF3+CMA	-0.008	-0.007	-0.005	-0.003	0.002	-0.938	-0.850	-0.678	-0.452	0.092
FF3+RMW	-0.008	-0.006	-0.004	-0.001	0.003	-0.835	-0.737	-0.522	-0.328	0.110
FF5	-0.008	-0.006	-0.004	-0.002	0.003	-0.852	-0.742	-0.542	-0.346	0.099
Mkt-rf						t-value				
CAPM	1.049	1.129	1.124	1.112	1.053	7.203***	7.334***	8.072***	8.387***	8.600***
FF3	0.909	0.954	0.981	1.007	1.002	6.670***	6.685***	7.423***	7.871***	8.465***
FF3+CMA	0.903	0.963	0.979	0.997	0.987	6.522***	6.568***	7.293***	7.729***	8.314***
FF3+RMW	0.916	0.948	0.968	0.995	0.992	6.214***	6.176***	6.831***	7.272***	7.901***
FF5	0.908	0.958	0.960	0.982	0.976	5.903***	5.893***	6.500***	6.937***	7.564***
SMB						t-value				
FF3	1.160	1.060	0.876	0.640	0.195	3.535***	3.030***	2.752***	1.980**	0.547
FF3+CMA	1.194	1.043	0.887	0.668	0.249	2.724***	2.310**	2.099**	1.502	0.427
FF3+RMW	1.209	0.993	0.755	0.512	0.110	1.699*	1.377	1.129	0.774	0.230
FF5	1.238	0.997	0.770	0.544	0.160	1.696*	1.368	1.141	0.792	0.245
HML						t-value				
FF3	-0.108	-0.266	-0.247	-0.211	-0.193	-0.188	-0.431	-0.415	-0.305	-0.047
FF3+CMA	-0.050	-0.278	-0.218	-0.165	-0.119	-0.035	-0.288	-0.229	-0.161	0.033
FF3+RMW	-0.102	-0.279	-0.273	-0.240	-0.209	-0.223	-0.485	-0.494	-0.373	-0.076
FF5	-0.039	-0.279	-0.219	-0.170	-0.131	-0.029	-0.282	-0.215	-0.151	0.020
CMA						t-value				
FF3+CMA	-0.078	0.048	-0.036	-0.066	-0.116	-0.118	-0.004	-0.061	-0.047	-0.043
FF5	-0.099	0.024	-0.087	-0.115	-0.129	-0.184	-0.084	-0.183	-0.149	-0.051
RMW						t-value				
FF3+RMW	0.043	-0.076	-0.135	-0.147	-0.084	-0.109	-0.205	-0.308	-0.270	-0.055
FF5	0.026	-0.064	-0.154	-0.169	-0.097	-0.150	-0.221	-0.343	-0.289	-0.052

Note: All are reserved to three decimal places; *, * *, * * They are significant at 10%, 5% and 1% levels

It can be seen from the data that the market factor is positively related to the A-share market return rate, and the explanation effect is significant. The larger the market value, the greater the effect. As the number of factors in the model increases, its dominant component gradually decreases. The market value factor is positively related to the A-share market return rate. It plays a significant role in explaining companies with small market values, but not in explaining companies with large market values. It can be seen that the company size is an important factor restricting small market value companies. Book to market ratio factor, profitability factor and investment factor are all negatively correlated with A-share market return, and are not significant.

3.4 Regression analysis of bivariate grouped returns in A-share market

Next, this paper divides the data into five groups according to market value and book to market value ratio from small to large, and conducts bivariate grouping regression analysis using CAPM, FF three factors, FF three factors+profit factor (RMW) or investment factor (CMA), FF five factor model. See Table .4 for the results.

Table 4. Regression Results of Bivariate Grouping Yield in A-share Market

B/M	low	2	3	4	high	low	2	3	4	high
	CAPM									
	alpha					t-value				
small	-0.004	0.004	0.010	0.011	0.015	0.380	0.006	0.187	0.358	0.828
2	-0.001	-0.002	0.001	0.001	0.003	-0.291	-0.252	-0.085	-0.001	0.296
3	-0.008	-0.006	-0.004	-0.004	-0.002	-0.572	-0.472	-0.320	-0.263	-0.087
4	-0.011	-0.009	-0.006	-0.003	-0.002	-0.881	-0.772	-0.564	-0.317	-0.186
big	-0.006	-0.007	-0.005	-0.005	-0.003	-0.685	-0.793	-0.552	0.600	-0.398
	FF3									
	alpha					t-value				
small	-0.010	0.003	0.012	0.012	0.011	-1.099	-0.216	0.154	0.281	0.699
2	0.000	-0.002	-0.001	0.000	0.002	-0.481	-0.361	-0.296	-0.189	0.141
3	-0.006	-0.007	-0.005	-0.006	-0.003	-0.703	-0.758	-0.616	-0.591	-0.250
4	-0.011	-0.01	-0.009	-0.006	-0.002	-1.146	-1.101	-0.988	-0.655	-0.199
big	-0.011	-0.011	-0.007	-0.006	-0.002	-1.281	-1.340	-0.982	-0.837	-0.321
	FF5									
	alpha					t-value				
small	-0.010	0.001	0.011	0.012	0.010	-0.903	-0.129	0.167	0.246	0.585
2	-0.001	0.001	0.001	0.000	0.002	-0.500	-0.228	-0.186	-0.150	0.197
3	-0.007	-0.006	-0.005	-0.006	-0.002	-0.669	-0.629	-0.503	-0.476	-0.139
4	-0.011	-0.011	-0.008	-0.005	-0.001	-1.037	-0.994	-0.801	-0.474	-0.097
big	-0.010	-0.011	-0.007	-0.005	-0.003	-1.128	-1.188	-0.792	-0.638	-0.354
	mkt-rf					t-value				
small	0.958	0.960	0.961	0.920	0.881	7.662^{***}	4.872^{***}	3.633^{***}	3.318^{***}	4.762^{***}
2	0.909	0.955	0.96	0.974	1.033	4.478^{***}	3.637^{***}	4.056^{***}	4.972^{***}	7.194^{***}
3	0.855	0.969	0.989	0.977	1.033	4.510^{***}	5.414^{***}	5.693^{***}	6.499^{***}	7.834^{***}
4	0.926	0.959	0.952	0.985	1.058	5.820^{***}	6.025^{***}	7.087^{***}	8.529^{***}	9.850^{***}
big	0.935	0.953	0.961	1.002	0.983	8.342^{***}	8.444^{***}	9.580^{***}	9.775^{***}	10.011^{***}
	smb					t-value				
small	0.975	1.086	1.398	0.712	0.251	1.950*	1.151	1.054	0.788	0.329
2	1.547	1.206	0.767	0.835	0.266	1.651*	1.075	0.838	0.913	0.416
3	1.490	1.033	0.916	0.630	0.120	1.568	1.340	1.234	0.981	0.376
4	1.113	1.021	0.659	0.428	0.054	1.710*	1.463	1.261	0.851	0.114
big	0.844	0.783	0.504	0.211	0.036	1.720*	1.633	1.145	0.474	-0.005
	hml					t-value				
small	0.018	-0.281	-0.332	-0.613	-0.721	0.069	-0.475	-0.434	-0.692	-1.179
2	-0.143	-0.674	-0.658	-0.321	-0.282	-0.219	-0.743	-0.87	-0.641	-0.808

3	-0.033	-0.338	-0.336	-0.19	-0.08	-0.156	-0.384	-0.544	-0.602	-0.044
4	0.02	-0.156	-0.151	-0.107	0.222	-0.001	-0.326	-0.170	-0.159	0.760
big	-0.121	0.009	0.164	0.171	0.511	0.167	0.350	0.587	0.931	1.805*
cma						t-value				
small	-0.192	-0.165	-0.264	-0.251	-0.435	-0.335	0.062	-0.170	-0.256	-0.343
2	-0.098	0.31	0.019	-0.158	0.009	-0.174	0.142	-0.024	-0.128	0.070
3	-0.165	0.041	-0.046	-0.197	0.051	-0.155	-0.14	-0.185	-0.203	0.004
4	-0.067	-0.104	-0.080	-0.050	-0.002	-0.157	-0.135	-0.218	-0.044	0.015
big	0.033	-0.067	-0.133	0.012	-0.005	-0.141	-0.236	-0.257	-0.125	0.173
rmw						t-value				
small	-0.248	-0.063	0.077	-0.312	-0.176	-0.543	-0.243	-0.126	-0.156	-0.051
2	0.163	-0.032	-0.220	-0.044	-0.078	0.018	-0.165	-0.274	-0.129	-0.153
3	0.130	-0.058	-0.106	-0.171	-0.158	-0.030	-0.249	-0.266	-0.324	-0.225
4	-0.040	-0.029	-0.219	-0.181	-0.117	-0.174	-0.164	-0.439	-0.348	-0.213
big	-0.043	-0.091	-0.164	-0.199	0.037	-0.237	-0.271	-0.451	-0.434	0.217

Note: All are reserved to three decimal places; *, * *, * * They are significant at 10%, 5% and 1% levels

From the regression results, it can be concluded that in general, when the market factor performs regression interpretation on companies with larger market value and larger book to market ratio, the effect is more prominent. However, for companies with very small book value ratios, market factors tend to play a greater role in those with small market values. When the market value factor (SMB) regresses the companies whose book to market ratio increases in turn, the effect shows a U-shaped trend. The effect of the book to market ratio factor (HML) is not significant. With the continuous increase of the book to market ratio, its negative correlation with the company's yield has become positive. Profitability factor (RMW) and investment factor (CMA) will weaken the role of book to market ratio factor (HML) in the original three factor model.

4. Conclusions and suggestions

As China's quantitative investment started late, and the effectiveness of various models in the A-share market is controversial, this paper conducts research on the effectiveness of various factors in the A-share market. Through the empirical results of this paper, it is found that all factors play an important role, in contrast, market factors play the largest role, and investment factors (CMA) play the smallest role. The market factor is positively correlated with the A-share market return rate, and the explanation effect is significant. In addition to the small market value of companies with small book to market ratio, the larger the market value, the greater the role of the book to market ratio. As the number of factors in the model increases, its dominant component gradually decreases. The market value factor is positively related to the market return rate of A-share. It plays a significant role in explaining companies with small market value, large book to market ratio and small book to market ratio, while it does not play a significant role in explaining companies with large market value and book to market ratio in the middle. It can be seen that the size of a company is an important factor that affects small-scale, minimum value and maximum value companies. With the increasing of the book to market ratio, its negative correlation with the company's yield has become positive correlation. Book to market ratio factor, profitability factor and investment factor are all negatively correlated with A-share market return, and are not significant. Compared with the three factor FF model, the addition of profit factor (RMW) and investment factor (CMA) in the five factor FF model will weaken the significance of market value factor (SMB) in the original three factor FF model. CAPM, FF three factor and FF five factor models are all applicable to China's A-share market. FF three factor and FF five factor models are continuous supplements to CAPM models, making them more comprehensive and effective.

In the A-share market, market risk plays a leading role, and there is no doubt that the effect of market factors is significant. The larger the company is, the more risks it faces, and the more important the market factor is. For very small companies, very small risks can be fatal, so they need to be considered separately. Today's high-value companies may lose their unique advantages in the face of risks. Market factors play a greater role. The market value factor (SMB) is significant in companies with small market value, while it is not significant in companies with large market value, because companies with small market size have greater flexibility and can make timely adjustments according to the market form to obtain more excess returns. At the same time, companies with extremely small and large values often show up through the size of the company, highlighting the value of the market value factor. The larger the book to market ratio is, the larger the company value is, and its yield will increase accordingly. The book to market ratio factor (HML), profit factor (RMW) and investment factor (CMA) are not significant, and the reasons involve many aspects. First of all, China's investment subjects are divided into national shares, corporate shares, individual shares and foreign shares. Among them, state-owned shares and corporate shares account for a large proportion, but are restricted by the circulation of listed shares, which affects the forecast of expected earnings to some extent. Secondly, in terms of investor structure, individual investors account for more. Due to the lack of professional knowledge, they only seek to obtain short-term benefits, and will not explore the founder, business philosophy, management team and other factors of a company, understand the real value of the company, buy and hold the company's shares for a long time, and follow the company's growth and development. It is difficult to form a fixed investment style because of the following trend and high turnover rate. In addition, due to the lag of information, fraud of disclosure and other reasons, there is information inequality, lack of trust and other situations, so it is difficult to know the actual value of the company and predict the profitability.

Therefore, the application of FF five factor model can be carried out for China's A-share market, and more suitable investment models can be obtained through continuous exploration for development and changes.

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Appendix: Detailed data of regression results of bivariate group returns in A-share market

B/M	low	2	3	4	high	low	2	3	4	high
	CAPM									
alpha						t-value				
small	-0.004	0.004	0.010	0.011	0.015	0.380	0.006	0.187	0.358	0.828
2	-0.001	-0.002	0.001	0.001	0.003	-0.291	-0.252	-0.085	-0.001	0.296
3	-0.008	-0.006	-0.004	-0.004	-0.002	-0.572	-0.472	-0.320	-0.263	-0.087
4	-0.011	-0.009	-0.006	-0.003	-0.002	-0.881	-0.772	-0.564	-0.317	-0.186
big	-0.006	-0.007	-0.005	-0.005	-0.003	-0.685	-0.793	-0.552	0.600	-0.398
mkt-rf						t-value				
small	1.120	1.155	1.182	1.147	1.083	9.311***	5.975***	4.667***	4.365***	5.827***
2	1.053	1.171	1.189	1.137	1.083	5.534***	4.729***	5.248***	6.274***	8.422***
3	1.003	1.140	1.170	1.107	1.075	5.577***	6.827***	7.208***	7.985***	9.075***
4	1.054	1.120	1.101	1.092	1.077	7.118***	7.523***	8.839***	10.241***	11.128***
big	1.080	1.087	1.055	1.067	0.968	10.021***	10.256***	11.493***	11.347***	10.600***
	FF3									
alpha						t-value				
small	-0.010	0.003	0.012	0.012	0.011	-1.099	-0.216	0.154	0.281	0.699
2	0.000	-0.002	-0.001	0.000	0.002	-0.481	-0.361	-0.296	-0.189	0.141
3	-0.006	-0.007	-0.005	-0.006	-0.003	-0.703	-0.758	-0.616	-0.591	-0.250
4	-0.011	-0.01	-0.009	-0.006	-0.002	-1.146	-1.101	-0.988	-0.655	-0.199
big	-0.011	-0.011	-0.007	-0.006	-0.002	-1.281	-1.340	-0.982	-0.837	-0.321
mkt-rf						t-value				
small	0.994	0.983	0.988	0.971	0.945	8.767***	5.467***	4.132***	3.843***	5.426***
2	0.889	0.913	0.986	0.994	1.043	5.025***	4.067***	4.634***	5.688***	8.080***
3	0.857	0.961	0.995	1.011	1.041	5.080***	6.184***	6.496***	7.441***	8.815***
4	0.933	0.968	0.977	1.003	1.070	6.593***	6.858***	8.144***	9.628***	11.042***
big	0.930	0.962	0.986	1.015	0.987	9.381***	9.587***	10.883***	10.998***	11.013***
smb						t-value				
small	1.112	1.126	1.195	0.896	0.234	4.598***	2.823***	2.233**	1.598	0.448
2	1.346	1.355	1.014	0.791	0.336	3.141***	2.476**	2.097**	1.972**	1.209
3	1.288	1.089	0.994	0.685	0.289	3.109***	2.973***	2.782***	2.373***	1.164
4	1.114	0.990	0.821	0.565	0.161	3.593***	3.067***	3.123***	2.308***	0.625
big	0.884	0.829	0.59	0.387	-0.002	3.788***	3.564***	2.957***	1.621	-0.253
hml						t-value				
small	-0.047	-0.387	-0.502	-0.683	-0.958	-0.072	-0.592	-0.785	-1.232	-2.027**
-___2	-0.243	-0.521	-0.631	-0.417	-0.255	-0.508	-0.858	-1.202	-1.001	-0.965
3	-0.161	-0.31	-0.351	-0.282	-0.021	-0.379	-0.605	-0.878	-0.931	0.004
4	-0.014	-0.217	-0.155	-0.112	0.231	-0.110	-0.547	-0.345	-0.196	1.070
big	-0.097	-0.018	0.114	0.206	0.504	0.157	0.296	0.641	1.231	2.540**
	FF3+CMA									
alpha						t-value				
small	-0.011	0.001	0.012	0.011	0.010	-1.114	-0.189	0.133	0.221	0.603
2	0.000	0.000	0.000	0.000	0.002	-0.516	-0.295	-0.273	-0.199	0.164
3	-0.006	-0.006	-0.005	-0.007	-0.003	-0.703	-0.746	-0.614	-0.596	-0.219
4	-0.011	-0.011	-0.010	-0.006	-0.002	-1.138	-1.096	-0.982	-0.614	-0.170
big	-0.010	-0.011	-0.008	-0.006	-0.002	-1.260	-1.334	-0.976	-0.802	-0.291
mkt-rf						t-value				
small	0.985	0.956	0.958	0.944	0.900	8.634***	5.371***	3.988***	3.635***	5.223***
2	0.883	0.957	0.989	0.975	1.039	4.874***	4.028***	4.521***	5.522***	7.966***
3	0.838	0.975	1.000	0.995	1.052	4.925***	6.072***	6.384***	7.280***	8.686***
4	0.931	0.960	0.978	1.005	1.071	6.435***	6.694***	8.009***	9.536***	10.906***
big	0.939	0.962	0.979	1.024	0.981	9.269***	9.432***	10.741***	10.889***	10.879***
smb						t-value				

small	1.147	1.160	1.282	0.987	0.429	3.454***	2.024**	1.744*	1.383	0.562
2	1.386	1.231	0.971	0.837	0.318	2.491**	1.839*	1.569	1.523	0.784
3	1.362	1.059	0.992	0.744	0.258	2.421**	2.299**	2.172**	1.805*	0.809
4	1.136	1.032	0.832	0.559	0.145	2.784***	2.379**	2.382**	1.647	0.418
big	0.863	0.848	0.62	0.365	0.009	2.832***	2.738***	2.206**	1.175	-0.256
hml						t-value				
small	0.004	-0.274	-0.341	-0.534	-0.696	0.039	-0.47	-0.447	-0.655	-1.158
2	-0.165	-0.668	-0.646	-0.333	-0.271	-0.215	-0.741	-0.874	-0.656	-0.799
3	-0.048	-0.343	-0.336	-0.201	-0.071	-0.164	-0.399	-0.558	-0.625	-0.041
4	0.015	-0.154	-0.146	-0.114	0.217	-0.006	-0.329	-0.184	-0.181	0.75
big	-0.118	0.008	0.157	0.173	0.519	0.168	0.34	0.565	0.913	1.832*
cma						t-value				
small	-0.091	-0.157	-0.221	-0.233	-0.423	-0.127	0.156	-0.077	-0.250	-0.363
2	-0.106	0.323	0.057	-0.119	0.036	-0.181	0.197	0.058	-0.065	0.139
3	-0.164	0.074	-0.007	-0.133	0.077	-0.116	-0.042	-0.096	-0.083	0.048
4	-0.041	-0.085	-0.02	0.008	0.031	-0.095	-0.070	-0.074	0.080	0.080
big	0.063	-0.034	-0.067	0.072	-0.020	-0.049	-0.139	-0.086	0.030	0.116
	FF3+RMW									
alpha						t-value				
small	-0.009	0.003	0.012	0.013	0.012	-0.854	-0.123	0.203	0.287	0.642
2	-0.001	0.000	0.001	0.001	0.003	-0.479	-0.26	-0.173	-0.125	0.198
3	-0.007	-0.006	-0.005	-0.005	-0.002	-0.657	-0.625	-0.495	-0.451	-0.160
4	-0.011	-0.010	-0.008	-0.005	-0.001	-1.029	-0.973	-0.778	-0.472	-0.106
big	-0.01	-0.011	-0.006	-0.005	-0.003	-1.116	-1.167	-0.766	-0.635	-0.364
mkt-rf						t-value				
small	0.976	0.985	0.996	0.953	0.932	8.026***	5.067***	3.865***	3.613***	5.093***
2	0.918	0.901	0.957	0.998	1.035	4.749***	3.752***	4.264***	5.265***	7.485***
3	0.873	0.957	0.990	0.999	1.024	4.776***	5.705***	5.990***	6.846***	8.178***
4	0.931	0.968	0.958	0.988	1.058	6.142***	6.346***	7.453***	8.861***	10.246***
big	0.925	0.955	0.974	0.993	0.986	8.691***	8.860***	10.025***	10.160***	10.353***
smb						t-value				
small	0.946	1.041	1.315	0.642	0.098	1.920*	1.196	1.048	0.741	0.237
2	1.541	1.243	0.762	0.783	0.260	1.672*	1.127	0.840	0.890	0.446
3	1.421	1.054	0.918	0.581	0.14	1.577	1.352	1.233	0.962	0.397
4	1.101	0.980	0.655	0.423	0.053	1.722*	1.450	1.241	0.853	0.117
big	0.839	0.761	0.478	0.204	0.019	1.713*	1.610	1.119	0.464	0.014
hml						t-value				
small	-0.074	-0.389	-0.511	-0.769	-0.981	-0.183	-0.667	-0.822	-1.271	-2.007**
2	-0.209	-0.540	-0.670	-0.423	-0.276	-0.495	-0.903	-1.256	-1.018	-1.020
3	-0.140	-0.322	-0.372	-0.298	-0.044	-0.381	-0.663	-0.933	-0.982	-0.044
4	-0.020	-0.224	-0.186	-0.136	0.218	-0.147	-0.585	-0.441	-0.280	1.009
big	-0.112	-0.030	0.094	0.176	0.502	0.079	0.230	0.521	1.099	2.499*
rmw						t-value				
small	-0.185	-0.063	0.100	-0.271	-0.119	-0.463	-0.284	-0.119	-0.107	0.011
2	0.192	-0.131	-0.265	-0.030	-0.086	0.080	-0.204	-0.301	-0.137	-0.189
3	0.137	-0.052	-0.090	-0.120	-0.157	-0.014	-0.203	-0.215	-0.290	-0.214
4	-0.018	-0.016	-0.180	-0.163	-0.119	-0.130	-0.145	-0.391	-0.359	-0.234
big	-0.058	-0.075	-0.124	-0.202	0.022	-0.206	-0.216	-0.394	-0.407	0.157
	FF5									
alpha						t-value				
small	-0.010	0.001	0.011	0.012	0.010	-0.903	-0.129	0.167	0.246	0.585
2	-0.001	0.001	0.001	0.000	0.002	-0.500	-0.228	-0.186	-0.150	0.197
3	-0.007	-0.006	-0.005	-0.006	-0.002	-0.669	-0.629	-0.503	-0.476	-0.139
4	-0.011	-0.011	-0.008	-0.005	-0.001	-1.037	-0.994	-0.801	-0.474	-0.097

big	-0.010	-0.011	-0.007	-0.005	-0.003	-1.128	-1.188	-0.792	-0.638	-0.354
mkt-rf						t-value				
small	0.958	0.960	0.961	0.920	0.881	7.662***	4.872***	3.633***	3.318***	4.762***
2	0.909	0.955	0.96	0.974	1.033	4.478***	3.637***	4.056***	4.972***	7.194***
3	0.855	0.969	0.989	0.977	1.033	4.510***	5.414***	5.693***	6.499***	7.834***
4	0.926	0.959	0.952	0.985	1.058	5.820***	6.025***	7.087***	8.529***	9.850***
big	0.935	0.953	0.961	1.002	0.983	8.342***	8.444***	9.580***	9.775***	10.011***
smb						t-value				
small	0.975	1.086	1.398	0.712	0.251	1.950*	1.151	1.054	0.788	0.329
2	1.547	1.206	0.767	0.835	0.266	1.651*	1.075	0.838	0.913	0.416
3	1.490	1.033	0.916	0.630	0.120	1.568	1.340	1.234	0.981	0.376
4	1.113	1.021	0.659	0.428	0.054	1.710*	1.463	1.261	0.851	0.114
big	0.844	0.783	0.504	0.211	0.036	1.720*	1.633	1.145	0.474	-0.005
hml						t-value				
small	0.018	-0.281	-0.332	-0.613	-0.721	0.069	-0.475	-0.434	-0.692	-1.179
2	-0.143	-0.674	-0.658	-0.321	-0.282	-0.219	-0.743	-0.87	-0.641	-0.808
3	-0.033	-0.338	-0.336	-0.19	-0.08	-0.156	-0.384	-0.544	-0.602	-0.044
4	0.02	-0.156	-0.151	-0.107	0.222	-0.001	-0.326	-0.170	-0.159	0.760
big	-0.121	0.009	0.164	0.171	0.511	0.167	0.350	0.587	0.931	1.805*
cma						t-value				
small	-0.192	-0.165	-0.264	-0.251	-0.435	-0.335	0.062	-0.170	-0.256	-0.343
2	-0.098	0.31	0.019	-0.158	0.009	-0.174	0.142	-0.024	-0.128	0.070
3	-0.165	0.041	-0.046	-0.197	0.051	-0.155	-0.14	-0.185	-0.203	0.004
4	-0.067	-0.104	-0.080	-0.050	-0.002	-0.157	-0.135	-0.218	-0.044	0.015
big	0.033	-0.067	-0.133	0.012	-0.005	-0.141	-0.236	-0.257	-0.125	0.173
rmw						t-value				
small	-0.248	-0.063	0.077	-0.312	-0.176	-0.543	-0.243	-0.126	-0.156	-0.051
2	0.163	-0.032	-0.220	-0.044	-0.078	0.018	-0.165	-0.274	-0.129	-0.153
3	0.130	-0.058	-0.106	-0.171	-0.158	-0.030	-0.249	-0.266	-0.324	-0.225
4	-0.040	-0.029	-0.219	-0.181	-0.117	-0.174	-0.164	-0.439	-0.348	-0.213
big	-0.043	-0.091	-0.164	-0.199	0.037	-0.237	-0.271	-0.451	-0.434	0.217

Note: All are reserved to three decimal places; *, * *, * * They are significant at 10%, 5% and 1% levels