

# Applicability Test and Existing Problems of Multi-factor Model in Chinese Market

## Test of Three-factor and Four-factor Models in the A-share Market

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### ABSTRACT

This article uses three-factor and four-factor models to analyze its applicability in the Chinese market by using data collected by China's A-share market fund companies from 2015 to 2020. By observing the size of the alpha value and combining with the current status of the Chinese market, we discovered the policy-oriented, group-oriented, and impulsive characteristics of the Chinese market, and introduced several other improved factor models to extend and explain the conclusions.

**Keywords:** component; Factor model, Chinese market, A-share market fund company, improved factor model, policy-oriented, group-oriented, impulsive (key words)

### 1. INTRODUCTION

Sharp (1964), Lintner (1965) and Mossin (1966) proposed the Capital Asset Pricing Model (CAPM). The core point of this is that the expected return and risk of stocks are positively correlated. At the same time, we choose  $\beta$  as a measure of systemic risk. An indicator that represents the impact of stock returns on the return of the entire market portfolio. In an effective asset portfolio, non-systematic risks can be eliminated by diversified and diversified investments, but systemic risks will not be dispersed and eliminated due to the diversification of investments. The expected rate of return is only related to the systematic risk of the asset portfolio. However, this theory, under the impact of anomalies such as the arbitrage pricing model and the capital pricing model that considers tax, only uses  $\beta$  to measure systemic risk and loses its explanatory power. Therefore, researchers began to think that it might not be reasonable to use a single system factor to explain stock returns. Risk may be affected by multi-dimensional factors. In 1993, Fama and French proposed a three-factor model for the first time, using the book-to-market value ratio and size factor of stocks as explanatory factors for stock returns in addition to  $\beta$ . Based on the original capital asset pricing model, Fama and French added the market value

scale factor and book-to-market value ratio factor as a supplement to market risk factors. This new model can more fully describe the investment contained in a single stock risk. The two factors of company size and book-to-market value ratio can better reflect the average return of the stock market. At the same time, the scale factor and book-to-market value ratio factor can better include the leverage effect and the price ratio effect to explain the cross-sectional return of stocks. However, as time goes by, the three-factor model is not enough to explain the phenomenon that stocks with high returns in the past will still have higher returns in the future than stocks with low returns in the past. Therefore, Jegadeesh and Titman (1993) put forward a question about stocks. The momentum effect of the Carhart four-factor model was proposed later on the basis of the three-factor model.

However Over the past 20 years, China's financial market has developed rapidly, and various financial market systems have become more and more perfect. At the same time, regarding the assumptions of the existing four-factor model, there are many special problems in the Chinese market. 1. The Chinese market has a strict IPO review system. Many companies use backdoor listing methods to quickly obtain listing opportunities. However, this situation will cause The acquired shell

companies often have stagnant business or basically have no business operations and are not large in scale, but still have huge virtual value, which is unfavorable to the construction of the scale combination in the factor model. 2 At the same time, there are a large number of retail investors in the Chinese market, lack of investment knowledge, and irrational impulsive sentiments of investors, which are easily agitated by the news and media. At the same time, investors with low education levels even have some "superstitions." 3 The policy orientation of China's A-share market is obvious. Since China is a socialist country, the country's macro-control of the economic and financial markets is effective and beneficial. Before and after the conference or the specific policy promulgation date, there are likely to be some violations of market development trends. Turning point, which will also have an adverse effect on the prediction of the factor model.4 the current Chinese securities market is probably still a weakly efficient market, not as effective as the US market, but overall its effectiveness is Rising. Therefore, we use the three-factor and four-factor models that are performed well in Western countries to explore whether there are "surviving ships" in China, or that there are some potential characteristics in the Chinese market that make Western multi-factor models unable to explain the current reality. Optimize the factor model. Our research and testing is necessary, because in China's A-share market, there are often some economic phenomena linked to policies and groups. We should use the existing factor model to test and determine the factor model in China's A-share market. It is very important to grasp the law of the development of China's financial market and predict market performance. In this article, we collected the factor data of fund companies competing to invest in the A-share market from 2015 to 2020 to observe the factors and the size of the US market factors and statistical data, and give reasonable model recommendations and suggestions based on the results.

**2. METHODS**

**2.1. Selecting a Template**

According to the Fama and French's (1993) [3] 3-factor model model and the four-factor model by (Carhart (1995)) [14]. We collected VWRF, SMB, HML and MOM (UMB)from the Wind website, which is the biggest platform including all publicly available data in financial markets. And all the data are public data provided by China A-share market fund companies, which can correspond to each company in terms of authenticity.

According to the requirements of (Fama and French (1993)), we divided the samples into big firm, medium firm and small firm according to the market price of Chinese A-share market stocks. Then divide the

company's book-to-market value ratio into three combinations of high (High), medium (Medium), and low (Low) in the order of the company's book-to-market value ratio; then we combine the company size and book-to-market value ratio into six Investment portfolio: Small company's small book-to-market ratio (S/L), small company's book-to-market ratio (S/M), small company's high book-to-market ratio (S/H), large company's small book-to-market ratio (B/L) , Book-to-market ratio (B/M) among large companies, and high-book-to-market ratio (B/H) among large companies. And calculate the Chinese market SMB (scale factor) and HML (book-to-market value ratio factor) through the formula below [14].

$$SMB = \frac{(S/L+S/M+S/H)}{3} - \frac{(B/L+B/M+B/H)}{3} \tag{1}$$

$$HML = \frac{(S/H+B/H)}{2} - \frac{(S/L+B/L)}{2} \tag{2}$$

Then ,we denote the part of portfolio income that exceeds the income of Treasury bills in a month as  $r_{it} - r_{ft}$ ; SMBt is the combined return rate of the scale factor at time t, HMLt is the combined return rate of the book-to-market value ratio factor at time t, and MOMt is the time t The combined rate of return of the momentum factor, a, b, c, d are regression coefficients to be fitted, and e is the residual term;

$$R_{i,t} - R_{f,t} = a_i + \beta_i(MKT_t) + s_i(SMB_t) + h_i(HML_t) + e_{i,t} \tag{3}$$

$$R_{i,t} - R_{f,t} = a_i + \beta_i[E(R_{m,t}) - R_{f,t}] + \beta_{i,SMB}E(SMB_t) + \beta_{i,HML}E(HML_t) + \beta_{i,UMD}E(UMD_t) + \varepsilon_{i,t} \tag{4}$$

In terms of statistics, we also used the collected data to calculate the Cross-Correlations of the corresponding factors. Our test results show that they have low correlations with each other and market agents, so theoretically 4 The factor model can explain considerable time series changes (however, there is still a little discrepancy between the results and the real conditions of China and the market).

Then we apply the OLS model method to Python to find the coefficient of each factor. At the same time, our code performs 1. (F test) significance test on the factor model: to detect whether the independent variable really affects the fluctuation of the dependent variable. 2. (t test) regression coefficient test: whether a single independent variable is valid in the model. And get the parameters: R-squared is the goodness of fit (reflecting how well the model fits the sample), and Adj.R-squared is the modified coefficient of determination.

**2.2. Statistical summary of the performance of the four-factor model and the three-factor model**

**Table 1** Cross-Correlations of 3 and 4 factor model in China A-Share Market (Mutual Fund)

	mkt	smb	hml	mom
mkt	1			
smb	0.370028	1		
hml	-0.44635	-0.76305	1	
mom	0.226133	-0.30764	0.05385	1

**Table 2** Correlation analysis of Carhart 1997 On Persistence in Mutual Fund Performance

	rmf	smb	hml	pr1yr
rmf	1			
smb	0.32	1		
hml	-0.37	0.1	1	
pr1yr	0.01	-0.29	-0.16	1

We collected data provided by China's A-share market fund companies from 2015 to 2016, and correlated the calculated market risk factor (MKT), size factor (SMB), book-to-market value ratio factor (HML), and momentum factor (MOM) Sex test. Comparing with the data in the correlation analysis (carhart 1997 On Persistence in Mutual Fund Performance [14]), we found that in China's A-share market, the market risk factor and the scale factor show a weak positive correlation (slightly stronger than that of the United States), which is similar to that of the United States. The market is similar. At the same time, when analyzing the correlation between MKT and HML and the correlation between MKT and MOM, it is found that the results are consistent with the US market. However, the factor

correlation performance of the Chinese A-share market is still different from that of the United States. In the US market from 1963 to 1993, the scale factor and the book-to-market value ratio showed a weak positive correlation, while the Chinese A-share market had a strong negative correlation ( -0.76), through the combination of (figure 1) the calculation formulas of SMB and HML, we found that it may be caused by the overall large return of the small company and small book-to-market ratio (S/L) portfolio in the investment portfolio. This result reflects the fact that a large number of small companies are listed in the Chinese market. After the company completes mergers and acquisitions, it will lead to the huge "shell value" of those small market capitalization listed companies. Buying these shell companies is like buying a domestically demolition concept house in China. It is easy to get rich and become worthless. At the same time, when analyzing the correlation between HML and MOM, China and the United States are also completely different, showing a certain positive correlation in the Chinese market, which reflects that in the Chinese market, the greater the difference between the book-to-market value and the momentum factor It may be more obvious. According to the explanation of the book-to-market value effect (Fama and French (1992)), companies with high book-to-market value ratios are mostly companies with poor market prospects. Investors in the book-to-market value ratio may be overly pessimistic about these companies. This leads to market prices relative to Net assets per share are low. In this downturn in China's A-share market, if the book-to-market ratio effect is widespread, the average return on stocks with high book-to-market ratio will be greater than that of stocks with low book-to-market ratio, and the value of HML will be further expanded, thus As a result, investors will invest in accordance with past experience or media guidance. This situation will also be reflected in the increase in the momentum factor.

**2.3. result and discussion**

In order to verify the effectiveness of the three-factor and four-factor models, we still compare the performance of the US market with the Chinese market. Refer to the classification method in (carhart 1997). The monthly income is divided into 10 groups from high to high.

**Table 3** Factor Coefficients and Statistical Analysis of China's A-Share Market

portfplio	Excess Return	3-FACTOR Model					Adj R-sq	4-Factor Model				
		Alpha	VWRF	SMB	HML	Alpha		VWRF	SMB	HML	MOM	Adj R-sq
1	5.9%	8.41%	0.7435	-0.0865	-0.9088	0.821	8.23%	0.7037	0.0158	-0.8504	0.1521	0.83
		(22.073)	(11.278)	(-0.726)	(-0.5860)		(21.201)	(10.224)	(0.12)	(-5.439)	(0.087)	
2	3.05%	5.56%	0.8235	-0.1483	-0.8462	0.893	5.38%	0.7833	-0.0451	0.7875	0.1534	0.90
		(19.349)	(16.554)	(-1.649)	(-7.233)		(18.717)	(15.361)	(-0.464)	(-6.799)	(2.382)	
3	1.88%	4.43%	0.8507	-1.879	-0.7981	0.916	4.27%	0.8142	-0.0942	-0.7448	0.1392	0.92
		(17.808)	(19.746)	(-2.411)	(-7.878)		(17.221)	(18.514)	(-1.124)	(-7.457)	(2.507)	
4	1.08%	3.63%	0.8626	-0.2244	-0.7764	0.928	3.48%	0.8287	-0.1374	-0.7268	0.1294	0.93
		(15.971)	(21.929)	(-3.155)	(-8.392)		(15.392)	(20.673)	(-1.798)	(-7.983)	(2.556)	
5	0.42%	3.63%	0.8787	-0.2494	-0.7355	0.936	2.84%	0.8454	-0.1638	-0.6867	0.1273	0.94
		(15.971)	(23.988)	(-3.765)	(-8.537)		(13.552)	(22.775)	(-2.315)	(-8.145)	(2.716)	
6	-0.26%	2.44%	0.897	-0.286	-0.6806	0.94	2.32%	0.8684	-0.2129	-0.6387	0.1092	0.94
		(12.134)	(25.737)	(-4.543)	(-8.303)		(11.516)	(24.341)	(-3.130)	(-7.882)	(2.424)	
7	-0.82%	1.97%	0.9065	-0.309	-0.6383	0.938	1.88%	0.8846	-0.2521	-0.6062	0.0837	0.94
		(9.792)	(25.984)	(-4.889)	(-7.779)		(9.154)	(24.333)	(-3.638)	(-7.341)	(1.824)	
8	-1.22%	1.55%	0.9167	-0.33	-0.6023	0.936	1.48%	0.9015	-0.2909	-0.5801	0.058	0.94
		(7.618)	(26.050)	(-5.184)	(-7.277)		(7.072)	(24.268)	(-4.108)	(-6.875)	(1.236)	
9	-1.56%	1.15%	0.9272	-0.352	-0.5681	0.926	1.11%	0.9138	-0.3295	-0.5551	0.034	0.93
		(5.261)	(24.546)	(-5.159)	(-6.395)		(4.891)	(22.847)	(-4.310)	(-0.6080)	(0.671)	
10	-1.96%	0.75%	0.9288	-0.363	-0.5365	0.907	0.73%	0.9244	-0.3517	-0.5301	0.0168	0.91
		(3.065)	(22.010)	(-4.756)	(-5.407)		(2.866)	(20.533)	(-4.098)	(-5.184)	(0.295)	
1-10 spread	7.86%	7.66%	-0.1853	0.2765	-0.3721		7.5%	-0.0106	0.3675	-0.3203	0.1353	
9-10 spread	0.40%	0.40%	-0.0016	0.0106	-0.0316		0.38%	-0.0106	0.0222	-0.025	0.0172	

At the same time, according to the performance data of China's A-share market fund companies collected on the wind platform, we used python to conduct a series of regression analysis and statistical tests on the data. In the data we get, R-Sq represents the percentage of regression model error to the total error, and its value is between 0% and 100%. The larger the value, the better the fit between the regression model and the data. R-Sq(adj) represents the adjusted R-Sq, and the value is also between 0% and 100%. The closer R-Sq(adj) and R-Sq are, the more reliable the regression model is. By observing the statistical data results, we can clearly observe that our regression model is effective, and the values of R-Sq (adj) are all greater than 75%, but only from this statistic, we are temporarily unable to draw a three-factor model. And the performance of the four-factor model in the Chinese market, which one is more efficient. When we analyzed the size of the alpha value, we were surprised to find that whether it is a three-factor model or a four-factor model, the value of the Chinese market is very large. If this result is valid, it means that the fund manager in the Chinese market The

level of investment is very high, or that the Chinese market is a weakly efficient market, with serious internal news and policy orientation, and there are surviving ships. However, the actual situation is that the Chinese market does not reflect the current situation of a weakly efficient market. In Halil Kiyamaz's article (Halil Kiyamaz, A performance evaluation of Chinese mutual funds, International Journal of Emerging Markets, V 10, No. 4, 2015) author The historical performance of 1037 public offering funds from 2000 to 2013 was calculated. [4] His research shows that public funds in the sample period can create positive alpha for their investors. Among them, excess returns are the most obvious among radical funds, but no excess returns are found in QDII funds. At the same time, the author found that China's public funds lacked stability. The performance of the fund varies greatly from year to year. This finding means that if investors choose to buy funds based on the historical performance of the fund, they are likely to be disappointed next. At the same time, Wang Sul (Wang Sul, Yu Tae, Chang Gyu, The Evaluation of Chinese Mutual Funds Performance, 2006) also came to a

similar conclusion when studying the historical performance of 65 mutual funds from 2002 to 2004. [9] The statistical sample size includes 48 closed-end funds and 17 open-end funds. His research shows that public funds generally produce positive alpha. However, these positive excess returns mainly come from open-end funds. Among closed-end funds, approximately 46% of funds have negative excess returns. Therefore, the excess returns created by fund managers mainly come from their ability to select stocks, rather than timing. In terms of time period, the Chinese market is very young, but in terms of market size, the Chinese market is second only to the US market, and is a market with a huge number of individuals. Regulating a huge volume in a short period of time obviously has not reached the standard of an effective market in terms of system and market maturity, and this phenomenon also reflects part of the reason why Alpha is big.

**Table 4** Frequency Distribution of the Single - Index Alpha Based on Mutual Funds Net Returns (2004-2010) [2]

$\alpha > 0$	109
$\alpha < 0$	40
Average $\alpha$	0.004829

However, even if the Chinese A-share market is still a weakly efficient market, it is still insufficient to explain the alpha value as high as 8%. Therefore, we believe that the existing factor calculation model may need to be adjusted. In the study by Liu et al (Size and Value in China (Liu et al. 2018) believes that due to the unique shell value problem of the Chinese stock market, the popular Fama-French three-factor model (Fama and French 1993) in the US market is not easy to use in China. 30% Of stocks have reduced shell value pollution [7]. Based on the Fama-French three-factor model, a Chinese version of the three-factor model suitable for A-shares has been proposed. The overall construction steps are similar to that of Fama French's three-factor model, but they have made a little change in the selection of value indicators: in addition to the three indicators of EP, BM, and AM, CP (Cash flow-to-price) has also been added. ) Indicators, four indicators are shared to test the value factor of China. The conclusion drawn through (figure 4) found that the Chinese version of the three-factor model can well explain most of the yield cross-section anomalies discovered by the academic community in the Chinese market, which is much stronger than the Fama-French three-factor interpretation. Therefore, the phenomenon of large alpha reflects the uniqueness of the Chinese market from some perspectives. When China uses the three-factor model and the four-factor model to predict and test, further optimization and adjustment are needed.

**Table 5** Comparison of the revised Chinese version of the three-factor model (Liu et al. 2018) and the Fama and French 1993 three-factor model

Factors	Alphas with respect to CH - 3 FF - 3	
	CH - 3	FF - 3
Panel A:Alpha (t-statistic)		
FFSMB	-0.04 (-0.66)	-
FFHML	0.34 (0.97)	-
SMB	-	0.47 (7.03)
VMG	-	1.39 (7.93)
Panel B:GRS F-statistics(p-value)		
FFSMB,FFHM	0.88 (0.41)	-
L	-	-
SMB,VMG	-	33.9 (2.4 × 10-3)

When observing the excess returns, we noticed that comparing carhart's 1997 data in the US market, the top five fund companies in the Chinese market have significant excess returns, but compared to the US market, the gap between the upper and lower returns of fund companies is obvious. In the Chinese A-share market, starting from the sixth group, there has been a phenomenon that is lower than the average performance of the market. In the market, the performance of the top brokerage is obvious. According to the data of "Brokers China" as of 2021, there are nearly 100 funds in the whole market with a return of more than 50% during the year, while there are as many as thousands of loss-making funds, and the gap between the beginning and the end of the fund has widened to 130%. At the same time, according to Choice data, as of October 25, the highest performance of public fund products has reached 93.66%, and the lowest loss is about 38%. The fund performance gap exceeds 130%. Calculated separately by share, up to now there are 94 mutual fund products in China whose performance has exceeded 50% during the year. The top ten fund products have all exceeded 70% since the beginning of the year, including Xincheng Emerging Industry Fund, Qianhai Open Source Public Utilities Fund, Qianhai Kaiyuan The top five players, including the Haikaiyuan New Economy Fund, the Golden Eagle National Emerging Fund, and the Great Wall Industry Rotation Fund, have all achieved more than 90% profit since 2021, while the number of fund products with a return of more than 30% during the year reached 359. This is surprisingly consistent with our statistics. The excess returns of the first and second groups (5.9%, 3.05%) far exceed the sum of the excess returns of other stocks in the A-share market. This phenomenon shows that there is a certain degree of

differentiation in the Chinese stock market. The obvious factors" are not ruled out. income gap is difficult to explain only from the technical level of fund company investors, and "non-transparent

**Table 6** Factor Coefficients and Statistical Analysis of Carhart 1997

Portfolio	Monthly Excess Return	Std Dew	CAPM			4-Factor Model					
			Alpha	VWRF	Adj R-sq	Alpha	RMRF	SMB	HML	PR1YR	Adj R-sq
1A	0.75%	5.45%	0.27%	1.08	0.777	-0.11%	0.91	0.72	-0.07	0.33	0.891
			(2.06)	(35.94)		(-1.11)	(37.67)	(19.95)	(-1.65)	(11.53)	
1B	0.67%	4.94%	0.22%	1.00	0.809	-0.10%	0.86	0.59	-0.05	0.27	0.898
			(2.00)	(39.68)		(-1.08)	(40.66)	(18.47)	(-1.38)	(10.63)	
1C	0.63%	4.95%	0.17%	1.02	0.843	-0.15%	0.89	0.56	-0.05	0.27	0.927
			(1.70)	(44.65)		(-1.92)	(49.76)	(20.86)	(-1.61)	(12.69)	
1(high)	0.68%	5.04%	0.22%	1.03	0.834	-0.12%	0.88	0.62	-0.05	.29	0.933
			(2.10)	(43.11)		(-1.60)	(50.54)	(23.67)	(-1.86)	(13.88)	
2	0.59%	4.72%	0.14%	1.01	0.897	-0.10%	0.89	0.46	-0.05	0.20	0.955
			(1.75)	(57.00)		(-1.78)	(66.47)	(22.95)	(-2.25)	(12.43)	
3	0.43%	4.56%	-0.01%	0.99	0.931	-0.18%	0.90	0.34	-0.05	0.16	0.963
			(-0.08)	(70.96)		(-3.65)	(90.03)	(18.99)	(-3.69)	(11.52)	
4	0.45%	4.41%	0.02%	0.97	0.952	-0.12%	0.90	0.27	-0.05	0.11	0.971
			(0.33)	(85.7)		(-2.81)	(90.03)	(18.18)	(-3.12)	(9.40)	
5	0.38%	4.35%	-0.05%	0.96	0.960	-0.14%	0.90	0.22	-0.05	0.07	0.970
			(-1.10)	(93.93)		(-3.31)	(89.65)	(14.42)	(-3.27)	(6.18)	
6	0.40%	4.36%	-0.02%	0.96	0.958	-0.12%	0.90	0.22	-0.04	0.08	0.968
			(-0.46)	(92.9)		(-2.82)	(86.16)	(14.02)	(-2.37)	(6.01)	
7	0.36%	4.30%	-0.06%	0.98	0.959	-0.14%	0.90	0.21	-0.03	0.04	0.967
			(-1.39)	(85.14)		(-3.09)	(85.73)	(13.17)	(-1.62)	(2.89)	
8	0.34%	4.48%	-0.10%	1.00	0.951	-0.13%	0.93	0.20	-0.06	0.01	0.958
			(-1.86)	(67.91)		(-2.52)	(75.44)	(10.74)	(-3.16)	(0.84)	
9	0.23%	4.60%	-0.21%	1.02	0.926	-0.20%	0.93	0.22	-0.10	-0.02	0.938
			(-3.24)	(46.09)		(-3.11)	(60.44)	(9.69)	(-3.80)	(-1.17)	
10(low)	0.01%	4.90%	-0.45%	1.00	0.851	-0.40%	0.93	0.32	-0.08	-0.09	0.887
			(-4.58)	(67.91)		(-4.33)	(42.23)	(9.69)	(-2.23)	(-3.50)	
10A	0.25%	4.78%	-0.19%	1.00	0.864	-0.19%	0.93	0.33	-0.11	-0.02	0.891
			(-2.05)	(40.67)		(-2.16)	(42.99)	(10.27)	(-3.20)	(-0.76)	
10B	0.02%	4.92%	-0.42%	1.00	0.817	-0.37%	0.91	0.32	-0.09	-0.09	0.848
			(-3.84)	(40.67)		(-3.45)	(35.52)	(8.24)	(-2.16)	(-2.99)	
10C	-0.25%	5.44%	-0.74%	1.05	0.736	-0.64%	0.98	0.32	-0.04	-0.17	0.782
			(-5.06)	(32.16)		(-4.49)	(28.82)	(6.29)	(-0.73)	(-4.09)	
1-10 spread	0.67%	2.71%	0.67%	0.01	-0.002	0.29%	-0.05	0.30	0.03	0.38	0.231
			(4.68)	(0.39)		(2.13)	(-1.52)	(6.30)	(0.53)	(10.07)	
1A-10C spread	1.01%	3.87%	1.00%	0.02	-0.002	0.53%	-0.07	0.40	-0.02	0.50	0.197
			(4.90)	(0.42)		(2.72)	(-1.61)	(5.73)	(0.32)	(8.98)	
9-10 spread	0.22%	1.22%	0.23%	-0.02	0.004	0.20%	-0.01	-0.10	-0.01	0.07	0.118
			(3.64)	(-1.60)		(3.13)	(-0.40)	(-4.30)	(-0.60)	(3.87)	

Further, we compare the coefficients obtained by regression tests between SMB and HML, and we can find that the SMB coefficient of China's A-share market from 2015 to 2020 is significantly smaller than that of the US market, and it is negative starting from the second group. We believe this "scale effect" This has something to do with China's policy guidance, the slow speed of information transmission and the distortion of information and the bureaucratization of management

caused by large enterprises. On the contrary, it has a certain relationship with "diseconomies of scale". At the same time, the scale factor coefficient is negative, reflecting that the current market value has a negative impact on investment income. In the Chinese market, strict anti-monopoly and regulatory control of large companies may cause the larger the company's market value, which may have an impact on the company's income. . Secondly, China's book-to-market ratio factor

has obvious negative effects relative to the US market. If the four-factor model is established, and the book-to-market value ratio effect is real (Liu Yuxi, Song Wang (2011) research pointed out that there are 11 intervals in 15 sample intervals, the book-to-market value ratio has a significant positive effect on stock returns) [6], from our statistics According to the results, the book-to-market value ratio effect may be harmful to investors, but there is insufficient evidence to surface the reliability of this conclusion, so there are certain doubts about the validity of the four-factor model and the book-to-market value ratio effect.

### 3. CONCLUSION

From the asset pricing model to the three-factor model and then to the four-factor model, the theoretical model of the financial market has been continuously improved. In developed countries such as Japan and the United States, the effectiveness of the three-factor model once reached 95%. However, in the face of China where the reform and opening up is only 40 years old, the establishment of the financial market is only a matter of about 30 years. Whether it is market efficiency, stockholders' knowledge reserves, and system management, further development and improvement are still needed. In such a development process, hypotheses and models that are more suitable for developing countries are needed to support the completeness and stability of national financial markets. Therefore, we validated the classic factor model, summarized the existing excellent models, and found some problems and highlights that can be observed from the basic data, so as to elicit more conjectures about model predictions. According to our comparison and analysis, it is found that the interpretation scope of the 3-factor model and 4-factor model in the Chinese market is still limited. There are many market phenomena that cannot be fully explained by the 4-factor model, especially those with excess returns and high alpha values. On the issue, it implies that data screening or reorganization of the factor model may be necessary, or there is a new factor that can weaken the explanation of the alpha value for the excess return. In our review, the Chinese version of the "shell pollution" three factors has been removed. The model may be a better explanation method, but from the perspective of market phenomena, the scale effect and book factor effect of China's A-share market require more factors. For complex systems, even nonlinear factor models can be tried to show the characteristics of Chinese society. Among them, factors that cannot be ignored include a strong retail investor base, impulse generation, herding phenomenon, and intentional or unintentional guidance by media news, as well as cyclical policy changes and incompletely transparent information channels. Pointing out these existing problems is not only to optimize the model to predict the income situation, but also to support the state's guidance, standardize the

system and improve the financial system. Analyzing and discovering problems through factor models will help China develop a more effective and efficient market, allow the financial market to more fully mobilize social resources, and avoid blind obedience and hidden factors that cause resource waste.

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