Study on Applicability of Fama-French Five-Factor Model in Chinese A-Share Market

Rui Qin

School of international business, Southwestern University of Finance and Economics, Chengdu 611130, China

1922842084@qq.com

Abstract. This paper takes the monthly data of China A-share market from March 1999 to April 2019 as the data sample, mainly focusing on analyzing the applicability of five factors in A-share market and the explanatory ability of CMA and RMW for excess returns. The conclusions are as follows: 1. Market risk premium, market value factor and book-to-market ratio factor are highly significant, and RMW adjusted by three-factor model is not redundant; 2. Linear regression and GRS test results show that CMA factor can explain the excess return in A-share market to some extent, yet its explanatory capability is still questionable; 3. Five-factor model has better explanatory ability than three-factor model in A-share market; 4. The performance of each model is better after the stock reform , which shows that the stock reform beginning in 2005 makes the price of A-share market more reasonable and the stock market more effective.

Keywords: Fama-French Five-Factor Model; Asset Pricing; Excess Return; China's A-Share Market.

1. Introduction

Fama and French (1992) presented that a three-factor model is practical to explain stock rate of return, based on a study on the factors that determine the variation of the return on stock in the Stock Market of the United States [1]. The model added three factors to the capital asset pricing model (CAPM), including book-to-market ratio (HML), market asset portfolio ($R_{\mathrm{m}} - R_f$) and market value factor(SMB). However, researchers found it difficult to fully explain the excess benefits of the various risks using Fama-French three-factor model. When Fama and French tested the data of major global securities markets in 1998, they found that this formula still could not be applied to all securities markets (Wu,2016) [2]. Therefore, Fama and French (2015a) claimed that profitability factor (RMW), investment style factor (CMA)can also bring the excess returns of individual stocks, which were regarded as two new factors in Fama-French model in order to give a better description of the expected yield on a cross-sectional stock portfolio [3].

The applicability of the five-factor model has been proved in European and American stock markets (Fama and French, 2015b)[4]. However, it still lacks evidence to prove its validity in some stock markets, taking Japanese stock market for example (Wu,2016) [5]. Because of the particularity of China's stock market, the applicability of this model needs to be tested even more. Since 2005, China's stock market, especially state-owned enterprises, has carried out large-scale equity allocation reform, which is a unique situation in China's market and has exerted great influence on the pricing mechanism of China's capital market (Gu,2015) [6]. Although some scholars have done empirical research on the Chinese stock market, there are still differences in the conclusions reached. Meanwhile, since the Chinese A-share market has experienced considerable volatility in recent months, Shanghai-Hong Kong Stock Connect and Shanghai-London Stock Connect have greatly promoted exchanges and cooperation among major stock markets and attracted foreign investment into China's market, the applicability of Fama-French model still needs to be tested.

This paper is written to solve several problems. Firstly, the paper tries to test the long-term applicability of Fama-French Model in China's stock market, based on relevant data of long-term China's A-share Market. Secondly, to test the stylistic effects of China's A-share Market. Thirdly, the paper will expand the applicability of the five-factor model, mainly focusing on China's A-share market. Fourthly, to research on the Impact of Stock Reform on Stock Pricing in A-share Market. Fifthly, this paper has guiding significance for China's stock investment.

Copyright © 2019, the Authors. Published by Atlantis Press.
This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/).

The paper is divided into five parts to interpret. The first part is introduction and background. The second part is literature review. The third section is data processing and factor construction method, including data source, data processing and factor construction method. The fourth part is the test of applicability of Fama-French Five-Factor Model, mainly analysis the performance of each factor and different models based on data. The conclusions will be summarized in the fifth part.

2. Literature Review

The development of stock asset pricing model has gone through a long period. Sharp (1964), based on the study of modern portfolio theory, proposed Capital Asset Pricing Model (CAPM), which is widely used as the most classical asset pricing model [7]. The central idea of CAPM model is to define the systemic risk (Beta) of the asset, so as to study the relationship between the expected return of the asset and the risky asset.

With the rapid development of global stock market, CAPM can no longer meet the need of accurate asset pricing. The beta coefficient in CAPM model can not fully explain systemic risk, but non-traditional factors such as company size and book-to-market value ratio have strong explanatory power on the average return of stocks. Banz (1981) claimed that based on the research of NYSE stock market, small firms, on average, have higher risk adjusted returns than large firms, thus putting forward 'size effect', and believing that there is no linear relationship between size effect and market value [8]. Based on data over the past 15 years, Stattman and Dennis (1980) found that the book value to market price ratio (BP) ratio was positively correlated with the follow-up risk-adjusted returns during the observation period [9]. In addition, academics have also observed calendar effects in stock markets, such as Trading-hours-of-the-day effect (stock price rises in trading time) and January effect (stock price in January is higher in the U.S. stock market).

Although many scholars have explained the financial anomalies and found some important factors, a systematic theory of formation still has not formed. Fama and French (1993) identified five common risk factors in the returns on stocks and bonds (10). For the stock market, Fama and French stated that there are three important factors: market portfolio ($R_m - R_f$), market value factor (SMB), book-to-market ratio factor (HML), and proposed a classical three-factor model:

$$R_{it} - R_{ft} = \alpha + \beta_{im}(R_{mt} - R_{ft}) + \beta_{is} SMB_t + \beta_{ih} HML_t + \varepsilon_t$$

The model interprets the cross-sectional change of average return rate which CAPM can not explain, and improves asset pricing by adding influence factors. However, scholars found that the modified model is not perfect enough, and there are still other factors affecting stock asset pricing. Based on firm level, Aharoni, Grudy and Zeng (2013) claimed that there is a positive correlation between expected returns and expected investment [11]. This result is contrary to the result of Fama and French (2006) which was tested at per share level [12]. On the basis of questioning and improving Fama-french three-factor model by many scholars, Fama and French (2015a) integrated profit factor (RMW) and investment factor (CMA) into the original three-factor model, and finally formed a five-factor model [13]:

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

At present, some scholars have tested the applicability of Fama-French five-factor model in Chinese A-share market, but there is no unified conclusion in academic circles. Li (2017) states that the effect of scale and book-to-market ratio is obvious in all samples [14]. Five-factor model has very strong explanatory power for A-share market, and its performance is better than CAPM and three-factor model. However, there are still some disagreements which have tested by some scholars. Through empirical analysis of trading data in A-share market, Zhao (2016) concluded that market

value effect and value effect perform significantly in China's stock market, but RMW and CMA have little effect on stock portfolio returns [15]. This result is contrary to the result of American stock market which means that the five-factor model is not suitable for Chinese stock market.

3. Data Processing and Factor Construction Method

3.1 Sample Selection and Data Processing

All the data in this paper are from CSMAR database. All the data sources in this database are from the public authorization data of Shanghai Stock Exchange and Shenzhen Stock Exchange, or from collection of the public data. Since most of the financial institutions, organizations and individual investors in China only invest in the mainland stock market, this paper only uses the data of China A-share market to analyze and test. Because of the lag of financial information disclosure, the annual report disclosure time of listed companies is generally from March to April of the following year, and our country stipulates that the financial year should be synchronized with the natural year. Therefore, this paper takes March of Year t to April of Year t+1 as a combination construction cycle, thus avoiding the problem of inconsistent data time.

The risk-free interest rate in this paper is based on the three-month consolidated deposit and withdrawal rate of RMB announced by the Central People's Bank of China. The data are processed during the adaptability test. The weighted weight of stock market value in the article is calculated directly by circulating stock capital. In addition, since China's stock market is still immature and there is no index of the whole stock market for the time being, this paper uses the representative Shanghai Stock Exchange Index and Shenzhen Stock Exchange Index to measure the market yield R_{Mt}.

The financial data in this paper are from the CSMAR financial annual report database, and the market data are from the CSMAR stock market transaction database which mainly includes the name of the stock, trading code, the total number of A shares, and the monthly closing price.

3.2 Model Interpretation and Factor Calculating Method

The five-factor model proposed by Fama and French (2015a) is as follows [16]:

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

In the formula, R_{it} is the rate of return of portfolio I in the T period, while R_{ft} represents a risk-free interest rate. The market factor $R_{Mt} - R_{Ft}$ is calculated by subtracting the risk-free interest rate R_{Mt} from the market value weighted average market rate of return reflecting market risk premium. SMB_t represents market value factor, calculated by the difference between small market value and large market value stock returns. The book-to-market ratio factor HML_t is the difference between the high book-to-market return rate and the low book-to-market ratio of the stock portfolio. RMW_t is a profitability factor, which is equal in value to the difference between the return of stock portfolio with high operating profit margin and low operating profit margin. CMA_t refers to the investment style factor, that is, the stock portfolio is grouped according to the conservative and radical investment style, and this factor is equal to the difference of the return of the two portfolio types.

Consistent with the methods adopted by Fama and French (2015a), this paper tests the data by three classification methods, so as to maximize the reliability of the test results [17]. The first method is 2x2 grouping, which divides all stocks into two groups: small market value (S) and large market value (B) according to the median of stock market value. Then, all stocks are grouped according to the book-to-market value ratio and divided into two groups: high (H) group and low (L) group. Then, the two classifications are crossed and combined. Thus four combinations of SH, SL, BH and BL are

formed. Secondly, on the basis of replacing the book-to-market ratio with operating profit margin and investment style respectively, the above steps are repeated, in which the operating profit margin is stable and the profit margin is weak, thus all stocks can be divided into eight combinations: SR, SW, BR, BW, SC, SA, BC and BA. The second is the 2x3 method, which differs from the first method in that it divides the whole stock into three groups: high (H), medium (N), and low (L) by comparing 30% and 70% of the book-to-market value ratios. The third method is 2x2x2x2x2. On the basis of 2x2 method, 16 stock portfolios are obtained by crossing four indexes at the same time. Based on this, four factors are calculated. The test ideas of the three methods are the same, but the table in this paper only shows the data results of the 2x3 method, and the other two methods are similar in construction.

There is a big difference between the five-factor model and the three-factor model, which is embodied in the cross-influence between some factors. For example, the size factor SMB, which crosses the book-to-market ratio, profit and investment respectively, and finally forms the size factor $SMB_{B/M}$ under the combination of scale-to-book-to-market ratio, SMB_{Inv} formed by both scale and investment, and SMB_{OP} formed by both scale and investment. The final size factor SMB is calculated from the three factors. Table 1 illustrates the calculation methods for each factor.

Table 1. Calculating methods for each factor

Grouping	Calculating method of each factor
2X3	$SMB_{B/M}=\frac{SH+SN+SL}{3}-\frac{BH+BN+BL}{3}$ $\mathrm{SMB}_{OP}=\frac{SR+SN+SW}{3}-\frac{BR+BN+BW}{3}$ $\mathrm{SMB}_{Inv}=\frac{SC+SN+SA}{3}-\frac{BC+BN+BA}{3}$ $\mathrm{SMB}=\frac{\mathrm{SMB}_{B/M}+SMB_{OP}+SMB_{Inv}}{3}$ $\mathrm{HML}=\frac{SH+BH}{2}-\frac{SL+BL}{2}$ $\mathrm{RMW}=\frac{SR+BR}{2}-\frac{SW+BW}{2}$ $\mathrm{CMA}=\frac{SC+BC}{2}-\frac{SA+BA}{2}$

4. Applicability Test of Five-factor Model in China A-share Market

This paper examines the applicability of both monthly and daily data related to the A-share market from March 1999 to April 2019. However, the results obtained from the monthly data show that the results from the daily data are similar to the present results. The following will explain the test results of the five-factor model in A-share market.

When testing the Fama-French five-factor model, this paper mainly explores whether the five factors can explain the excess returns of individual stocks in Chinese A-share market, and takes the size of the intercept distance alpha after regression of the model as the basis to judge whether the performance of the factors is significant or not. If alpha rejects the original hypothesis that alpha is not zero in the empirical analysis, it shows that the five-factor model can not be perfectly applied to China's A-share market. If the alpha value of the regression results obeys the original hypothesis, it proves that the five-factor model has better applicability to A-share market.

4.1 Full Sample Test Results of Five-Factor Model in A-share Market

Table 2. Descriptive statistics of the return rates of each factor in the Chinese and American stock markets

Panel A: Descriptive Statistics of Return Rates of Various Factors in A-share Market(2X3)					
	$R_M - R_F$	*SMB*	*HML*	*RMW*	*CMA*
Mean	0.73***	0.72***	0.18	-0.06	0.13
t-Statistic	1.41	2.42	0.88	-0.31	0.87
Panel B: Descriptive Statistics of Return Rates of Factors in American Stock Market(2X3)					
	$R_M - R_F$	*SMB*	*HML*	*RMW*	*CMA*
Mean	0.51**	0.36*	0.12	0.34*	0.25*
t-Statistic	1.84	1.77	0.60	1.76	1.83

Notes: To ensure the accuracy of the conclusions, the data from March 1999 to April 2019 were used to analyze the two tables.

Mean's unit is a percentage sign, *,** and *** representing significant at 1%, 5%, and 10% significant levels, respectively

Data Source: Data in Panel A comes from CSMAR database, and data in Panel B comes from Professor French's home page.

Table 2 Panel A shows that both size factor and market factor are significant in Chinese A-share market. However, both profit factor and investment style factor obey the original assumption that the mean value is 0. Panel B show that market factor has strong significance in American stock market. Meanwhile, size factor, profitable factor and investment style factor are significant at 1% level.

Table 2 is only a preliminary descriptive statistic based on the relevant stock data. Whether the investment style factor and profit factor are applicable to China's A-share market still needs further analysis. Taking the performance of each factor in the US stock market as an example, under the preliminary statistical results, the book-to-market value ratio factor (HML) does not show a high significance. However, it does not mean that this factor is not applicable to the US stock market. This result shows that the saliency test based on a short sample interval cannot accurately reflect the applicability of each factor. Many factors, such as the overall volatility of major abnormal stock market and other factors that not have been researched, may lead to the deviation of significance test results. Therefore, this paper continues to examine the interaction between control factors through style effect test and redundancy test, thus get more accurate test results.

Table 3. A-Share Market Style Effect Test and Five-Factor Model Redundancy Test

Panel A: Test of Style Effect in Chinese A-share Market		
2 X 3	*RMW*	*CMA*
Alpha	0.47***	-0.20*
	(3.85)	(-1.69)

Panel B:Redundancy Test of Five-Factor Model					
2 X 3	$R_M - R_F$	*SMB*	*HML*	*RMW*	*CMA*
Alpha	1.48**	0.82***	0.50***	0.36***	0.08
	(2.48)	(5.23)	(3.35)	(3.50)	(0.71)

Notes: The brackets are T statistic values, and alpha units are percentages;
*, *** and *** indicate that the index is significant at 10%, 5% and 1% levels, respectively
This table only reports the results of 2X3 grouping, while the results of other groupings are similar

Because the descriptive statistics in Table 2 cannot exclude the interaction between factors, Table 3 uses the commonly used Fama-French three-factor model as the benchmark model to explore the risk premium of risk-adjusted related factors concerned by academia. Table 3 chooses the whole sample data of A-share market in China for a period of time to analyze. RMW and CMA are used to regression the three-factor model, and the interval after regression is used to express the regression results, to verify whether there is still a risk premium after eliminating the interaction between the factors. Table 3 anel A shows that after regression to the three-factor model, the risk premium adjusted by profit factor RMW is still significantly greater than 0. This data states that the condition that the mean of RMW in Table 2 is not significant may be the result of other factors, and this factor still has a high applicability to China's A-share market. However, for the investment style factor CMA, the original assumption that the risk premium is 0 cannot be rejected in the test of the style effect, and it cannot be proved that this factor can explain the risk premium problem in A-share market. This result is consistent with the conclusion in Table 2.

Fama-French five-factor model redundancy test is based on the other four factors as the benchmark model, one by one regression of single factor, thus verify whether the risk premium is significant after excluding the influence of other factors. The regression results interpret in intercept terms. The results of Table 3 Panel B show that market factors are significant at the level of 10%, SMB, HML and RMW are significant at the level of 1%. After excluding the influence of each other, these four factors still show a significant risk premium, which is still highly applicable to China's A-share market. However, the regression intercept of investment style factor CMA in the redundancy test cannot reject the original hypothesis that the intercept term is zero. The validity of this factor cannot directly denied since this result may be caused by China's A-share stock reform in 2005. This paper will continue to study the applicability of CMA factor.

Table 4. Linear regression results of five-factor model

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

Panel A:4 Factors: $R_M - R_F$, *SMB, HML* and *CMA*

Inv	Low	2	3	4	High	Low	2	3	4	High
	r					t(r)				
Small	0.38***	-0.02	-0.18***	-0.21***	-0.36***	33.31	-1.18	-10.88	-12.22	-19.13
2	0.34***	-0.06***	-0.17***	-0.33***	-0.39***	19.87	-3.36	-9.93	-16.61	-15.24
3	0.38***	0.15***	-0.11***	-0.15***	-0.30***	23.76	9.37	-5.60	-6.94	-13.46
4	0.35***	0.24***	0.18***	0.04***	-0.05**	29.77	22.35	14.96	2.99	-2.29
Big	0.38***	0.28***	0.18***	-0.14***	-0.04***	22.39	24.40	21.57	-15.99	-3.78

Panel B:5 Factors: $R_M - R_F$, *SMB, HML, RMW* and *CMAO*

Inv	Low	2	3	4	High	Low	2	3	4	High
	r					t(r)				
Small	-0.52***	-0.16***	0.01	-0.02	0.50***	-41.56	-8.78	0.53	-0.73	21.95
2	-0.25***	-0.05**	0.16***	0.19***	0.41***	-15.05	-2.50	8.25	-8.37	19.25
3	-0.33***	-0.03*	0.14***	0.01	0.51***	-22.10	-1.55	8.62	-0.28	11.88
4	-0.15***	-0.10***	-0.10***	0.11***	0.54***	-8.57	-7.62	-6.88	6.73	19.34
Big	-0.29***	-0.04**	0.05***	0.15***	0.25***	-14.46	-2.60	3.08	10.93	18.18

Panel C:5 Factors: $R_M - R_F$, *SMB, HML, RMW* and *CMAO*

	c					t(c)				
Small	0.14***	-0.27***	-0.40***	-0.50***	-0.18***	3.96	-5.70	-7.88	-9.10	-3.36
2	0.50***	-0.21***	-0.20***	-0.52***	-0.48***	11.26	-4.53	-4.09	-9.40	-7.44
3	0.55***	0.32***	-0.10**	-0.35***	-0.25***	15.52	8.81	-2.40	-6.92	-4.00
4	0.66***	0.47***	-0.32***	0.21***	0.39***	21.30	16.45	10.40	5.60	6.46
Big	0.56***	0.62***	-0.47***	-0.18***	0.15***	13.27	19.00	17.74	-8.68	5.34

Note: *, ** and *** are significant at 10%, 5% and 1% levels respectively.
c in Panel C is a percentage number

Table 4 used 2X3 grouping method for regression analysis. Since the results of Table 2 and Table 3 show that CMA factor is not significant in China's A-share market, this table will focus on the relationship between company size and investment style. Table 4 analyses the regression results of 25 stock portfolios after grouping the company size to explore whether CMA factors are redundant. In this paper, the investment style factor CMA is transformed into CMAO by orthogonalizing strictly according to the redundancy factor treatment method in regression, thus to ensure the consistency with Fama-French test method. Fama and French (2015a) states that when CMAO is used for regression, the risk load coefficients of the regression intercept Alpha, residual and investment style factors are the same as those of CMA [18]. Therefore, this test method would not affect the results of the intercept term and the subsequent analysis.

Controlling other factors unchanged, if the coefficient of CMA factor is significantly positive, the higher the future return rate, the stronger the applicability of this factor in A-share market. For the stock portfolio with conservative investment style, if the coefficient of CMA factor is significantly negative, low future return rate represents strong explanatory power of style effect on China's A-share market. According to the results of linear regression in Table 4, the profit factor RMW shows high significance at 1% level in size-inversion grouping, which reflects the high applicability in A-share market. In the five-factor regression, the investment style factor CMA is significant at 1% or 5% level in all groups, which states that this factor is not redundant in China's stock market. Considering the sample interval selected in this paper, the redundancy of CMA in Table 2 and Table 3 may be caused by the non-tradable shares of A-share market before 2005. Under this policy, there are a series of problems in China's stock market, such as malicious circle money, excessive price-earnings ratio and ambiguous market positioning (Chen,2017), which make the early stock market data cannot be standardized and the market does not perform perfectly [19].

4.2 Comparisons of Five-Factor Model and Three-Factor Model and Periodic Testing

Following the model comparison method proposed by Fama and French (2015a) [20], this paper judges the performance of different models in China's A-share market through the results of regression intercept terms. This paper will continue to use the GRS test method proposed by Gibbins and Shanken (1989), which is widely used in academia, to test the validity of the model by testing the type of stock portfolio [21]. This method analyses portfolio and judges whether the combined intercept terms are all 0. If the intercept term is zero at the same time, it shows that the model can fully explain the excess returns with portfolio in cross-sectional A-share market. Meanwhile, if the intercept term of the model does not satisfy the original hypothesis of zero at the same time, the closer the intercept term approaches zero, the better the performance of the model in the stock market. This paper mainly uses GRS test to compare the applicability of three-factor model and five-factor model in A-share market. In addition, because GRStest2 can explain the results of asymptotically valid chi-square test in more detail, this index is also used to supplement the description of GRS test. The following table will report the test results periodically

Table 5. Comparisons of Five-Factor Model and Three-Factor Model

	199903-201904		199903-200501		201501-201904	
	GRS	GRS2	GRS	GRS2	GRS	GRS2
Size - inv						
Mkt.SMB.HML	20.42	33.70	17.12	17.12	15.02	19.04
Mkt.SMB.HML.RMW	17.69	29.20	16.22	16.22	12.93	16.39
Mkt.SMB.HML.CMA	19.86	32.79	16.94	16.94	14.46	18.33
Mkt.SMB.HML.RMW.CMA	17.55	28.97	15.73	15.73	12.94	16.40

Notes: The smaller the index, the better the performance of the representative model.
P-Value equals zero during 199903-201904 and 201501-201904.

Table 5 illustrates the GRS test of each model in different periods, and reports the proportion of excess earnings that each model cannot explain. According to the test results of different periods, stock reform has played a role in promoting the rationalization of stock pricing in China's A-share market. For example, from 1999 to 2019, the five-factor model can explain 82.45% of the excess return. However, from 2005 to 2019, the model can explain 87.06%, which shows that the A-share market after the stock reform is more effective.

By comparing the performance of each model, whether considering the impact of stock reform on A-share market or not, the test values of the five-factor model are less than those of the three-factor model, which means that five-factor model can better explain the stock pricing of A-share market. At the same time, table data can show that both RMW and CMA factors have certain explanatory effect on A-share market. For example, from 1999 to 2019, the four-factor model with RMW can explain the excess return of A shares to 82.31%, while the four-factor model with CMA can explain 80.14%.Howerver, the three-factor model with RMW can only explain 79.58%. This comparison shows that both CMA and RMW have explanatory power to A-share market, but the explanatory degree of CMA factor still needs to be tested.

5. Conclusion

Taking the monthly data of China A-share market from March 1999 to April 2019 as the data sample, this paper mainly analyses the applicability of five factors in A-share market, and analyses the explanatory ability of CMA and RMW for excess returns. In addition, this paper also analyses the impact of stock reform on China's stock market. The conclusions are as follows: 1. Descriptive statistics and redundancy test results in A-share market show that market risk premium, market value factor and book-to-market ratio factor are highly significant, and RMW adjusted by three-factor model is not redundant; 2. Linear regression and GRS test results show that CMA factor can explain the excess return in A-share market to some extent, yet its explanatory capability is still questionable; 3. Five-factor model has better explanatory ability than three-factor model in A-share market, which is consistent with the results of most foreign stock markets; 4. The performance of each model is better after the stock reform , and the difference between before and after the stock reform is significant, which shows that the stock reform makes the price of A-share market more reasonable and the stock market more effective.

Based on the full sample data over a period of time, this paper verifies the explanatory power of each factor in A-share market, confirms the applicability of the five-factor model in China A-share market, and supplements the discussion on pricing model of A-share market in academic circles. At the same time, this paper also tests the applicability of each model in different periods, which provides data analysis for the validity of stock reform. In this paper, the time-division test is used to compare the models. It proves that the five-factor model is more suitable for A-share market. Meanwhile, it also analyses the impact of stock reform and proves that the stock reform has an important impact on the stock pricing of A-share market. Therefore, through data analysis, this paper also provides a way of data selection for researching for a more suitable factor model that is to consider stock reform as a time node, mainly focusing on the stock pricing of A-share market after stock reform. The results of this paper can be applied to the analysis of stock prices of securities companies, and also can provide reference for the auditing of corporate stock pricing by regulators.

References

[1]. Fama, E.F. and French, K.R. (1992). The Cross-Section of Expected Stock Return. The Journal of Finance, 47(6), 425-465.

[2]. Wu, 2016. Empirical Research of the Fama-French Five-Factor Model in China’s A-Share Market [D]. Changchun: Jilin University.

[3]. Fama, E.F. and French, K.R. (2015a). A five-factor asset pricing model. The Journal of Financial Economics, (116), 1-22.

[4]. Fama, E.F. and French, K.R. (2015b). International Tests of a Five-Factor Asset Pricing Model. Tuck School of Business Working Paper, No.2622782.

[5]. Wu,2016. Empirical Research of the Fama-French Five-Factor Model in China's A-Share Market [D]. Changchun: Jilin University.

[6]. Gu. (2015). Review and prospect of split-share reform in China. Economic and Social Development, (4), 210.

[7]. Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. The Journal of Finance, 19(3), 425.

[8]. Banz, R.W. (1981). The relationship between return and market value of common stocks. The Journal of Finance, 3(9), 3-18.

[9]. Stattman and Dennis. (1980). Book Values and Stock Returns. The Chicago MBA: A Journal of selected Papers, (4), 25-45.

[10]. Fama, E.F. and French K.R. (1993). Common risk factors in the returns on stocks and bonds. The Journal of Finance, (33), 33-56.

[11]. Aharoni, G., Grund, B. and Zeng, Q. (2013). Stock returns and the Miller Modigliani valuation formula: Revisiting the Fama French analysis. Journal of Financial Economics, (110), 347-357.

[12]. Fama, E.F. and French K.R. (2006). Profitability, investment, and average returns. Journal of Financial Economics, (82), 491-518.

[13]. Fama, E.F. and French, K.R. (2015a). A five-factor asset pricing model. The Journal of Financial Economics, (116), 1-22.

[14]. Li, Yang, Feng and Jing. (2017) Fama -French Five Factor Model in China Stock Market. Journal of Financial Research, (6), 191-206.

[15]. Zhao, Yan and Zhang. (2016). Does Fama-French Five Factor Model Outperform Three Factor Model? Evidence from China's A-Share Market. Nankai Economic Studies, (2), 41-59.

[16]. Fama, E.F. and French, K.R. (2015a). A five-factor asset pricing model. The Journal of Financial Economics, (116), 1-22.

[17]. Fama, E.F. and French, K.R. (2015a). A five-factor asset pricing model. The Journal of Financial Economics, (116), 1-22.

[18]. Fama, E.F. and French, K.R. (2015a). A five-factor asset pricing model. The Journal of Financial Economics, (116), 1-22.

[19]. Chen and Tang. (2017). The effect of split-share reform on the stock market. Management Observer, (23), 139-142.

[20]. Fama, E.F. and French, K.R. (2015a). A five-factor asset pricing model. The Journal of Financial Economics, (116), 1-22.

[21]. Gibbons, M. R., Ross, S. A. and Shanken, J. (1989). A test of the efficiency of a given portfolio. Econometrica, 57(5), 1121.