

## Review of Multi-Factor Asset Pricing Theory

Jiangzhou Li

Business school, The university of western Australia, Perth6009, Australia

13262939109@163.com

### Abstract

**Fama-French multi-factor model is not just an important innovation after CAPM, but also the latest achievement in the field of capital asset pricing. This paper introduces the background and significance of asset pricing theory, analyzes and sorts out its development context, the advantages and disadvantages of CAPM and APT model, the development and advantages of multi-factor model, and systematically summarizes the relevant research at home and abroad. It is found that the research on multi-factor model by scholars at this stage is more complicated and some conclusions are uniform. At the same time, after considering the overall market sentiment, institutional investor sentiment and individual investor sentiment, we select some basic indicators to construct the composite investor sentiment index. Therefore, this paper reviews the above theories, and some suggestions are advanced for the future development direction.**

### Keywords

**Capital asset pricing, Multi-factor model, Analysis.**

### 1. Introduction

Capital asset pricing model (CAPM) is developed by Sharpe (1964), Linter (1965) and Mossin (1965) of the United States on the basis of Markowitz's portfolio theory. It is the basis of contemporary financial economic theory and is widely used in market investment decision-making and corporate investment and financial management. It is utilized to study the relationship between the expected return on assets and its main assets in the stock market. The core of the capital asset pricing model is to price only the systematic risk of the portfolio, and the non systemic risk market will not compensate for it. CAPM model is to compensate for the systematic risk of the portfolio on the basis of risk-free return.

The main problem of the CAPM model is the empirical problem. The empirical effect is poor and the pricing efficiency is problematic. The reason for the problems in the empirical test lies in the theoretical basis of the model, that is, the hypothesis of Markowitz's optimal portfolio theory can hardly be effectively satisfied in reality. Markowitz's hypothesis proves that. First, investors are completely rational. Second, the capital market has the conditions of complete efficiency. However, the reality is that people's rational cognitive ability is objectively limited by psychological and physiological thinking ability after all, so that people's behavioral rationality is limited, not completely lucid. At the same time, assuming that the risk aversion of investors is the same ones, most of these models ignore the analysis of psychological factors of investors' actual decision-making behavior, and think that investors are homogeneous. Because of advocating the quantitative model and a series of strict assumptions, it is sometimes difficult to effectively use it in investment practice. In reality, we can not find a fully competitive market, and the market is not effective. The market is so full of information asymmetry, and the cost of obtaining information is very high. Therefore, in the capital asset pricing model, it is very important to consider the irrational characteristics of human beings, and it is very important to adopt the research model of the integration of behavioral finance and asset pricing.

Behavioral finance theory is prepared from the challenge and challenge of CAPM theory. Behavioral finance can better explain financial market anomalies such as the "equity premium puzzle". Investor sentiment has always been one of the foremost theoretical bases for behavioral finance to explain financial market anomalies. Investor sentiment well explains many anomalies that traditional financial can't explain. A large number of behavioral finance studies at home and abroad have proved that investor sentiment has an inevitable relationship with humanity's thinking judgment and investment behavior. Investor sentiment affects investors' specific investment decisions. More importantly, when these investment decisions are related to risks and uncertainties, investor sentiment is one of the crucial factors that determine the price and trend of the stock market. Because non systematic risk factors contained in the portfolio of different investors are different, the sentiment of market changes can not be the same. The strength of different investor sentiment is different, so the sentiment of an individual investor is synthesized into a kind of market sentiment, and the herding effect is the full reflection of this market sentiment.

## 2. Asset Pricing Theory

### 2.1. Developments in Asset Pricing Theory

In 1964, A. Osborne's "random walk theory" was given attention to, and he interpreted this theory. The change in the stock price is like Brownian motion in chemistry, so we can't make a correct and specific judgment on its change path. In 1970, E. Fama also pointed out that investors could not make a more accurate judgment on the future trend and performance of the stock price based on the historical price of the stock. In order to make better financial decisions, they focus on the research and analysis of accounting statements of various companies, so as to increase their ability and level of expected judgment of stock prices in the future. In a stable and healthy financial market, is there no law of economics that can be the investment path followed by relevant investors? In the face of this problem, the interpretation of Paul A. Samuelson, an American economist, is that an efficient market can be further enhanced under the support of economic laws.

In 1965, Eugene Fama published an article entitled "The behavior of stock market prices". Through the understanding of this chapter, he took the lead to put forward the concept of the efficient market: in the capital market, all participants from the perspective of pursuing their own interests, try to use their potential strength to capture all kinds of favorable information for themselves, so as to make a correct prediction of the future development trend of a single stock. The mutual game among many investors makes the capital market present such a development situation: the price of a single stock market is in great agreement with the expected and happened events in the market.

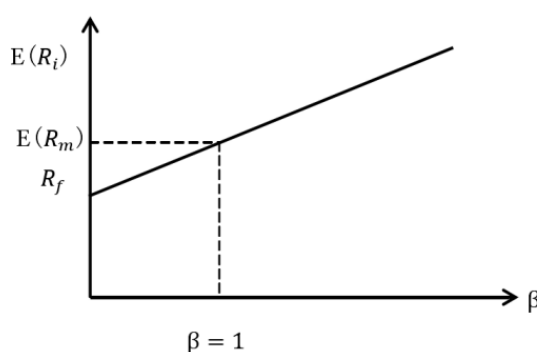
In 1970, Fama put forward the theory of the efficient market hypothesis. The profound connotation of this theory is that when there is a greater agreement between price and the available information, then this market is described as an efficient market. Two important signs are the premise and important support to judge whether the securities market has external efficiency: on the one hand, whether the price can follow the change of information and produce significant price fluctuation; on the other hand, whether the relevant information of securities can be captured and obtained by many investors who participate in the investment in the first time. Through the understanding of this hypothesis, we think that the change in the stock price is more hidden in the activities of investors using useful information to make the relevant investment. If only relying on this speculative knowledge, then the technical analysis of stocks is not tenable. Therefore, if we want to make the market more effectively, we must take the following aspects as the essential premise and basis. First of all, to a certain extent, the relevant investors can make full use of the reliability of information to obtain a relatively productive

return on profits. Secondly, the security's price can usher in a better fast response performance in the market information. Moreover, in the market game, the security's price and the innovation of new information show two distinct main contents, which are relatively independent. The efficient market hypothesis (EMH) has laid a certain foundation for later research on asset pricing.

In 1952, Markowitz pointed out in his article portfolio selection effective diversification of investment that portfolio selection is of great practical significance for the whole history of modern financial theory. It even means that the modern portfolio investment theory has officially opened and the capital market has ushered in an important period of development opportunities. This paper uses expected return and risk represented by the variance of the study portfolio and selection. Obviously, the choice made by investors under the decentralized investment concept is inconsistent with that we usually make. No matter what they do, in order to better avoid all kinds of unpredictable potential risks, they usually abandon the practice of putting all their eggs in the same basket. Driven and led by the mean variance theory of portfolio, portfolio theory gets a more correct and scientific interpretation, and even gives a new interpretation of the true connotation of risk and return, that is, it can better use the average value of portfolio to scientifically and comprehensively interpret the expected return of the portfolio, and use the variance of portfolio return to interpret the portfolio risk. This leads to the successful introduction of rigorous mathematical statistical methods in the study of portfolio. Of course, under the assumption that investors are risk averse, we should use this theory to make a conclusive judgment on the relationship between securities risk and return. Driven by the expectation idea of reducing all kinds of potential risk factors to the minimum, investors adopt more appropriate investment methods, so as to achieve good expected return effect and profit target.

## 2.2. Capital Asset Pricing Models

CAPM is a single index model, and its advantage is more hardheaded. This practical effect can save a lot of calculation processes than portfolio theory in the investment calculation. According to the relationship of CAPM, we can find that there is a positive correlation between the return of individual stock  $i$  and its coefficient  $\beta$ , as showed in Figure 1.



**Fig.1** The relationship between stock return and coefficient

Although CAPM seems perfect in form and computation, it still has great limitations.

First of all, CAPM has many strict assumptions, for example, it requires that in a fully competitive market, all investors can obtain complete market information, investors pursue the maximum investment return, and there is a risk-free interest rate in the capital market. In the actual operation, due to various assumptions, the normal use of the function is greatly weakened. In addition, in CAPM, it is difficult to grasp  $\beta$  the coefficient well, which makes the current research only stay at the calculation value of pertinent historical data to estimate the

future value, so the accuracy of the calculation results is discounted. However, although a variety of asset pricing models have emerged, the historical status of the CAPM model is still incomparable.

### 2.3. Arbitrage Pricing Models

Arbitrage is the behavior of using separate prices of the same or similar physical assets or financial assets to obtain risk-free returns. It is realized by buying stocks with higher yield and selling with a lower yield. Here we emphasize the importance of buying or selling at the same time. For example, if you see an egg for 70 cents in A, and the same egg in B costs one yuan, then you buy the egg from A and sell it immediately to B. This is the basic arbitrage.

In 1976, the arbitrage pricing model came into being in the process of Rose's continuous research. The core value of this concept is mainly reflected in the relatively balanced market environment, and arbitrage opportunities are completely lost. The form of the arbitrage pricing model is the linear correlation model between stock return and multiple factors.

$$R_i = a_i + b_{i1}F_1 + b_{i2}F_2 + b_{i3}F_3 \cdots b_{ij}F_j + e_i \quad (1)$$

Among them,  $R_i$  is the return rate of individual stock  $i$ ,  $a_i$  is the expected return rate of individual stock  $i$  when all factors are 0,  $b_{ij}$  is the sensitive response of individual stock return to  $j$  factor,  $e_i$  is the unique residual part of individual stock  $i$ , and  $F_i$  is various factors affecting stock return.

Rose's arbitrage pricing model (APT) only gives us a framework. It not fixes for the factors that affect the stock return. Forming the basis of its assumption is the relationship between the stock return and the unknown factors. So whether the arbitrage portfolio is really profitable depends more on what factors we put into the formula. Therefore, the arbitrage pricing theory is often regarded as a generalized capital asset pricing model.

### 2.4. Multi Factor Models

Fama and French extracted the data samples of the American stock market from 1930 to 1963. By analyzing the influence of the size of listed companies (ME) and book to market ratio (BE / ME) on stock price changes and their impact on stock returns, Fama and French draw a conclusion that the scale and book to market ratio of listed companies have good explanatory power to the yield. Therefore, on the basis of this study, they formally proposed the Fama-French three factor model. The three factors are market value, book to market ratio and P / E ratio. When these three factors are grouped, it can explain the return of the portfolio.

The formula of Fama-French three factor model is as follows.

$$E(R_i) = R_f + \beta_i \times (E(R_m) - R_f) + S_i \times SMB + H_i \times HML \quad (2)$$

Among them,  $E(R_i)$  is the expected return of the portfolio;  $E(R_m)$  is the expected return of the market portfolio;  $R_f$  is the risk-free interest rate;  $\beta_i$ ,  $S_i$ ,  $H_i$  are the coefficients of the three factors.

SMB (small minus big) refers to the scale effect of the company as a whole. Taking stock performance of each cycle as the research object, the average return of small market value stock portfolio minus the average return of large market value stock portfolio is the yield.

HML (high minus low) generally refers to the company's value investment, specifically refers to the average return of individual stocks with high book to market ratio minus the average return of low book to market ratio.

Fama and French three factor model tests are many theoretical effects, such as book to market ratio effect, income growth rate effect and so on. However, in the follow-up studies of scholars, although the Fama-French three factor model does surpass the CAPM's explanatory power, it still has two problems. First, the Fama-French three factor model is more empirical than based on the efficient market hypothesis. Therefore, although it has made a better confirmation of the scale effect and value effect in the market, it has never constructed the relevant theory to explain the reasons for these two effects. Second, in the later research, we found that the Fama-French three factor model has a better explanation for long-term returns than short-term returns.

So this seemingly flawless model still has some defects. However, just as Fama adjusted and summarized the debate between W. Sharp and J. Limner, Fama-French three factor models are also a comprehensive summary of CAPM and apt.

The exploration of scientific theory is constantly advancing, so based on the discussion framework of dividend discount model (DDM), in order to better make a comprehensive evaluation of the expected return rate of stock organization in cross-section. Fama and French analyzed market value, book to market ratio, profitability and investment scale on the basis of CAPM model, and proposed three factor pricing model including market factor, scale factor and value factor, and five factor pricing model with profitability factor and investment mode factor on the basis of three factors.

The five factor model proposed by Fama and French can be described by the following formula.

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) - s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + e_{it} \quad (3)$$

$R_{it}$  and  $R_{Ft}$  on the left of the formula represent the return and the risk-free interest rate of portfolio  $i$  in period  $t$ , respectively. The  $R_{Mt} - R_{Ft}$  on the right side of the formula reflects the market risk premium.  $SMB_t$ ,  $HML_t$ ,  $RMW_t$  and  $CMA_t$  represent market value factor, book to market ratio factor, profitability factor and investment style factor respectively. Among them,  $HML_t$  most accurately refers to the difference between superior book to market ratio and low book to market ratio stock portfolio returns.

Fama and French used the usual analytical method, divided the sample data into three combinations, and obtained the mean value, standard deviation and  $t$  statistical value of five factors under the three groups, and then confirmed their previous hypothesis with regression results. Regardless of the fact that the five factor model has better performance than the three factor model, the book to market ratio factor in the five factors is redundant in the measurement test. Therefore, with the modern theory of capital asset pricing, the discovery of new methods and new data collection methods, new factors are bound to be discovered.

### 3. Multi Factor Asset Pricing Theory

#### 3.1. Foreign Research

The earliest theoretical model of financial investment is very easy to understand. Its core idea originates from the linear programming problem in linear algebra, that is, to seek the maximum value of the objective function under restricted conditions. The most typical representatives are the well-known mean variance model and the applicable margin theory (Markowitz, 1952) [1]. Due to the diversity and complexity of the capital market data, the conventional marginal

planning is not enough to solve the real asset pricing problem, so economists turn their attention to the application of correlation regression in probability statistics, that is, to simulate the one-way or mutual influence of two or more things through data. Based on this idea, some classical model theories have been born in the field of monetary theory. Among them, the theory of capital asset pricing model (Sharp, 1966) [2] and arbitrage pricing theory (Ross, 1976) [3] have had a profound impact on Asset Pricing in the capital market.

CAPM is simple in calculation and strict assumptions. Apropos is perfect in form but complicated in calculation. Finally, some scholars have put forward a three factor models (Fama and French, 1993) [4]. Based on previous models mainly considering market factors, the three factor model constructively integrates two factors, namely, the size of market value and the ratio of book value to market value. During this period, some breakthrough achievements have been recorded in the research on the factors influencing securities pricing. For example, the stock market in the United States has a significant momentum effect (Jegadeesh and Titman, 1993) [5]. Subsequent scholars extracted the momentum factor from the momentum effect, thus deriving the four factor model (Carhart, 1997) and the specific calculation method is proposed [6]. Subsequent research found that the former model still omitted the factors of profitability and investment style, so a five factor model was created on the basis of the three factor model (Fama and French, 2015), the stability of the model is greatly improved [7]. Soon, the momentum factor proposed by Carhart was discussed by Fama and French (Fama and French, 2016) [8], and the word "six factor model" was also used in his recent paper (Fama and French, 2018) [9]. So far, the number of factors in the model has developed to six, and a relatively complete six factor model systems have been formed. Based on the above summary, we can summarize the development of fiscal capital asset pricing theory into three stages. The first stage (1952-1965): The germination period represented by the mean variance model; the second stage (1966-1992): the innovation period represented by CAPM and apt; the third stage (1993-present): The development period represented by multi factor model. The three stages of development constitute a more complete context for the development of an asset pricing model.

### 3.2. Domestic Research

Domestic research on the theory of multi factor model is relatively late, and the results are limited, and many conclusions of the multi factor model research are uniform, and some of them are still controversial. After summarizing the existing research results on multi factor model in China, we can find that market factor (Gao Chunting and Zhou Xiaohua, 2016; Cheng Shiyu and Fang Hua, 2019), scale factor (Tian Lihui and Wang Guanying, 2014; Zhou Yan and Tang Yutong, 2019), profit factor (Qi Xiong and Huang Wei, 2014; Zhang Xindong and Li Jianying, 2018), momentum factor (Wang Dehong and song Jianbo, 2017; and Zhang Yanhe, Tang Yutong, 2019); Wang Hao et al., 2018) have basically reached an agreement on the significance in China's market, while the insignificant style factor has been more recognized (song Guanghui et al., 2017; Zhou Yan and Tang Yutong, 2019). Through in-depth study on momentum factor, it is found that both momentum effect and the reversal effect exist in China's investment market (Wang Dehong and song Jianbo, 2017), and momentum effect is stronger than reversal effect (Wang Hao et al., 2018).

However, there are always some differences in some aspects of the multi factor model. For instance, some scholars believe that China's market value factor is not significant (Tian Lihui et al., 2014, Yin Liya, 2018), while others believe that it is not a redundant factor (Zhang Bing and Chen Xiaoying, 2017). Among them, a detailed study of some segments of the stock market will also lead to some results distinct from the mainstream. For example, the scale factor of the automobile industry has no significant effect on stock returns (Cheng Shiyu and Fang Hua, 2019).

Of course, Chinese scholars have made some good breakthroughs in the field of factory construction. For example, the volume factor represented by turnover and turnover rate is added to study its influence on stock returns (Tian Lihui and Wang Guanying, 2014). Depending on the characteristics of China's market, the liquidity factor is introduced into the multi-factor model to improve its explanatory power (song Guanghui et al., 2017). Through market turnover, margin trading balance, market P / E ratio, market turnover rate, and newly established funds, emotional factors are built to enhance the application effect of multi-factor model in China (Yin Liya, 2018).

## 4. Analysis of Asset Pricing Model based on Investor Sentiment

### 4.1. Index Selections

According to the existing literature, there are two types of investor sentiment indicators, which are the direct indicators of investor sentiment and the indirect indicators of investor sentiment using other indicators. In China's capital market, common direct indicators include stock market investor confidence index, CCTV's Kanpan index, Haodan index, etc. Indirect indicators can be divided into a single index and the composite index. Single index refers to the use of a certain indicator as an indicator of investor sentiment, such as the number of new accounts, fund flow, investors' net purchase on the first day of IPO, etc. The composite index is calculated by multiple indicators through mathematical methods. Firstly, factors that can reflect investor sentiment are found, and then they are combined into a comprehensive index through certain mathematical methods (mostly factor analysis method), which is called composite investor sentiment index. Compared with the indirect investor sentiment, the honest investor sentiment index is too subjective, and it is difficult to find a sample that can represent the whole capital market. Therefore, this paper uses indirect sentiment as an indicator to measure investor sentiment. In order to make the results more accurate, we construct a single investor sentiment index and compound investor sentiment index respectively.

The "herd effect" in China's capital market is obvious, and individual investors usually follow institutional investors to buy or sell stocks. As the representative of institutional investors, the number of newly established funds reflects the expectations of institutional investors for the future market to a certain extent. In China's capital market, there are still many restrictions on short selling, so the number of newly established funds is large, indicating that institutional investors are optimistic about the future market and think that the probability of stock market rising in the future is higher. The small number of new funds indicates that institutional investors are bearish on the future market and believe that the probability of the stock market falling in the future is high. Therefore, this paper uses the number of newly established funds as a definite indicator of investor sentiment.

Different scholars use different indicators to construct composite investor sentiment. After considering the overall market sentiment, institutional investor sentiment and individual investor sentiment, this paper selects market turnover rate, market P / E ratio, IPO first day premium rate and the number of new shareholders' accounts as the basic indicators to construct the composite investor sentiment index.

Market turnover(turn): Baker et al. [10] has verified that turnover rate, which can reflect market liquidity, can better explain stock market returns when it is used as investor sentiment. Therefore, this paper selects the monthly turnover rate of the market as the turnover index, and the data are from the wind database.

Market P / E ratio(pe): P / E ratio is derived from the ratio of earnings per share in the same year. It is often used to evaluate whether the value level of the stock price is reasonable. To a certain extent, the overall P / E ratio of the capital market can reflect the investor's sentiment. If the overall P / E ratio is too high, the investor's investment sentiment is elevated; if the overall

P / E ratio is low, the investor's investment interest is insufficient. Therefore, this paper selects the overall monthly P / E ratio of the market as one of the indicators to build investor sentiment, and the data are from the wind database.

IPO first day premium rate (IPO): In different periods, the IPO premium rate on the first day of the IPO (initial public offering, abbreviated as IPO) varies greatly. When the IPO premium rate is prohibitive, it is usually called "hot issuance market", and when the IPO premium rate is low, it is called "cold issuance market". When the investor's sentiment is high and they are keen on investing in the stock market, the higher demand will promote the IPO price to a certain extent, making it higher than the intrinsic value of the stock, thus forming a high IPO first day premium rate; on the contrary, when the investor's mood is low, it will form a low IPO first day premium rate. The index of IPO first day premium rate is the arithmetic average of all IPO first day premium rates of each month.

The number of new accounts opened by investors(open): the number of new accounts opened by investors can directly reflect the sentiment of investors. When investor sentiment is high, the number of new accounts opened in the stock market is large; when investor sentiment is low, the number of new accounts opened is small. This paper uses the monthly number of account opening as one of the indicators to construct and restore investor sentiment, and the data are from Dongfang fortune.com.

#### 4.2. Factor Calculation

Market factor (MRT). The market factor is calculated by the market income minus the risk-free interest rate. According to the practice of many mathematicians, the risk-free interest rate in this paper is the one year fixed deposit interest rate announced by the central bank. Since China's stock market does not cover the entire market index of Shanghai and Shenzhen stock markets, but the Shanghai stock index is highly representative. Investors often say that the stock market index is the Shanghai stock index. Therefore, this paper selects the cyclic return rate of Shanghai stock index as the market return index.

Scale factor (SMB) and value factor (HML). Using the method of Fama et al. [11] to calculate the scale factor and value factor, all non ST and listed stocks over one-year are divided into two groups according to the market value, and each group is divided into three groups according to the book to market ratio, so as to obtain the six groups of stocks shown in Table 1.

**Table 1.** Scale factor and value factor

	Low book to market ratio(L)	Book to market ratio(M)	High book to market ratio(H)
Small market value(S)	SL	SM	SH
Big market value(B)	BL	BM	BH

The value factor HML can be obtained by reducing the return of the group with high book to market ratio and the group with high book to market ratio.

$$HML_t = \frac{SH_t + BH_t}{2} - \frac{SL_t + BL_t}{2} \tag{4}$$

The scale factor SMB is obtained by subtracting the monthly return of stocks of small market value group from that of large market value group



$$SMB_t = \frac{SL_t + SM_t + SH_t}{3} - \frac{BL_t + BM_t + BH_t}{3} \quad (5)$$

This paper uses monthly data, using the Shanghai Stock Exchange 50 index, which can represent the trend of blue chip stocks in China's stock market, the CSI 300 index which can represent the comprehensive trend of Shanghai and Shenzhen stock markets, and the China Securities 500 index, which can represent the trend of small cap stocks in the stock market, respectively. Using the one-year fixed deposit rate stipulated by the central bank as the risk-free interest rate, the sample interval of this paper is January 2013 and December 2016, in which the bull market is from January 2013 to May 2015, and the bear market from June 2015 to December 2016. All the data in this paper are from Dongfang fortune.com and wind information. The data processing and principal component analysis are completed by SPSS software, and the model regression is accomplished by Eviews software. In order to make the results comparable, the sole investor sentiment index and the composite investor sentiment index selected in this paper are standardized.

### 4.3. Conclusion

This paper uses the number of newly established funds as a single index of investor sentiment, and uses principal component analysis method to construct a composite investor sentiment index by selecting market turnover rate, market P / E ratio, IPO first day premium rate and number of new accounts opened by shareholders. A four factor asset pricing models based on investor sentiment are constructed by substituting single investor sentiment index and compound investor sentiment index into traditional Fama-French three factor model. The main conclusions are as following. First of all, when investor sentiment is used to explain stock market returns separately, the explanation degree of compound investor sentiment is considerably higher than that of single investor sentiment. In the four factor model, the explanatory power of the model with a compound emotional factor is higher than that of the model with a single emotion factor, and the influence of compound investor sentiment on capital market investment return is greater than that of single investor sentiment. Secondly, investor sentiment has the greatest impact on the small cap stocks' CSI 500 indexes, while the Shanghai Stock Exchange 50 index, which represents blue chips, has the least impact. The price fluctuation of small cap stocks is more easily affected by investor sentiment. Finally, larger listed companies have higher book to market ratio, while small-scale listed companies are more inclined to spend on reproduction.

### 5. Summary

Reviewing the relevant research and literature review, we can find that with the deepening of the research, more and more factors have been discussed by the theoretical and practical circles, and the explanatory power of the multi-factor capital asset pricing model is becoming stronger and stronger, and it is constantly approaching the real situation of the market. It can be expected that the future development direction of multi-factor capital asset pricing model is as follows.

Firstly, more and more explanatory factors are found based on the market characteristics, and the explanatory variables become more and more, which will make the model more convincing. From the initial CAPM single market factor to the six factor model with scale, value, profit, style and the momentum, it is not difficult to see that with the enhancement of market effectiveness, it is more and more difficult to explain the capital return. In order to improve the persuasive effect of the model, the corresponding influencing factors will continue to increase.

Secondly, explanation factors are combined and reduced to remove the redundant parts of the model to make the model more simple and efficient. With the deepening of the research on multi-factor model, there are more and more explanatory factors, and a paradox appears, that is, the factor model will be gradually degenerated into a long list of factors, which are close to various possible combinations that can affect the return on capital. In other words, the construction of multi-factor model will become a redundant factor deletion test. With the scientific nature of the theory, this is not in line with the concise and highly generalized principle of the theory.

## References

- [1] Markowitz, Harry M:Portfolio Selection. The Journal of Finance, Vol.7 (1952) No.1,p. 77-91.
- [2] Sharpe, William F. Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. The Journal of Finance, Vol.19(1964) No.3,p. 425-442.
- [3] Ross, Stephen A:The Arbitrage Theory of Capital Asset Pricing,Journal of Economic Theory, Vol.13(1976) No.5,p. 341-360.
- [4] Fama, Eugene F. and French, Kenneth R. Common Risk Factors in the Returns on Stocks and Bonds. Journal of Financial Economics, Vol.33 (1993) No.1,p.3-56.
- [5] Jegadeesh, Narasimhan and Sheridan Titman: Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. The Journal of Finance, Vol.48 (1993) No.1,p. 65-91.
- [6] Carhart, Mark M:On Persistence in Mutual Fund Performance, The Journal of Finance, Vol.52 (1997) No.1,p.57-82.
- [7] Fama, Eugene F. and French, Kenneth R. A Five-Factor Asset Pricing Model,Journal of Financial Economics, Vol.116 (2015) No.1,p.1-22.
- [8] Fama, Eugene F. and French, Kenneth R. Dissecting Anomalies with a Five-factor Model, Review of Financial Studies, Vol.29 (2016) No.1,p.69-103.
- [9] Fama, Eugene F. and French, Kenneth R. Choosing Factors,Journal of Financial Economics, Vol.128(2018) No.1,p.234-252.
- [10] Baker, M, Wurgler, J: Investor Sentiment and the Cross-Section of Stock Returns, The Journal of Finance, Vol.61(2006) No.4,p.1647-1680.
- [11] Fama, Eugene F. and French, Kenneth R. Common risk factors in the returns on stocks and bonds, Journal of Financial Economics, Vol.33 (1993) No.1,p.3-56.
- [12] Ma Qiang:Margin trading, stock index and investor sentiment,Accounting monthly, Vol.11 (2006) No.4,p.124-128.