

# An Empirical Study of the Fama–French 5-factor Model in Chinese A-Share Market

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**Abstract.** One of the most significant models in asset pricing theory is the Fama-French five-factor model, which has long been the focus of both theoretical and practical study. An empirical examination of the Chinese A-share market from 2000 to 2022 is used in this paper to determine the efficacy of the Fama-French 5-factor model in the Chinese A-share market. The study shows that the 5-factor model works fairly well in describing stock returns in A-share market, particularly when profit and investment variables are taken into account. However, in this paper's investigation of the excess returns of small-cap and high price-to-book companies, the 5-factor model still has certain limitations, since the selected data is the whole Chinese A-share market, which does not go deep into specific fields, which may lead to inaccurate and unrepresentative results. These findings have significant theoretical and practical implications for enhancing asset pricing models and understanding the characteristics of China's A-share market. The study divides stocks into five size groups (quintiles) based on market capitalization and valuation. It suggests that investors should pay attention to the intersection of market capitalization and valuation when selecting stocks. Small-cap stocks may offer higher returns, while large-cap stocks may have reduced risk. By considering both factors, investors can potentially optimize their investment portfolios.

**Keywords:** Fama - French Five - Factor Model; Construction of Factors; Asset Pricing.

## 1. Introduction

Since Sharpe suggested the Capital Asset Pricing Model (CAPM) in 1964, the Fama-French 3- and 5-factor models have had the most influence on asset pricing theory. Initially proposed in 1992, the Fama-French 3-factor model includes a book-to-market ratio component based on CAPM, and the market value factor was added to account for the excess returns of small-cap businesses and high book-to-market ratio stocks [1]. Because the 3-factor model could not fully explain all asset price events, they introduced a 5-factor model in 2015 that included the profitability and investment components [2].

## 2. Literature Review

Some researchers have conducted empirical investigations into the Fama-French 5-factor model in the Chinese A-share market. Due to the significance of the profitability and investment variables in understanding stock returns, Zhang Yanliang et al. [3] discovered that the 5-factor model exhibits a stronger explanatory power than the 3-factor model in the Chinese A-share market. Nevertheless, the 5-factor model demonstrates some explanatory capability in the Chinese A-share market, as noted by Chen [4]. However, it remains insufficient in fully explaining the excess returns of small-cap enterprises and stocks with high book-to-market ratios.

Although empirical investigations into the Fama-French 5-factor model in the Chinese A-share market have produced certain findings, numerous questions still require answers. This study aims to empirically examine the performance of the Fama-French 5-factor model in the Chinese A-share market, aiming to address this research gap and enhance the asset pricing model for the Chinese A-share market.

### 3. Empirical Research and Regression Results

#### 3.1. Data Selection

In recent years, significant progress has been made in the comprehensive and profound reform of the Chinese capital market. Consequently, this paper primarily focuses on a comparative analysis of the feasibility of utilizing Fama-French 5-factor models to estimate returns on Chinese A-share stocks over the past two decades. This analysis involves the selection of monthly return data for A-share stocks from January 2000 to December 2022 for empirical testing. Two primary sources of data are utilized within this article. One source is derived from the Financial Research Database (RESSET), while the other is collected by employing a Python program to crawl the Tushare website.

#### 3.2. Introduction to Empirical Models

As an extension of the Fama-French 3-factor model, the Fama-French 5-factor model incorporates two additional variables (profitability and investment) to comprehensively explain stock returns.

The Fama-French 5-factor model encompasses the following five factors:

(1) The market factor (MKT), representing the overall market risk. This factor is typically evaluated using the rate of return from a market index, such as the S&P 500 Index.

(2) The size factor (SMB), which gauges how firm size impacts stock returns. By segregating equities into large-cap and small-cap stocks and analyzing return variations, this factor is derived.

(3) The value factor (HML), illustrating the influence of a company's valuation on stock returns. Equities are categorized into overpriced and undervalued groups using the book-to-market ratio, and the disparity in returns between these groups is used to quantify this factor.

(4) The profitability factor (RMW), showcasing how a company's profitability affects stock returns. This factor is computed by categorizing equities into high- and low-profitability groups (based on metrics like operational profit margin, net profit margin, etc.) and comparing the yield differences between these groups.

(5) The investment factor (CMA), which measures the impact of a company's investment on stock returns. This component is determined by classifying equities into high- and low-investment groups, using investment indicators such as the rate of growth of total assets, the rate of investment in fixed assets, etc., and subsequently comparing the returns of each category [2].

Through regression analysis involving stock returns and the returns of these five factors, the contribution of each factor to stock returns can be estimated, further elucidating the relationship between risk and return for stocks.

By incorporating the profitability and investment factors, the time series regression equation of the 5-factor model is as follows:

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + e_{it} \quad (1)$$

$R_{it}$  is the rate of return of one of the portfolios in month  $t$ ;

$R_{Ft}$  is the risk-free rate;

$R_{Mt} - R_{Ft}$  is the return difference between the stock market and cash weighted by market capitalization;

HML represents the return disparity between low-priced stocks and high-priced stocks (i.e., the value effect); SMB is the return differential between small stocks and large stocks (i.e., the size effect); RMW is the difference between the profits of the most profitable companies and the earnings of the least profitable companies; CMA is the difference between the returns of firms with conservative investments and those with aggressive investments [5].

#### 3.3. Variable Selection and Grouping

##### 3.3.1 Variable Selection

(1)  $R_m$  calculation:

From April 3, 1991, to February 1, 2023, utilize Python to compute the daily rate of return by excluding any absent values from the daily closing price. Subsequently, convert the daily rate of return into a monthly rate of return in order to obtain the monthly rate of return for each stock, denoted as  $R_m$ .

(2) Calculation of  $R_f$

The risk-free interest rate,  $R_f$ , in this paper is based on China's one-year bank time deposit rate, which has been converted into monthly data.

(3) Market capitalization to book-to-market capitalization ratio:

The aggregate market value of the individual stocks within the sample constitutes the market value of the sample (circulating market value = number of tradable shares  $\times$  stock price per share). The book-to-market value ratio is computed by dividing the shareholders' equity (including minority shareholders' interests) at the end of the period by the total market value of the individual stocks at that particular time.

### 3.3.2 Data Processing

Prior to categorizing stocks, this part initially excluded certain specific stocks. The rationale for removing these stocks stems from three main factors:

(1) These stocks belong to the ST (Special Treatment), ST, or SST classifications. The ST labels on the Chinese stock market — ST, ST, and SST — indicate varying degrees of financial hardship. ST signifies that a stock has been subject to special treatment due to two consecutive years of losses, ST indicates that a stock has received a delisting warning due to three consecutive years of losses, and SST indicates that a stock has not undergone equity restructuring \* ST shares [6]. These stocks with special treatment significantly differ from ordinary stocks and might eventually be delisted from the stock market. Consequently, prior to model analysis, this article eliminates these three stock categories.

(2) Stocks with a higher count of missing daily return data. For instance, some companies did not disclose data due to specific reasons, thus necessitating the removal of these stocks. Failure to do so would impact the accuracy of empirical findings.

(3) Stocks with a negative book value. These stocks possess negative net worth, signifying that the company's liabilities surpass its assets. This situation indicates financial difficulties or poor management, possibly leading to a higher risk of delisting. Eliminating these stocks serves two purposes: preventing the presence of negative values that could complicate calculations and analyses, and enhancing the quality and reliability of the samples.

### 3.3.3 Grouping Method

After data processing, the grouping methods used in this paper are as follows:

(1) At the end of each month, all stocks are separated into large and small market value groups using the cross-section's median for market capitalization (size) as the dividing line.

(2) At the end of each month, all stocks are classified into three categories based on their book market value: the first 30% (Low), the middle 40% (Middle), and the last 30% (High). These cutoff thresholds are determined by the cross-section 30% and 70% quantiles of the ratio (BM).

(3) Similarly, at the end of each month, using the 30% and 70% quantiles of the return on equity (ROE) for all stocks on the cross-section, stocks are divided into three groups: the top 30% (Weak), the middle 40% (Neutral), and the bottom 30% (Robust).

(4) At the end of each month, the total asset growth rate of all stocks on the cross-section is used to divide them into three groups: the top 30% (Conservative), the middle 40% (Neutral), and the bottom 30% (Aggressive), based on the 30% and 70% quantiles.

These groups are then intersected, considering both market value groups, book market value groups, ROE groups, and total asset growth rate groups. This results in 18 different combinations, as illustrated in Table 1. For stocks falling into these 18 combinations, the portfolio return is calculated based on the total market capitalization. Table 1 showcases the investment portfolio generated by combining these two investment methods ( $6 \times 3 = 18$  combinations).

**Table 1.** The investment portfolio obtained by crossing two investment methods (6×3 =18 kinds)

| Panel A                                        |                                         |                                         |
|------------------------------------------------|-----------------------------------------|-----------------------------------------|
| Market Capitalization<br>Book-to- Market Ratio | Small Market Capitalization<br>(S, 50%) | Large Market Capitalization<br>(B, 50%) |
| High Book-to-Market Ratio (H,<br>30%)          | SH                                      | BH                                      |
| Middle Book-to-Market Ratio<br>(M, 40%)        | SM                                      | BM                                      |
| Low Book-to-Market Ratio (L,<br>30%)           | SL                                      | BL                                      |
| Panel B                                        |                                         |                                         |
| Market Capitalization<br>Return on Equity      | Small Market Capitalization<br>(S, 50%) | Large Market Capitalization<br>(B, 50%) |
| Robust Return on Equity (R,<br>30%)            | SR                                      | BR                                      |
| Neutral Return on Equity (M,<br>40%)           | SN                                      | BN                                      |
| Weak Return on Equity (W, 30%)                 | SW                                      | BW                                      |
| Panel C                                        |                                         |                                         |
| Market Capitalization<br>Investment Portfolio  | Small Market Capitalization<br>(S, 50%) | Large Market Capitalization<br>(B, 50%) |
| Aggressive Investment Portfolio<br>(A, 30%)    | SA                                      | BA                                      |
| Neutral Investment Portfolio (N,<br>40%)       | SN                                      | BN                                      |
| Conservative Investment<br>Portfolio (C, 30%)  | SC                                      | BC                                      |

Using the portfolio mentioned above, construct the RMV, CMA, and SMB factors (in the following formulas, S represents Small, B represents Big, H represents High, L represents Low, R represents Robust, W stands for Weak, C stands for Conservative, and A stands for Aggressive) [7]:

$$RMW = \frac{1}{2} \left( \frac{S}{R} + \frac{B}{R} \right) - \frac{1}{2} \left( \frac{S}{W} + \frac{B}{W} \right) \quad (2)$$

$$CMA = \frac{1}{2} \left( \frac{S}{C} + \frac{B}{C} \right) - \frac{1}{2} \left( \frac{S}{A} + \frac{B}{A} \right) \quad (3)$$

$$SMB = \frac{1}{3} (SMB_{BM} + SMB_{OP} + SMB_{INV}) \quad (4)$$

Where:

$$SMB_{BM} = \frac{1}{3} \left( \frac{S}{H} + \frac{S}{M} + \frac{S}{L} \right) - \frac{1}{3} \left( \frac{B}{H} + \frac{B}{M} + \frac{B}{L} \right) \quad (5)$$

$$SMB_{OP} = \frac{1}{3} \left( \frac{S}{R} + \frac{S}{N} + \frac{S}{W} \right) - \frac{1}{3} \left( \frac{B}{R} + \frac{B}{N} + \frac{B}{W} \right) \quad (6)$$

$$SMB_{INV} = \frac{1}{3} \left( \frac{S}{C} + \frac{S}{N} + \frac{S}{A} \right) - \frac{1}{3} \left( \frac{B}{C} + \frac{B}{N} + \frac{B}{A} \right) \quad (7)$$

## 4. Construction of Five Factors

### 4.1. 5-factor Descriptive Statistics

18 investment portfolios can be utilized to depict the data for each factor in the Fama-French 5-factor model's sex statistics (as displayed in Table 2):

**Table 2.** 5-factor data descriptive statistics

|     | Count | Mean  | Standard deviation | Min     | P50    | Max    |
|-----|-------|-------|--------------------|---------|--------|--------|
| MKT | 276   | 0.687 | 7.744              | -26.835 | 0.866  | 29.604 |
| SMB | 276   | 0.196 | 3.613              | -15.751 | 0.281  | 14.718 |
| HML | 276   | 0.174 | 3.568              | -15.599 | 0.295  | 14.141 |
| RMW | 276   | 0.009 | 3.249              | -15.273 | 0.059  | 13.570 |
| CMA | 276   | 0.001 | 2.407              | -9.220  | -0.070 | 8.615  |

Table 2 illustrates that all five components exhibit positive returns, with MKT having the highest average return (0.687), followed by SMB (0.196), HML (0.174), RMW (0.009), and CMA (0.001).

The market factor (MKT) in the Fama-French 5-factor model represents the overall market's rate of return. In the Chinese A-share market, the market factor demonstrates the highest rate of return, potentially attributed to its status as one of the world's largest stock markets, boasting a market value of 12,292.579 USD billion as of April 2023 [8]. Due to the market's size, investors enjoy a broader array of investment options, which enhances the potential for greater yields.

However, the market factor also exhibits the highest variance or volatility. This characteristic could arise from the myriad uncertainties inherent in the Chinese A-share market, encompassing policy changes, economic fluctuations, market adjustments, and more. These elements collectively contribute to increased market volatility. For instance, the COVID-19 outbreak in 2022 had a substantial impact on the Chinese stock market's rate of return, serving as a notable example. The pandemic significantly affected the transportation sector as the first industry hit by the crisis, leading to an average monthly shareholder value loss of 5.70% in 2020 [6].

### 4.2. 5-Factor Correlation Analysis

#### 4.2.1 Explanation of Strong Positive Correlation between HML and RMW

A significant positive correlation is evident between HML (High Minus Low) and RMW (Robust Minus Weak), as indicated by their correlation coefficient of 0.691 (refer to Table 3). This could be attributed to:

**Table 3.** 5-factor data correlation analysis

|     | MKT       | SMB       | HML      | RMW       | CMA   |
|-----|-----------|-----------|----------|-----------|-------|
| MKT | 1.000     |           |          |           |       |
| SMB | 0.149**   | 1.000     |          |           |       |
| HML | -0.269*** | -0.538*** | 1.000    |           |       |
| RMW | -0.341*** | -0.557*** | 0.691*** | 1.000     |       |
| CMA | -0.003    | 0.135**   | -0.040   | -0.570*** | 1.000 |

Both HML and RMW reflect the financial risk of the company. The HML factor gauges the company's book-to-market ratio, while the RMW factor evaluates the quality of the company's earnings. A notable positive correlation exists between these two factors, as they both indicate the financial risk associated with the company. This relationship was demonstrated in the research conducted by Fama and French [2].

Investor activity in the Chinese A-share market could potentially contribute to the pronounced positive correlation between HML and RMW. Due to the preference of many investors for firms exhibiting high book-to-market ratios and strong earnings quality, Chiang et al. [9] speculate that

these two variables might exhibit a positive correlation. The distinctive environment of the Chinese A-share market could potentially influence the connection between HML and RMW. For instance, given the prevalent information asymmetry on the Chinese A-share market, investors may be more inclined to invest in businesses with high book-to-market ratios and robust earnings quality. This tendency could account for the observed positive correlation between HML and RMW.

#### 4.2.2 Explanation of Negative Correlation between SMB and HML, RMW

A significant negative correlation exists between SMB and both HML and RMW, with correlation coefficients of -0.538 and -0.557, respectively. This could be attributed to the distinct behaviors of small and medium-sized businesses (SMBs) and high book-to-market ratio companies (HMLs) across different economic cycles. For instance, SMBs might thrive during a market upswing in an economic expansion, leading to an increase in the number of SMBs. Furthermore, companies with high book-to-market ratios may experience a rise in HML during a recession due to their robust financial position. According to Prabheesh and Vidya [3], these varying performances across diverse economic cycles might contribute to the negative correlation between SMB and HML.

As for the inverse relationship between SMB and RMW, one explanation is that small-cap enterprises usually carry higher levels of risk due to less stable company structures, market positions, and financial conditions. Conversely, profitable enterprises typically exhibit more stable businesses, healthier financial situations, and lower risk profiles. Retail investors hold a substantial position in the investment structure of the Chinese A-share market, accounting for over 60% of the market's total trading volume in 2022 [10]. They often favor investing in small-cap companies over large-cap corporations with established profitability. This investment strategy contributes to the accentuated negative connection between the SMB and RMW factors.

Furthermore, the issue of information asymmetry in the Chinese A-share market cannot be overlooked. Small-cap companies frequently disclose less information compared to their large-cap counterparts, causing investors' expectations of profitability for small-cap firms to be more uncertain. This aspect impacts the relationship between the SMB factor and the RMW factor.

### 5. Dependent Variable Construction in 5-Factor Model

Firstly, this part aims to assess whether the average return rate of the Chinese A-share market correlates with the five aforementioned factors. Thus, this paper chose to categorize all stocks into three dimensions: Size-BM (market capitalization factor-valuation factor), Size-OP (market capitalization factor-profitability factor), and Size-Inv (market capitalization factor-investment style factor).

For the Size-BM grouping, the approach involves arranging stocks into five size groups (quintiles) based on both market capitalization and valuation sizes. This results in  $5 \times 5 = 25$  portfolios that represent the intersections of market capitalization and valuation. Subsequently, each stock is assigned to one of five market capitalization groups and five valuation groups. By employing an analogous method, you can derive three sets of 25-grid portfolios. In this methodology, the 5-factor return time series functions as the independent variable for regression, while the monthly returns of the stock portfolio within each grid serve as the dependent variable to be regressed.

**Table 4.** Dependent variable average rate of return (unit: %)

|                             | 1 (Small) | 2     | 3     | 4     | 5 (Large) |
|-----------------------------|-----------|-------|-------|-------|-----------|
| Group A: Size-BM 5×5 table  |           |       |       |       |           |
| 1 (Low)                     | 0.554     | 0.842 | 0.781 | 0.796 | 0.961     |
| 2                           | 0.954     | 0.987 | 1.041 | 0.962 | 1.100     |
| 3                           | 0.799     | 0.943 | 1.057 | 1.094 | 1.156     |
| 4                           | 0.914     | 1.075 | 1.181 | 1.149 | 1.346     |
| 5 (High)                    | 1.163     | 1.302 | 1.448 | 1.442 | 1.298     |
| Group B: Size-OP 5×5 table  |           |       |       |       |           |
| 1 (Low)                     | 0.785     | 0.835 | 0.728 | 0.786 | 1.041     |
| 2                           | 1.011     | 0.943 | 0.960 | 1.125 | 1.040     |
| 3                           | 0.993     | 0.997 | 1.000 | 1.174 | 0.792     |
| 4                           | 0.904     | 1.173 | 1.199 | 1.276 | 0.880     |
| 5 (High)                    | 1.198     | 1.251 | 1.491 | 1.293 | 1.390     |
| Group C: Size-Inv 5×5 table |           |       |       |       |           |
| 1 (Low)                     | 0.710     | 0.793 | 0.924 | 0.902 | 0.886     |
| 2                           | 1.040     | 1.054 | 1.011 | 0.943 | 1.036     |
| 3                           | 1.092     | 0.917 | 1.018 | 0.983 | 0.988     |
| 4                           | 1.052     | 1.161 | 1.085 | 1.180 | 1.035     |
| 5 (High)                    | 1.215     | 1.315 | 1.298 | 1.459 | 1.246     |

It can be seen from Table 4 that stock portfolios with larger market capitalizations exhibit higher average monthly return rates. This contrasts with the results obtained by Fama-French [1], whose explanation involves the higher risk associated with small-cap stocks due to potential exposure to market uncertainty and liquidity risk. Consequently, investors might demand greater returns when selecting a stock portfolio to compensate for the risk tied to small-cap stocks, leading to higher returns for these stocks. Conversely, large-cap stocks yield lower returns due to their reduced risk.

In my perspective, the absence of this effect in the Chinese A-share market might be due to the fact that larger market capitalizations typically correspond to larger company sizes. This correlation could be linked to the long-term stable growth and profitability of companies with larger market capitalizations. Larger enterprises often possess more resources and market share, enabling them to better withstand risks in a competitive market environment and achieve sustained profitability. This stability in long-term returns could contribute to the enhanced performance in average monthly returns for stock portfolios with larger market capitalizations.

Moving on, when examining Table 4 from top to bottom, it becomes apparent that in group A, stocks with high valuations generally exhibit higher average monthly returns. In group B, there is an overall upward trend in average return rates as stock profitability increases. Similarly, in Group C, a stronger company's investment ability correlates with a higher average stock return rate.

These findings mirror those of Fama-French: elevated valuations signify the market's anticipation of high returns for these stocks, as elevated valuations suggest investors have high expectations for future earnings growth and are thus willing to pay a premium. When these expectations materialize, the stock's return rate increases. Moreover, companies with higher profitability typically achieve superior earnings growth, attracting more investors and propelling stock prices upward. Similarly, companies with robust investment capabilities often demonstrate better capital utilization, leading to heightened profitability. This is likely due to their improved ability to select and manage investment projects, consequently yielding higher returns on investment [5].

## 6. 5-factor Regression Model Analysis

### 6.1. Factor Multicollinearity Test

Before conducting regression analysis on the five factors, the possibility of multicollinearity among the factors should be considered. Multicollinearity refers to the presence of high correlation among variables within multiple factors, which can diminish the accuracy of regression results [11]. A test for multicollinearity was performed on the factors.

By regressing each of the five factors against the other four factors (as shown in Table 5), it is evident that RMW exhibits correlations with MKT (-1.869), HML (1.608), and CMA (-0.850). This indicates a notable collinearity issue. Consequently, the stepwise regression method was employed to alleviate the collinearity within the profit factor (RMW), leading to the derivation of a new profit factor termed RMWO:

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_iSMB_t + h_iHML_t + r_iRMWO_t + c_iCMA_t + e_{it} \quad (8)$$

**Table 5.** Multicollinearity test among factors

| Variable being explained | MKT        | SMB        | HML       | RMW        | CMA        |
|--------------------------|------------|------------|-----------|------------|------------|
| MKT                      |            | -0.048     | 0.035*    | -0.073***  | -0.064***  |
| t-value                  |            | -1.556     | 1.656     | -5.225     | -3.886     |
|                          |            |            |           |            |            |
| SMB                      | -0.281     |            | -0.077    | -0.159 *** | -0.093 **  |
| t-value                  | -1.606     |            | -1.384    | -4.494     | -2.154     |
|                          |            |            |           |            |            |
| HML                      | 0.401      | -0.150     |           | 0.480 ***  | 0.419***   |
| t-value                  | 1.627      | -1.326     |           | 15.436     | 8.827      |
|                          |            |            |           |            |            |
| RMW                      | -1.869 *** | -0.686 *** | 1.068 *** |            | -0.850 *** |
| t-value                  | -4.895     | -4.726     | 11.612    |            | -15.402    |
|                          |            |            |           |            |            |
| CMA                      | -1.367***  | -0.335**   | 0.778***  | -0.710***  |            |
| t-value                  | -3.625     | -2.261     | 8.199     | -15.840    |            |
|                          |            |            |           |            |            |
| Adjusted R <sup>2</sup>  | 0.188      | 0.369      | 0.667     | 0.819      | 0.606      |

### 6.2. Analysis and Interpretation of Regression Results

As depicted in Table 6, let's take the Size-BM group as an example. It becomes apparent that the beta coefficient of the market factor MKT remains relatively stable around 1, with its t-value also being the largest. This indicates that the market factor can be considered significantly associated with stock returns, making it the factor most strongly correlated with the rate of return. Consequently, the stock portfolio's return is most influenced by the market factor among the five factors.

Regarding the coefficient of the market value factor SMB, a consistent decreasing pattern is observed from left to right. Specifically, under the same valuation, the coefficient for smaller stocks tends to be closer to 1, while that for larger stocks is closer to -1. This phenomenon might arise due to smaller companies generally possessing lower market liquidity, resulting in less trading of their shares. Consequently, smaller stocks might experience greater difficulty in buying and selling, rendering their prices more susceptible to supply and demand forces. As a consequence, the prices of smaller stocks could be more sensitive to market volatility, thus leading to a stronger positive relationship between their returns and market returns.

Conversely, no clear monotonic trend is discernible from the regression coefficients for the valuation factor HML and the profit factor RMWO, and the regression outcomes are predominantly insignificant.

Turning to the CMA factor, intriguing findings emerge. Within small-cap stocks, from left to right, the first four groups exhibit a progressively decreasing trend as stock valuation increases. However, this trend does not extend to the largest market capitalization stocks. The rationale behind this observation may be that companies with lower BP values (higher valuations) among small-cap stocks have slower total asset growth rates and adopt more conservative investment styles. The higher valuations might stem from their "shell value," implying that the equity valuation of listed companies differs significantly from when they were private entities. In small-cap stocks, investor attention might focus more on company valuation, with elevated valuations potentially indicating higher risks or uncertainties. This scenario could lead to reduced investor demand for these stocks, impacting their value return.

Group 5, representing the highest market capitalization, contrasts with the other groups. This disparity could be attributed to the fact that stocks with the highest market capitalization are typically larger companies, likely boasting more stable cash flows and greater market recognition. These companies might attract more attention from institutional investors, and their valuations might be influenced more by fundamental factors than shell value considerations. Consequently, despite their larger market capitalization, the regression coefficients for CMA might not exhibit the same monotonic decrease as observed in the other groups.

**Table 6.** Size-BM group regression results

|             | 1<br>(Small) | 2              | 3              | 4              | 5<br>(Large) | 1<br>(Small)  | 2               | 3               | 4               | 5<br>(Large) |
|-------------|--------------|----------------|----------------|----------------|--------------|---------------|-----------------|-----------------|-----------------|--------------|
|             | Beta_MKT     |                |                |                |              | t-value (MKT) |                 |                 |                 |              |
| 1<br>(Low)  | 1.035        | 1.01<br>7      | 1.05<br>8      | 1.09<br>5      | 1.036        | 64.283        | 35.65<br>3      | 52.42<br>5      | 48.22<br>9      | 33.921       |
| 2           | 1.003        | 1.02<br>6      | 0.98<br>8      | 1.00<br>4      | 0.955        | 56.940        | 56.85<br>8      | 50.80<br>9      | 47.08<br>3      | 28.827       |
| 3           | 0.992        | 0.96<br>9      | 0.99<br>4      | 0.93<br>6      | 0.895        | 55.184        | 56.77<br>5      | 34.21<br>8      | 36.39<br>9      | 32.188       |
| 4           | 1.012        | 0.99<br>3      | 0.99<br>1      | 1.01<br>2      | 0.979        | 63.843        | 49.69<br>8      | 48.30<br>0      | 41.28<br>7      | 36.101       |
| 5<br>(High) | 1.027        | 1.04<br>9      | 1.08<br>3      | 1.09<br>8      | 1.058        | 35.653        | 49.24<br>2      | 64.31<br>3      | 52.32<br>5      | 55.824       |
|             | Beta_SMB     |                |                |                |              | t-value (SMB) |                 |                 |                 |              |
| 1<br>(Low)  | 0.878        | 0.85<br>3      | 0.65<br>3      | 0.32<br>9      | -0.356       | 22.104        | 15.21<br>5      | 14.55<br>6      | 5.993           | -4.534       |
| 2           | 1.011        | 0.91<br>4      | 0.74<br>5      | 0.38<br>6      | -0.342       | 24.600        | 16.06<br>7      | 16.40<br>1      | 6.772           | -4.607       |
| 3           | 1.057        | 0.92<br>7      | 0.75<br>0      | 0.49<br>6      | -0.428       | 16.571        | 17.64<br>2      | 10.68<br>3      | 4.385           | -4.544       |
| 4           | 1.092        | 0.82<br>0      | 0.69<br>1      | 0.46<br>4      | -0.097       | 19.392        | 14.75<br>3      | 9.711           | 8.029           | -1.389       |
| 5<br>(High) | 0.962        | 0.88<br>9      | 0.61<br>3      | 0.45<br>2      | -0.270       | 16.891        | 17.12<br>2      | 11.95<br>3      | 8.987           | -6.350       |
|             | Beta_HML     |                |                |                |              | t-value (HML) |                 |                 |                 |              |
| 1<br>(Low)  | -0.527       | -<br>0.53<br>7 | -<br>0.56<br>6 | -<br>0.69<br>5 | -1.012       | -10.894       | -<br>13.85<br>3 | -<br>11.12<br>8 | -<br>11.39<br>2 | -11.933      |

|             |            |                |                |                |        |                |                 |        |                 |         |
|-------------|------------|----------------|----------------|----------------|--------|----------------|-----------------|--------|-----------------|---------|
| 2           | -0.393     | -<br>0.43<br>3 | -<br>0.47<br>4 | -<br>0.58<br>0 | -0.765 | -11.856        | -<br>10.31<br>7 | -9.503 | -<br>10.40<br>3 | -12.206 |
| 3           | -0.268     | -<br>0.37<br>1 | -<br>0.39<br>8 | -<br>0.48<br>3 | -0.456 | -5.652         | -8.655          | -6.126 | -6.895          | -5.504  |
| 4           | -0.017     | -<br>0.03<br>3 | -<br>0.11<br>8 | -<br>0.11<br>2 | 0.033  | -0.409         | -0.753          | -2.072 | -2.046          | 0.464   |
| 5<br>(High) | 0.313      | 0.35<br>5      | 0.23<br>3      | 0.35<br>3      | 0.522  | 4.369          | 8.195           | 5.113  | 7.973           | 12.979  |
|             | Beta_RMWO_ |                |                |                |        | t-value (RMWO) |                 |        |                 |         |
| 1<br>(Low)  | -0.093     | -<br>0.24<br>1 | -<br>0.36<br>8 | -<br>0.55<br>4 | -0.620 | -1.069         | -1.953          | -3.471 | -3.235          | -4.264  |
| 2           | 0.002      | -<br>0.04<br>1 | 0.04<br>6      | 0.22<br>7      | 0.625  | 0.017          | -0.372          | 0.394  | 1.251           | 3.452   |
| 3           | 0.053      | -<br>0.01<br>4 | 0.26<br>5      | 0.22<br>3      | 0.434  | 0.468          | -0.117          | 1.379  | 0.968           | 2.425   |
| 4           | -0.024     | 0.10<br>9      | 0.02<br>3      | 0.02<br>2      | 0.230  | -0.216         | 0.927           | 0.146  | 0.207           | 2.290   |
| 5<br>(High) | 0.056      | -<br>0.12<br>5 | -<br>0.15<br>6 | -<br>0.25<br>3 | -0.321 | 0.376          | -1.047          | -1.583 | -2.349          | -3.366  |
|             | Beta_CMA_  |                |                |                |        | t-value (CMA)  |                 |        |                 |         |
| 1<br>(Low)  | 0.352      | 0.25<br>8      | 0.20<br>8      | 0.07<br>4      | 0.494  | 5.513          | 3.393           | 3.533  | 0.786           | 4.613   |
| 2           | 0.019      | -<br>0.04<br>0 | -<br>0.28<br>2 | -<br>0.22<br>2 | -0.351 | 0.355          | -0.504          | -4.267 | -3.239          | -3.252  |
| 3           | -0.108     | -<br>0.09<br>0 | -<br>0.33<br>7 | -<br>0.45<br>5 | -0.455 | -1.412         | -1.190          | -2.776 | -3.403          | -4.553  |
| 4           | 0.016      | -<br>0.07<br>5 | -<br>0.19<br>1 | -<br>0.22<br>2 | -0.342 | 0.269          | -1.002          | -2.002 | -2.926          | -4.319  |
| 5<br>(High) | 0.139      | 0.10<br>6      | 0.12<br>8      | 0.18<br>5      | 0.255  | 1.565          | 1.577           | 1.786  | 2.598           | 3.952   |

## 7. Conclusion

Based on the aforementioned study data and conclusions, this paper conducts an empirical investigation of the Fama-French 5-factor model within the Chinese A-share market. Initially, a descriptive statistical analysis of the 5 factors reveals that while MKT boasts the highest average return rate, it also exhibits the highest volatility. In contrast, RMW and CMA demonstrate lower average returns but reduced volatility. Moving forward, a correlation study involving the 5 factors uncovers a negative correlation between SMB and HML and RMW, whereas HML and RMW display a significant positive correlation. The findings of the 5-factor regression model also indicate that

MKT exerts the most considerable influence on stock returns. Meanwhile, the coefficients of SMB in various market capitalization groups exhibit a monotonic decreasing trend. On the whole, the regression coefficients of HML and RMWO hold relatively little significance. CMA reveals a declining trend in small-cap stocks, but additional factors might be at play within the category with the largest market capitalization.

In conclusion, this research provides valuable new insights into the empirical analysis of the Fama-French 5-factor model within the Chinese A-share market. These research findings furnish investors with reference data concerning stock returns, which are pivotal for comprehending the asset pricing model of the Chinese A-share market. The understanding of asset pricing models in the Chinese A-share market can be further enhanced through additional research and discussion in specific areas. Subsequent studies can explore the effects of supplementary parameters.

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