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The Empirical Test of the Fama–French Three-Factor Model in the Chinese Stock Market

Yibo Wang

Abstract:

This paper examines the applicability of the Fama–French (1993) three-factor model in China's A-share market. Using monthly data from September 1999 to June 2022, we estimate time-series regressions of excess returns on six representative Chinese A-share stocks on the market factor, the size factor, and the value factor. The evidence shows that the market factor is highly significant for all six stocks, the size factor is significantly positive for four of them, while the value factor is not statistically significant in any case. All estimated intercepts (alphas) are large and negative. These results suggest that the Fama–French three-factor structure captures important market and size-related components of risk in the Chinese stock market but does not fully reconcile realised returns with model-implied expected returns.

Keywords: Fama–French three-factor model; CAPM; size effect; value effect; Chinese stock market; asset pricing

1. Introduction

This paper provides an empirical test of the Fama–French three-factor model in the Chinese A-share market using individual stock data. Since the early 1990s, the Shanghai and Shenzhen Stock Exchanges have developed into one of the largest equity markets in the world, characterised by high turnover, a large proportion of retail investors, and frequent regulatory interventions. Whether asset-pricing models originally developed for developed markets can be applied directly to this environment is an important empirical question.

The Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) implies that the market portfolio is the only priced risk factor and that expected excess returns are proportional to market beta. A large body of empirical research documents systematic deviations from this simple benchmark. Banz (1981) shows that small-cap stocks tend to earn higher average returns than large-cap stocks, while Basu (1983), Stattman (1980), and Rosenberg et al. (1985) report that high book-to-market stocks outperform low book-to-market stocks even after controlling for beta.

Fama & French (1993) incorporate these patterns into a three-factor model in which expected returns depend on exposures to the market factor, a size factor (SMB), and a value factor (HML). In U.S. data, this three-factor model explains a large proportion

of the variation in average returns across portfolios sorted by size and book-to-market and has become a standard benchmark in empirical asset pricing.

In emerging markets, including China, market microstructure and investor composition differ markedly from those in the United States. The Chinese A-share market is dominated by individual investors, short selling is limited, and institutional and regulatory factors play a prominent role. These features may affect both the behaviour of risk factors and the performance of standard pricing models.

In this study, we focus on a simple and transparent test of the Fama–French three-factor model using six individual A-share stocks. We estimate monthly time-series regressions of stock excess returns on the three Fama–French factors over the period September 1999 to June 2022 and analyse the statistical significance, economic magnitude, and goodness-of-fit of the model. The results show that the market factor is always strongly priced, the size factor is important for four of the six stocks, the value factor is not significant, and all alphas are large and negative.

The remainder of the paper is organised as follows. Section 2 briefly reviews the related literature. Section 3 describes the data and methodology. Section 4 presents the empirical results for the six A-share stocks. Section 5 discusses the implications of the findings. Section 6 concludes.

2. Literature Review

Our work relates to three main strands of the asset-pricing literature: tests of the CAPM and multifactor models, evidence on size and value effects, and empirical studies on emerging and Chinese stock markets. The CAPM (Sharpe 1964; Lintner 1965) provided the classical one-factor description of expected returns. Early empirical tests by Black et al. (1972) and Fama & MacBeth (1973) found deviations from the linear beta–return relation, which motivated models with additional risk factors or mispricing components. Subsequent studies identified several characteristics that forecasted returns, including firm size (Banz 1981), earnings–price ratios (Basu 1983), and book-to-market ratios (Stattman 1980; Rosenberg et al. 1985). Fama & French (1993) summarised these regularities in a three-factor model, adding SMB and HML to the market factor. The model became a standard benchmark for empirical asset-pricing tests and performance evaluation. Later extensions introduced further factors such as profitability and investment (Fama & French 2015) or investment-based factors (Hou et al. 2015), but the original three-factor specification remained widely used. For emerging markets, Harvey (1995) and Bekaert & Harvey (1995) documented time-varying risk premia and partial market segmentation. In the Chinese context, existing empirical work generally found that the CAPM alone had difficulty explaining observed returns, and that size, value, and liquidity characteristics were relevant. However, the evidence on the performance of the Fama–French model in China was mixed, partly because of differences in sample periods, data sources, and estimation methods. Our study contributes to this literature by providing a clear and focused implementation of the Fama–French three-factor model for a long sample of Chinese A-share data, using six specific individual stocks as test assets.

3. Data and Methodology

3.1 Data and Sample Period

The empirical analysis uses monthly data from September 1999 to June 2022. The sample consists of six representative A-share stocks listed on the Shanghai and Shenzhen Stock Exchanges:

· Stck000016 (R1)
· Stck000032 (R2)
· Stck000068 (R3)
· Stck000010 (R4)
· Stck000047 (R5)
· Stck000089 (R6)

For each stock, we obtain monthly closing prices and calculate simple monthly returns. Excess returns are defined as stock returns minus the risk-free rate. The risk-free rate is proxied by a short-term interest rate series (such as the three-month central bank bill yield or the three-month Shanghai interbank offered rate, Shibor), converted to monthly simple returns.

3.2 Fama–French Three Factors

We use three monthly Fama–French-style factors commonly employed in empirical asset pricing: the market factor (RMRF), the size factor (SMB), and the value factor (HML).

RMRF (market risk premium) $\mathrm{RMRF}_t = R_{m,t} - R_{f,t}$, is defined as the return on a broad market index of A-share stocks minus the risk-free rate.

SMB (small minus big) is defined as the return difference between a portfolio of relatively small firms and a portfolio of relatively large firms. At each year-end, we split the universe at the median market capitalisation into small (S) and big (B) stocks and at the 30th and 70th percentiles of book-to-market into low (L), medium (M), and high (H) BM groups. This yields six value-weighted portfolios: SL, SM, SH, BL, BM, and BH. SMB is defined as

$$\mathrm{SMB}_t = \frac{1}{3}(R_{SL,t} + R_{SM,t} + R_{SH,t}) - \frac{1}{3}(R_{BL,t} + R_{BM,t} + R_{BH,t}).$$

HML (high minus low) is defined as the return difference between a portfolio of high book-to-mar-

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ket firms and a portfolio of low book-to-market firms. $\mathrm{HML}_t = \frac{1}{2}(R_{SH,t} + R_{BH,t}) - \frac{1}{2}(R_{SL,t} + R_{BL,t})$.

In the empirical work, we use monthly time series of RMRF, SMB, and HML over the period from September 1999 to June 2022. These factor series summarise common movements in the Chinese stock market related to overall market conditions, firm size, and relative valuation.

3.3 Regression Specification

To test the Fama–French three-factor model at the individual-stock level, we estimate the following time-series regression for each stock:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \mathrm{RMRF}_t + s_i \mathrm{SMB}_t + h_i \mathrm{HML}_t + \epsilon_{i,t}, t = 1, \ldots, T,$$

Where

Symbol	Explanation
$R_{i,t}$	Return on stock i in month t
$R_{f,t}$	Risk-free rate in month t
RMRF_t	Market risk premium in month t (market return minus risk-free rate)
SMB_t	Size factor (small-minus-big) in month t
HML_t	Value factor (high-minus-low) in month t
α_i	Intercept (pricing error) for stock i
β_i, s_i, h_i	Factor loadings on RMRF_t, SMB_t, and HML_t, respectively
$\epsilon_{i,t}$	Regression disturbance term for stock i in month t

The model is estimated by ordinary least squares (OLS) using monthly data. For each stock, we record the estimated coefficients, their t-statistics, the coefficient of determination R^2, the sample size N, and the F-statistic for the joint significance of the regressors.

4. Empirical Results

4.1 Regression Results for Six A-Share Stocks

Table reports the Fama–French three-factor regressions for the six A-share stocks. The dependent variables (R1)–(R6) are the excess returns on Stck000016, Stck000032, Stck000068, Stck000010, Stck000047, and Stck000089, respectively. The explanatory variables are the market risk premium (RMRF), the size factor (SMB), and the value factor (HML). The constant term is denoted by (_cons). (N) is the number of monthly observations, R^2 is the coefficient of determination, and F is the F-statistic for the joint significance of the regressors.

	(1)	(2)	(3)	(4)	(5)	(6)
	R1	R2	R3	R4	R5	R6
RMRF	0.010***	0.012***	0.011***	0.010***	0.014***	0.009***
	(9.98)	(13.64)	(9.54)	(7.95)	(3.93)	(13.28)
HML	0.002	-0.002	-0.002	-0.004	-0.003	0.000
	(1.08)	(-0.82)	(-0.92)	(-1.49)	(-0.59)	(0.23)
SMB	0.006***	0.006***	0.007***	0.015***	0.005	0.000
	(3.55)	(4.18)	(3.53)	(7.36)	(0.74)	(0.02)
cons	-0.190***	-0.188***	-0.182***	-0.175***	-0.184***	-0.189***
	(-24.23)	(-28.32)	(-21.25)	(-19.49)	(-8.53)	(-35.29)
N	272	263	250	236	32	274
r2	0.322	0.476	0.328	0.408	0.440	0.402
F	42.435	78.290	40.066	53.215	7.327	60.452

t statistics in parentheses
$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$
(1) Market factor (RMRF).
The market factor is strongly priced for all six stocks. The estimated coefficients on RMRF are positive in every case, lying between 0.009 and 0.014, and all are significant at the 1% level. The corresponding t-statistics range from 3.93 to 13.64. This indicates that all six stocks co-move closely with broad market returns and that market risk is an important component of their expected excess returns.
(2) Value factor (HML).
The HML coefficients are small in magnitude and statistically insignificant for all six stocks. The estimates range from –0.004 to 0.002, with t-statistics between –1.49 and 1.08. Conditional on market and size exposures, the value factor does not have a statistically detectable impact on the expected excess returns of these particular A-share stocks.
(3) Size factor (SMB).
The SMB coefficients display more heterogeneity. Four stocks—Stck000016 (R1), Stck000032 (R2), Stck000068 (R3), and Stck000010 (R4)—exhibit positive and statistically significant SMB loadings. The corresponding estimates are 0.006, 0.006, 0.007, and 0.015, with t-statistics of 3.55, 4.18, 3.53, and 7.36, respectively. This suggests that these stocks behave more like small-cap stocks in factor space and are exposed to size-related risk.
In contrast, Stck000047 (R5) and Stck000089 (R6) have SMB coefficients that are not statistically different from zero (0.005 and 0.000, with t-statistics of 0.74 and 0.02). For these two stocks, size does not appear to be a significant risk driver once market conditions are taken into account.
(4) Intercepts (alphas).
All six intercepts are large, negative, and highly significant. The estimated alphas range from –0.175 to –0.190, with t-statistics between –8.53 and –35.29. In every case the intercept is significant at the 1% level. The joint hypothesis that all alphas are equal to zero is therefore strongly rejected. Economically, these negative alphas imply that the realised average excess returns on these six stocks are below the levels implied by their exposures to the three Fama–French factors over the sample period.
(5) Goodness-of-fit.
The R^2 values lie between 0.322 and 0.476, indicating that the three factors explain roughly one-third to one-half of the time-series variation in monthly excess returns for these stocks. The F-statistics reported in the last row of the table confirm that the regressors are jointly significant in all six cases. The relatively high R^2 for Stck000047 (0.440), which is based on only 32 observations, should be interpreted with caution because small samples may lead to unstable estimates.

5. Discussion

The empirical results for the six A-share stocks show a clear pattern. First, the market factor is always highly significant, confirming that overall market conditions are a key determinant of individual stock returns in China. Second, the size factor is economically and statistically important for four of the six stocks, indicating that size-related risk is relevant for many individual firms. Third, the value factor is not statistically significant for any of the six stocks, suggesting that book-to-market characteristics do not play a strong role for these particular names once market and size exposures are taken into account.
The uniformly large and negative alphas indicate that the Fama–French three factors do not fully reconcile realised excess returns with model-implied expected returns. For these six stocks, the three-factor model tends to overpredict average excess returns, even though it captures a substantial fraction of the time-series variation. This pattern suggests that additional risk factors or market-specific features may be needed to achieve a more complete description of expected returns in the Chinese A-share market.
At the same time, the three-factor model remains a useful organising framework. By decomposing excess returns into market, size, and value components, the model helps to identify which sources of risk are important for a given stock and which are not. For the six stocks considered here, the evidence points to strong market exposure, meaningful size exposure in most cases, and weak value exposure.

6. Conclusion

This paper provides an empirical test of the Fama–French three-factor model in the Chinese A-share market using six representative individual stocks over the period from September 1999 to June 2022. We estimate monthly time-series regressions of excess stock returns on the market, size, and value factors and analyse the resulting coefficients, alphas, and goodness-of-fit.
The main findings are as follows. The market factor is highly significant for all six stocks. The size factor is significantly positive for four stocks, while the value factor is not statistically significant for any of them. All estimated alphas are large and negative, and the three factors explain a non-trivial but incomplete fraction of the time-series variation in returns.
These results suggest that the Fama–French three-factor model captures key aspects of risk and return in the Chinese stock market but does not provide a complete pricing model for individual A-share stocks. Future research could extend this analysis by considering a larger set of stocks,

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incorporating additional factors such as momentum, profitability, or liquidity, and examining how factor exposures and pricing errors evolve around major regulatory and macroeconomic events.

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