

Can the Fama-French Three-Factor Model Incorporating Emotional Factors Improve Its Applicability to the A-Share Market?

—An Empirical Test Based on a Full Sample of A-Shares

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Abstract. In China's A-share market, retail participation and sentiment-driven trading challenge the explanatory power of the traditional Fama-French three-factor model. This paper tests whether adding a sentiment factor to the FF3 framework improves stock excess return pricing and whether the factor has independent risk-pricing power. Using monthly data of a full A-share sample and a STAR Market subsample from July 2019 to December 2025, we estimate three- and four-factor models via panel regressions and the Breusch-Pagan LM test. Results show significant firm-specific effects in the full A-share sample, supporting a random-effects specification, while pooled OLS fits the STAR Market. The sentiment factor is significantly positive in both samples and improves model fit. The STAR Market has a higher market beta, and sentiment plays a stronger role in the broader A-share market. Robust size effects and negative value effects reveal structural heterogeneity across market segments. These findings support incorporating behavioral factors into A-share asset pricing and offer quantitative implications for allocation, risk management and regulation.

Keywords: Fama-French three-factor model, investor sentiment, asset pricing, A-share market, STAR Market

1. Introduction

China's A-share market exhibits a retail-dominated structure where sentiment-driven trading can cause pronounced divergence between technology growth stocks and traditional value sectors, a pattern difficult to explain through mature-market pricing logic alone [1]. This paper asks whether adding a sentiment factor to the Fama-French three-factor model improves the explanation of A-share excess returns and whether it possesses independent pricing power. Using monthly data from July 2019 to December 2025 for a full A-share sample and a STAR Market subsample, this study evaluates the incremental contribution and segment-level heterogeneity of sentiment within a panel-regression framework.

2. Theoretical framework and literature review

2.1. Asset pricing models and behavioral biases in A-shares

While the Fama-French three-factor model remains the benchmark for empirical asset pricing [2-4], its explanatory power in the A-share market is limited by structural features: retail investors dominate liquidity despite rising institutional participation (~25%), and their information asymmetry and overconfidence amplify factor premiums through feedback trading [5, 6]. Behavioral finance further indicates that market sentiment drives irrational biases—overconfidence, loss aversion, overreaction—causing prices to deviate from fundamentals. Bird et al. [7] found that positive emotions shape investor behavior more than negative ones, and investors are disproportionately influenced by news media. Sentiment is therefore not merely short-term noise but a potential source of systemic risk with an independent premium, meriting integration into the Fama-French framework as a behavioral factor.

2.2. Sentiment factor in multi-factor pricing: research gap

In China, scholars constructed the CICSI index to measure investor sentiment and confirmed its impact on A-share volatility and returns [8, 9]; Chen et al. [10] further integrated sentiment into quantitative strategies. Nevertheless, existing research remains at the indicator-construction stage, with limited efforts to embed sentiment into multi-factor pricing models or conduct comparative analyses between the broader market and the STAR Market. This paper addresses this gap by constructing a sentiment factor from CICSI and embedding it into the FF three-factor model. We test whether sentiment has incremental explanatory power and whether its pricing effect differs across market segments.

3. Data collection and empirical research methods

3.1. Data selection and preprocessing

Monthly closing prices for all A-share stocks (excluding Beijing Stock Exchange, ST and PT listings), CICSI sentiment index, and Fama-French factor data were collected from Wind and CSMAR for July 2019–December 2025, yielding 356,634 firm-month observations after removing missing values.

3.2. Model specification

3.2.1. Variable definitions

Table 1. Variable definitions

Variable	Symbol	Definition
Individual Stock Excess Return	$R_{it}-R_{ft}$	Log return of stock i in month t minus the 1-year China government bond yield.
Market Risk Premium	$R_{mt}-R_{ft}$	Shanghai Composite Index monthly return minus the risk-free rate.
Size Factor	SMB_t	Return spread between small-cap and large-cap portfolios (sorted by market cap, cross-grouped by P/B).

Table 1. (continued)

Value Factor	HML _t	Return spread between high P/B (value) and low P/B (growth) portfolios.
Sentiment Factor	Sentiment _t	Monthly change rate of the CICI.

$$(CICSI_t = 0.231DCEF_t + 0.224TURN_{t-1} + 0.257IPON_t + 0.322IPOR_t + 0.268CCI_t + 0.405NIA_{t-1})$$

As shown in Table 1, the CICI index is constructed through the refinement of the BW Index methodology. It selects standardized values for closed-end fund discounts, trading volume, the number of IPOs, first-day IPO returns, the consumer confidence index, and the number of new investor accounts. Subsequently, these variables are weighted using the top five principal components obtained from principal component analysis. A one-period lag is applied to trading volume and the number of new accounts. After deriving the formula, substituting the monthly values of the six variables results in the monthly sentiment score. Higher values of this score signify a more optimistic investor sentiment. The regression model in this paper employs data from the CICI field in the Wind database, where the field values are calculated based on the original model.

3.2.2. Model

To examine the role of the four-factor model with the sentiment factor in China's A-share asset pricing, this paper establishes two regression models:

Model 1: Fama-French three-factor model

$$R_{it} - R_{ft} = \alpha_i + \beta_1 i(R_{mt} - R_{ft}) + \beta_2 iSMB_t + \beta_3 iHML_t + \varepsilon_{it} \quad (1)$$

Model 2: Fama-French four-factor model incorporating the sentiment factor (extended model)

$$R_{it} - R_{ft} = \alpha_i + \beta_1 i(R_{mt} - R_{ft}) + \beta_2 iSMB_t + \beta_3 iHML_t + \beta_4 iSentiment_t + \varepsilon_{it} \quad (2)$$

A significant β_4 with improved R^2 indicates incremental explanatory power of sentiment.

3.3. Regression methods and tests

With 5,509 stocks over 78 months, pooled OLS may ignore firm-level heterogeneity. We employ the Breusch-Pagan LM test to select among pooled OLS, fixed-effects, and random-effects specifications. For the full A-share sample, the LM test ($\chi^2 = 483.60$, $p \approx 0.000$) rejects the null of no individual effects, supporting a random-effects specification.

4. Empirical results and analysis

4.1. Summary statistics results

The descriptive statistics (Table 2) came from Wind and CSMAR show that the STAR Market has higher average prices (55.6 vs. 21.8) and greater return volatility (Std. Dev. 15.1% vs. 13.4%) than the full A-share sample. Sentiment changes are slightly negative in both samples.

Table 2. Statistics for all A-share and STAR market panel samples

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
All A-shares						
Monthly Closing Price	362,164	21.819	12.100	42.652	0.019	2,218.000
Monthly Growth Rate Ri (%)	356,634	0.017	-0.427	13.422	-315.396	247.099
SSE Composite Index Closing Price	362,164	3,264.926	3,255.670	283.596	2,750.300	3,968.840
Risk-free Rate (%)	362,164	0.163	0.169	0.037	0.095	0.239
SMB Factor (%)	362,164	0.516	0.677	4.209	-11.627	10.957
HML Factor (%)	362,164	0.092	-0.107	3.244	-6.237	10.917
Change in Investor Sentiment (%)	358,654	-0.348	0.161	3.365	-23.410	4.085
STAR Market						
Monthly Closing Price	31,027	55.616	34.600	72.428	0.640	1,492.490
Monthly Growth Rate Ri (%)	30,431	-0.483	-0.912	15.117	-133.005	247.099
SSE Composite Index Closing Price	31,027	3,291.904	3,279.030	281.426	2,750.300	3,968.840
Risk-free Rate (%)	31,027	0.156	0.159	0.034	0.095	0.239
SMB Factor (%)	31,027	0.607	0.791	4.417	-11.627	10.957
HML Factor (%)	31,027	0.304	0.134	3.332	-6.237	10.917
Change in Investor Sentiment (%)	31,002	-0.330	0.211	3.330	-23.410	4.085

Notes: All returns and factors are in percentage terms. Macro-level variables (market index, risk-free rate, SMB, HML, sentiment) repeat across firm-month observations. The STAR Market shows higher price levels (55.6 vs. 21.8) and return volatility (15.1% vs. 13.4%) than the full A-share sample. Sentiment changes are slightly negative in both samples.

4.2. STAR market regression results

Table 3 reports STAR Market OLS results. All FF3 factors are significant; the sentiment factor (coefficient = 0.184***) improves R^2 from 0.210 to 0.212. The Breusch-Pagan LM test (Table 4: $\chi^2 = 0.00$, $p = 1.000$) finds no individual effects, confirming pooled OLS.

Table 3. Comparison of OLS regressions using STAR market data

Variable	pool_ff3	pool_ff4
RiskPremium2	36.396*** (17.120)	35.784*** (16.900)
smb2	0.632*** (26.400)	0.609*** (25.820)
hml2	-1.511*** (-44.870)	-1.489*** (-43.640)
sentiment_change		0.184*** (7.810)
_cons	0.051*** (15.350)	0.051*** (15.290)
N	30431	30431

Table 3. (continued)

R2	0.210	0.212
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Notes: z-values in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Next, the Breusch-Pagan LM test (Table 4) yields $\chi^2=0.00$ with $p=1.000$, indicating no significant individual effects in the STAR Market sample; pooled OLS is therefore appropriate.

Table 4. Breusch-Pagan test and variance decomposition

Component	Variance	Standard Deviation
excess_return	0.0229	0.1512
Residual (e)	0.0182	0.1349
Individual effect (u)	0.0000	0.0000
Test: H0: Var(ui) = 0		
χ^2 statistic	0.00	
p-value	1.0000	

Notes: The model is specified as $\text{exces_return}_{it} = X\beta + u_i + \epsilon_{it}$. The null hypothesis of the Breusch-Pagan test is that the variance of the individual random effect u_i is zero.

4.3. Regression results for the full A-share sample

For the full A-share sample, the Breusch-Pagan LM test ($\chi^2 = 483.60$, $p \approx 0.000$, $\rho \approx 0.045$) rejects the null of no individual effects, supporting random-effects estimation (Table 5). All factors are significant; the sentiment factor (0.280***) markedly improves model fit.

Table 5. Random effects results for the entire A-share data set

Variable	re_ff3	re_ff4
RiskPremium2	13.902*** (28.130)	14.638*** (29.790)
smb2	0.648*** (78.910)	0.608*** (75.030)
hml2	-0.782*** (-69.870)	-0.758*** (-67.560)
sentiment_change		0.280*** (43.730)
_cons	0.018*** (20.990)	0.020*** (23.930)
N	356634	356634

Notes: Cluster-robust standard errors at the individual stock level are used.

4.4. Comparative analysis of the STAR market and the full A-share sample

Table 6 compares the two samples. The STAR Market shows a higher market beta (36.40 vs. 14.64) consistent with its growth-oriented profile. SMB is positive in both, confirming the small-cap effect. HML is negative (-1.51 vs. -0.76), stronger in the STAR Market. Sentiment has greater impact on the full A-share market (0.28 vs. 0.18). Model fit (R^2) is higher for the STAR Market, reflecting more homogeneous structural characteristics, leading to better model fit.

Table 6. Comparison of regression results between the STAR market and the full A-share sample

Indicator	STAR Market (Pooled OLS)	All A-shares (Random Effects)
Market Premium Coefficient	36.40	14.64
SMB Coefficient	0.63	0.61
HML coefficient	-1.51	-0.76
Emotional factor coefficient	0.18	0.28
R^2 (FF4)	0.2115	0.1123
Individual effect ρ	0	0.044

4.5. Interpretation, contributions, and practical implications

The sentiment factor exhibits significant positive pricing power in both samples, confirming incremental explanatory power. Its effect is stronger in the full A-share market, while the STAR Market shows higher market beta—reflecting heterogeneity between growth-oriented and diversified markets. Limitations include the single composite sentiment index and potential interference from external shocks during 2019–2025; future research may employ Fama-MacBeth regression or high-frequency data.

5. Conclusion

This study examines the full A-share sample, including a comparison sample from the STAR Market, from July 2019 to December 2025. Within a panel data framework, it systematically tests the explanatory power of the Fama-French four-factor model, which incorporates the China Stock Market Sentiment Index (CICSI monthly rate of change), compared with the traditional three-factor model. The empirical results indicate that the sentiment factor exhibits significant positive pricing power in both the full A-share and STAR Market samples, contributing to risk premiums independently of the market risk premium, size factor, and value factor. After incorporating the sentiment factor, the overall model fit improves across the samples, validating the incremental explanatory power of investor sentiment for A-share excess returns. Further comparative analysis shows that the role of the sentiment factor is more pronounced in the full A-share sample, whereas the market risk premium beta is higher in the STAR Market sample. Scale effects and negative value effects are also robustly present in both sample types, indicating that traditional Fama-French factors remain important while behavioral factors provide additional explanatory power.

In summary, against the backdrop of profound changes in the investor structure of the A-share market and the increasingly prominent characteristics of behavioral finance, the four-factor model incorporating the sentiment factor significantly enhances the explanation of stock excess returns. The findings suggest that investor sentiment should not be regarded merely as short-term market noise, but as an important behavioral pricing factor. Future research may further examine the

interaction between sentiment and other behavioral variables, such as investor attention and overconfidence, to deepen the understanding of asset pricing mechanisms in emerging markets.

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