Research on the Impact of Investor Sentiment on Stock Returns Based on Uncertainty

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Abstract. This paper examines the relationship between firm-level investor sentiment and stock returns, and attempts to illustrate the impact of financial market uncertainty on this relationship. The results show that investor sentiment significantly affects the short-term returns of stocks, and this influence weakens when uncertainty increases. And in companies with less uncertainty, the effect becomes even stronger.

Keywords: Investor Sentiment; Uncertainty; Mispricing.

1. Introduction

In modern financial markets, irrational markets driven by investor sentiment often challenge traditional financial theories, resulting in traditional financial models often becoming difficult to stand on. Investors tend to be irrational, generating collective emotions or biases that influence investment decisions, leading to a deviation from asset price and value, which can lead to market anomalies and irrational exuberance. In recent decades, a growing number of scholars have discussed the impact of emotions on financial markets.

Baker and Wurgler (2006) constructed a market-wide monthly sentiment indicator (BW index) by performing principal component analysis on six major sentiment proxy indicators. Their findings suggest that high sentiment tends to lead to lower subsequent returns, i.e., stock prices are overvalued during periods of high sentiment and undervalued during periods of low sentiment. This effect is more pronounced for firms that are harder to arbitrage. Arif and Lee (2014) look at the world and further explore the relationship between emotions and global financial markets. Baker, Wurgler, and Yuan (2012) developed the Global Market Sentiment Index, arguing that investor sentiment influences returns at the country level as well as cross-sectional returns. Wang, Su, and Duxbury (2021) studied more than 50 markets around the world and concluded that sentiment can negatively impact future returns on an international scale.

Certainty measures the unpredictability of future events or outcomes and is an important factor in the pricing of financial assets. Merton (1973) argues that uncertainty can significantly affect the decision-making of investors, policymakers, and other market stakeholders. Jiang, Lee and Zhang (2005) and Zhang (2006) argue that firms with high uncertainty are more likely to misprice. Arnold and Vrugt (2008) demonstrate that market volatility and macroeconomic uncertainty are correlated. Liu and Zhang (2015) found that uncertainty in economic policy increases market volatility. Asgharian, Christiansen, and Hou (2023) show that both macroeconomic and financial uncertainty predict the volatility and correlation of the stock market from month to month. Manela and Moreira (2017) argue that uncertainty is a predictor of stock market returns.

This paper connects investor sentiment and uncertainty at the firm level, expanding on Birru and Young's (2022) market-level research. The results show that investor sentiment affects stock returns, with short-term stock returns increasing when sentiment is high and short-term returns declining when sentiment is low. When a company's uncertainty level falls, the impact of sentiment on short-term returns becomes more significant. This study helps to understand the impact of investor sentiment and uncertainty on asset pricing at both the company level and the market level, and to consider the importance of investor sentiment and uncertainty in actual financial analysis.

2. Literature review

Classical financial theory believes that rational investors dominate the market, and even if some investors behave irrationally, rational arbitrageurs will offset the influence of irrational investors, but the introduction of behavioral finance breaks this assumption. Shleifer, summers, and Waldmann (1990) have shown that investors are not entirely rational and that emotions can cause asset prices to deviate from their fundamental values. Black (1986) argues that investor sentiment can influence stock prices through the behavior of irrational traders, known as noise traders.

Existing research shows that there is a significant relationship between investor sentiment and stock market returns. Brown and Cliff (2004) argue that sentiment predicts future stock returns, and that high sentiment can lead to market downturns. Tetlock (2007) shows that high pessimistic levels in news articles are associated with high market volatility. At the same time, Kumar and Lee (2006) found that individual investor sentiment correlates with high volatility in the stock market, especially under extreme market conditions. In addition, investor sentiment is associated with various market anomalies. Ljungqvist, Nanda, and Singh (2006) argue that sentiment can lead to the underpricing of initial public offerings (IPOs), while Stambaugh, Yu, and Yuan (2012) suggest that sentiment contributes to the momentum effect of stock returns.

Previous studies have used a variety of proxy indicators to measure sentiment, such as consumer confidence (Lemmon and Portniaguina, 2006), United States individual investor sentiment (Chau, Deesomsak, and Koutmos, 2016), closed-end fund discount rates (Lee et al., 1991), turnover rates (Liu, 2015), etc. With the rise of the internet, advances in big data and natural language processing have expanded the scope of sentiment quantification, such as Hasan (2022) constructing an investor sentiment index based on Google search, and Bang et al. (2023) using deep learning-based natural language processing to quantify sentiment.

The BW index proposed by Baker and Wurgler (2006) is widely considered to be an effective measure of investor sentiment in the market. The index uses six common sentiment agents: closed-end fund discounts, turnover, number of IPOs, first-day IPO returns, dividend premiums, and the ratio of equity offerings to the sum of equity and debt issuances, and performs principal component analysis on the six agents to construct market-level investor sentiment. Later, in order to overcome the irrational limitation that the index can only measure the whole market and cannot capture the irrational constraints at the firm level, Yang ET Zhou (2016) proposed a firm-level sentiment index based on principal component analysis of relative strength index, psychological line index, adjusted turnover rate and trading volume.

Financial market uncertainty refers to the unpredictability of future market movements, economic policies, and geopolitical events, and is an important factor in asset pricing. Pindyck (1991) argues that uncertainty affects investor behavior and often leads to risk-averse decisions that reduce the value of financial assets. Bloom (2009) states that a high degree of uncertainty can lead to a decrease in investment, as well as a decrease in stock prices. Pástor and Veronesi (2012) argue that greater policy uncertainty is associated with lower asset prices and higher expected returns, while also increasing market volatility. Bekaert et al. (2013) further validated this conclusion.

The mechanism by which uncertainty affects the market is closely related to investor sentiment. High levels of uncertainty often lead to unpredictable behavior among market participants, leading to rapid fluctuations in asset prices, prompting investors to make decisions based on sentiment rather than analytical reasoning. In times of high uncertainty, the lack of reliable fundamentals means that investors are more susceptible to sentiment. When uncertainty is high, noisy traders who consider fundamental and sentiment signals tend to focus less on fundamental analysis and instead engage in speculative valuations based on general sentiment. In addition, arbitrage is limited when uncertainty is high, which in turn prevents rational arbitrageurs from counteracting irrational trading behavior. As a result, investor sentiment tends to have a more significant impact during periods of high uncertainty.

Hirshleifer (2001) hypothesizes that the increase in uncertainty amplifies the influence of irrational investors. Research by Baker and Wurgler (2006) shows that sentiment has a greater impact on stocks

with higher levels of uncertainty. Kim, Ryu and Yang (2021) argue that the impact of sentiment on stock returns varies with the degree of information uncertainty. Birru and Young (2022) argue that when uncertainty is high, corrections to sentiment-induced mispricing are easier to predict, and that sentiment is more predictive of portfolios ranked by beta and volatility.

3. Data and Variables

The study in this paper focuses on China's A-share market, which has 325.2 million investors as of 2023, of which individual investors account for the vast majority (99.7%). Retail traders are often referred to as noise investors, and their decisions are heavily influenced by psychological factors and emotions (Ryu and Yang, 2020). Therefore, the China A-share market is an ideal testing ground for analyzing the impact of sentiment on financial markets. Referring to Seok, Cho and Ryu (2019) based on firm-level sentiment indicators, this paper selects the Relative Relative Strength Index (RSI), the Psychological Line Index (PLI), the adjusted turnover rate (ATR), and the logarithm of trading volume (LTV) .

$$RSI_{i,t} = \frac{RS_{i,t}}{1 + RS_{i,t}}, where RS_{i,t} = \frac{\sum_{k=0}^{11} max P_{i,t-k} - P_{i,t-k-1}, 0}{\sum_{k=0}^{11} max P_{i,t-k-1} - P_{i,t-k}, 0} \quad (1)$$

$$PLI_{i,t} = \sum_{k=0}^{11} \frac{max P_{i,t-k} - P_{i,t-k-1}, 0}{P_{i,t-k} - P_{i,t-k-1}} / 12 \quad (2)$$

$$ATR_{i,t} = \frac{R_{i,t}}{R_{i,t}} \times \frac{V_{i,t}}{S_{i,t}} \quad (3)$$

$$LTV_{i,t} = lnV_{i,t} \quad (4)$$

$P_{i,t}$, $R_{i,t}$, $V_{i,t}$, $S_{i,t}$ are the stock price, earnings, total trading volume, and total number of shares outstanding at time t, respectively.

Since these proxy indicators are derived from trading data, they contain both sentiment and non-sentiment components, which may reflect overall market conditions and company-specific fundamental information. Therefore, in order to isolate the influence of market conditions and fundamental factors, control excess stock market returns, term spreads and default spreads to consider the overall market conditions, and incorporate company size, book market value ratio and price-to-earnings ratio to adjust company-specific fundamental factors, the following regression is carried out to obtain the residuals of regression. Using residuals as orthogonal proxies effectively eliminates the influence of overall market trends and fundamental information.

$$Comp_{i,t} = \alpha_0 + \beta_1 MKT_t + \beta_2 term_t + \beta_3 default_t + \gamma_1 Size_{i,t} + \gamma_2 BM_{i,t} + \gamma_3 EP_{i,t} + \varepsilon_{i,t} \quad (5)$$

$Comp_{i,t}$ indicates one of the four agents of company i on day t (RSI, PLI, ATR, LTV). MKT is the market excess return, term is the term spread, defined as the difference between the long-term yield (10-year Treasury yield) and the short-term yield (1-year Treasury yield), default represents the default spread, calculated as the yield difference between BBB and AA rated bonds. $Size_{i,t}$ represents the size of company i on day t, which is determined by multiplying the company's outstanding shares by the closing price. $BM_{i,t}$ represents the book value ratio of company i on day t, and $EP_{i,t}$ represents the price-to-earnings ratio of company i on day t, calculated as the earnings per share of company i divided by the share price on day t. We use these regression residuals as a more accurate proxy of investor sentiment. Using these four orthogonal proxies, PCA is performed to extract the common components of each company's sentiment indicator. Based on this analysis, the first principal component is used to construct the investor sentiment index $S_{i,t}$.

The research in this paper focuses on the uncertainty of the stock market, and previous research has proposed to measure uncertainty in terms of the volatility of the stock market. Bloom et al. (2007) argue that the volatility performance of stock markets acts as a proxy for firm-level uncertainty. Jiang,

Liu, and Lu (2024) confirm that stock market volatility increases with increasing market uncertainty. Referring to the research of Birru and Young (2022) and Bloom (2014), this paper uses the equity return volatility (TVOL) and idiosyncratic volatility (IVOL) over the past 20 trading days as two measures of uncertainty.

Table 1 Descriptive Statistics.

Panel A:Samplestatistics					
	Mean	Median	Std.dev.	25%	75%
S	0	-0.0674	1	-0.6554	0.5876
TVOL	0	-0.1518	1	-0.5240	0.3390
IVOL	0	-0.1585	1	-0.4817	0.2712
TO	0	-0.0585	1	-0.0644	0.0000
Panel B:Correlations					
	S	TVOL	IVOL		
S	1.0000	0.1735	0.1524		
TVOL	0.1735	1.0000	0.9105		
IVOL	0.1524	0.9105	1.0000		

Panel A in Table 1 shows aggregated data for variables at the firm level in this paper, and panel B reports the correlation between variables. As can be seen from the table, the correlation between sentiment index S and uncertainty indicators is weak, and the correlation with TVOL is stronger than that with IVOL, but the correlation coefficient is more than 0.2. In contrast, the correlation coefficient between the uncertainty variables is much higher, with the correlation coefficient between the TVOL and IVOL indicators being about 0.9.

4. Empirical Analysis

This section examines the relationship between investor sentiment and subsequent returns, focusing on how changes in uncertainty affect this relationship. Investor sentiment can and may be affected by market conditions, and the level of uncertainty reflects the market environment. In order to study the impact of investor sentiment on subsequent returns, and whether the change in uncertainty will change the extent of this impact, this paper first conducts a group test to classify each company in each period as high or low company-level sentiment, with a period of high sentiment defined as a period of high sentiment that is higher than that of the previous day, and a period of low sentiment defined as a period of lower corporate sentiment than the previous day. Similarly, based on changes in uncertainty at the company level, defined as periods of increased or decreased uncertainty. We focus primarily on the difference in returns between periods of high sentiment and downturns, especially when uncertainty levels fluctuate. Therefore, the benchmark analysis divides the portfolio according to the level of sentiment and tracks the cumulative return of holding for 1-5 days, while the inclusion of uncertainty analysis is to first divide the group according to the level of uncertainty, and then divide it again according to the level of sentiment to calculate the cumulative return. The results of this analysis are shown in Table 2.

Table 2 Sorting Testing.

Panel A:Baseline					
	CRET1	CRET2	CRET3	CRET4	CRET5
HIGH	0.1240	0.1905	0.1629	0.1674	0.1831
LOW	-0.0836	-0.1151	-0.0599	-0.0364	-0.0245
DIFF	0.2076***	0.3057***	0.2228***	0.2038***	0.2076***
Panel B:IVOL					
	CRET1	CRET2	CRET3	CRET4	CRET5
DEC					
HIGH	-0.0722	-0.1062	-0.2107	-0.2690	-0.3136
LOW	-0.1247	-0.2695	-0.3001	-0.3447	-0.3914
DIFF	0.0525***	0.1632***	0.0893***	0.0757***	0.0778***
INC					
HIGH	0.3051	0.4645	0.5085	0.5755	0.6539
LOW	-0.0477	0.0392	0.1878	0.2864	0.3688
DIFF	0.3529***	0.4252***	0.3207***	0.2891***	0.2851***
Panel C:TVOL					
	CRET1	CRET2	CRET3	CRET4	CRET5
DEC					
HIGH	0.0839	0.1390	0.1264	0.2040	0.2161
LOW	-0.0553	-0.1375	-0.0992	-0.1056	-0.1055
DIFF	0.1393***	0.2765***	0.2256***	0.2271***	0.2526***
INC					
HIGH	0.1558	0.2303	0.1879	0.2040	0.2161
LOW	-0.1251	-0.1005	-0.0241	0.0364	0.0701
DIFF	0.2810***	0.3308***	0.2121***	0.1675***	0.1459***

Note: Standard errors in parentheses, *, **, and *** indicate significance levels of 10%, 5%, and 1%, respectively. Same as below.

Panel A shows baseline results categorized by sentiment high and low levels only, with rows labeled HIGH showing the average returns for each company during periods of high sentiment and rows labeled LOW showing average returns for periods of low sentiment. The bottom row DIFF shows the difference between these returns. In panels B and C, IVOL and TVOL are used to measure uncertainty, first according to the increase or decrease in the degree of uncertainty, and then further divided according to the level of emotion, and the rows labeled DEC and INC provide the results of the period of uncertainty reduction and increase, respectively. CRETk represents the average return over the subsequent cumulative k days.

Panel a shows that the cumulative return after a rise in sentiment is significantly higher than a decrease in sentiment, and this positive effect lasts for at least five days. Mispricing that may be caused by investor sentiment is not corrected immediately, but lasts for several days, resulting in daily investor sentiment having a positive impact on short-term equity returns.

Panels B and C show the impact of uncertainty on sentiment in relation to stock market returns. As can be seen from the table, the influence of emotions is more pronounced during periods of heightened uncertainty. In Panel B, the difference in returns during periods of increased uncertainty is 2-6 times greater than in periods of decrease, and this difference in returns remains significantly positive for up to five days. When using the TVOL to measure uncertainty, the difference in returns between high and low sentiment in the case of uncertain growth in the following day is about twice that of the period of uncertainty reduction, and the difference in returns between the return difference in the period of uncertainty growth and the difference between high and low sentiment returns in the period of uncertainty reduction becomes closer and closer with the push of time, and the difference in returns is greater when the uncertainty of the cumulative three-day return weakens. In times of heightened uncertainty, the impact of sentiment on returns intensifies.

To analyze the combined impact of investor sentiment and uncertainty on subsequent returns, firm-level predictive regression is used. Although the grouping test in Table 2 intuitively shows that sentiment affects future returns and uncertainty exacerbates the extent to which sentiment is affected, it does not take into account firm-specific characteristics, and the statistical significance of the results is difficult to interpret. Therefore, a predictive regression was performed for each company, given by the equation described below, to provide a more comprehensive analysis.

$$CRET_{i,t+k} = \beta_0 + \beta_1 S_{i,t} + \beta_2 D_{UNCT,i,t} + \beta_3 SENT_{i,t} \times D_{UNCT,i,t} + \varepsilon_{i,t} \quad (6)$$

Where $CRET_{i,t+k}$ represents the cumulative return of company i k days after day t, and $S_{i,t}$ represents the sentiment level of company i on day t. Using the sentiment of day t to predict the cumulative returns of the subsequent 1 to 5 days, analyze whether sentiment and uncertainty can predict returns for up to five days. $D_{UNCT,i,t}$ is a dummy variable that is equal to 1 when the uncertainty at the company level increases compared to the previous day, and 0 otherwise, using IVOL or TVOL to measure the uncertainty.

Table 3. Regression Analysis.

	CRET1	CRET2	CRET3	CRET4	CRET5
Panel A:Baseline					
Intercept	0.0149***	0.0297***	0.0438***	0.0588***	0.0754***
	(12.7920)	(12.7549)	(21.2707)	(24.6445)	(28.1727)
S	0.0293***	0.1069***	0.1645***	0.2203***	0.2827***
	(26.2312)	(66.7730)	(83.4524)	(96.4383)	(101.36)
Panel B:IVOL					
Intercept	0.0149***	0.0296***	0.0441***	0.0597***	0.0772***
	(12.7824)	(17.7198)	(21.3995)	(25.0088)	(28.8128)
S	0.0411***	0.1254***	0.1848***	0.2369***	0.2964***
	(35.9702)	(76.5975)	(91.6445)	(101.4099)	(113.1459)
D_{UNCT}	0.0039***	0.0040***	0.0217***	0.0523***	0.0955***
	(2.9275)	(2.0640)	(9.0281)	(18.7729)	(33.5658)
$S \times D_{UNCT}$	-0.0803***	-0.1240***	-0.1515***	-0.1560***	-0.1767***
	(-66.692)	(-71.8584)	(-71.3018)	-(63.3610)	(-64.0002)
Panel C:TVOL					
Intercept	0.0147***	0.0290***	0.0429***	0.0577***	0.0742***
	(12.6066)	(17.3520)	(20.8032)	(24.1834)	(27.7270)
S	0.0425***	0.1289***	0.1925***	0.2509***	0.3176***
	(37.2157)	(78.7447)	(95.5152)	(107.4261)	(121.2583)
D_{UNCT}	0.0057***	0.0248***	0.0367***	0.0423***	0.0454***
	(4.3270)	(12.9874)	(15.5930)	(15.5224)	(14.8353)
$S \times D_{UNCT}$	-0.0904***	-0.1335***	-0.1642***	-0.1771***	-0.2050***
	(-75.6214)	(-77.9105)	(-77.8481)	(-72.4435)	(-74.81812)

β_1 measures the impact of sentiment on stock market returns, and is positive if there is a positive correlation between investor sentiment and stock returns. In the benchmark analysis, the coefficient is positive and very significant, increasing over time, suggesting that an increase in investor sentiment yields greater gains in the short term, with sentiment having a positive impact on subsequent time-series returns for up to five days. Specifically, when the dependent variable is CRET1, the sentiment coefficient is 0.0293, indicating that when sentiment increases by one standard deviation, the next day's return increases by about 0.03%, and when the dependent variable is CRET5, the sentiment coefficient is 0.2827, indicating that for every standard deviation increase in sentiment, the cumulative return increases by 0.28% over the next five days. These findings are consistent with previous findings that investor sentiment has a positive impact on short-term returns due to the short-term persistence of the mispricing effect. (Aboody et al., 2018, Allen et al., 2019, Kim and Suh, 2021).

Panels B and C use IVOL and TVOL, respectively, to measure uncertainty, showing the combined impact of investor sentiment and uncertainty on subsequent returns. The results show that even if

uncertainty is included in the analysis, the sentiment coefficient is significantly positive, indicating that sentiment and uncertainty independently affect subsequent returns. The uncertainty indicator is significantly positive across the cumulative returns of one to five days, indicating that increased uncertainty leads to higher subsequent returns, and the degree of its impact gradually deepens, confirming that high uncertainty can lead to more severe asset pricing deviations and thus higher returns.

The interaction term between the dummy variables of emotion and uncertainty can reflect the effect of uncertainty on the relationship between emotion and return. The coefficients of the interaction terms in panels B and C are negative, indicating that uncertainty weakens the effect of sentiment, and when sentiment increases by one standard deviation, the increase in uncertainty results in the cumulative return of the next five days being 0.18% and 0.20% lower than that of the period when uncertainty decreases. This finding suggests that sentiment-induced mispricing wanes as uncertainty increases in the short term.

5. Conclusion

The research in this paper shows that investor sentiment can have a positive impact on short-term returns. Uncertainty can also affect subsequent earnings, with high uncertainty often implying stronger mispricing and higher subsequent earnings. But in times of high uncertainty, the impact of investor sentiment on short-term returns has weakened.

This study contributes to understanding how investor sentiment and uncertainty at the firm level affect asset pricing and market dynamics, and the results show that sentiment and uncertainty are important in financial analysis. At the company level, investor sentiment plays a key role in short-term mispricing.

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