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ARTICLE



## Overreaction to extreme market events and investor sentiment

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### ABSTRACT

This article investigates the role of investor psychology, captured here by investor sentiment index, in driving individual stock price reactions to extreme movements in the broader market. In addition to confirming prior evidence of overreaction, we find much stronger overreaction when investor sentiment is low rather than high. This is consistent with the role of the contrast dimension of an uncommon event, suggested in the psychology literature, over and above the emotion of surprise it brings about. In a low sentiment environment, the contrast is sharper and hence leads to stronger overreaction.

### KEYWORDS

Overreaction; extreme events; surprise; contrast; behavioural finance

### JEL CLASSIFICATION

G12; G14; D84



## I. Introduction

Many studies document stock price overreaction to extreme shocks that cannot be reconciled with finance-theoretic approaches such as changes in systematic risks or microstructure effects.<sup>1</sup> This article instead explores a behavioural explanation where the state of investor sentiment drives investor reaction to extreme events.

We compare the reaction of individual stocks to the event of an extreme movement in the broader US market during environments of low versus high level of investor sentiment. The event of extreme market movement is assumed to occur when the return on a long or short position in the SP 500 Index on a day exceeds its 99% Value at Risk (Basel regulatory capital for market risk) based on the empirical distribution of the previous 500 trading days.<sup>2</sup> We define the sentiment regime according to the Baker and Wurgler Sentiment Index (Baker & Wurgler, 2007);<sup>3</sup> a higher value of this index represents more optimism.

We find that the individual stocks tend to overreact and the overreaction is statistically and economically more significant when investor sentiment is low rather than high. This lends support to a behavioural explanation of the overreaction phenomenon. However, if overreaction is considered anomalous to theoretical alignment of risk and return, our evidence contradicts studies (Yu and Yuan 2011; Stambaugh, Yu, and Yuan 2012) that find greater anomaly when investor sentiment is high rather than low.

Our behavioural explanation is as follows. Extreme market movements are by construction low probability events. When they do occur, they violate common expectation and elicit the emotion of 'surprise' (Meyer, Reizenzein, and Schützwohl 1997; Reizenzen 2000) leading to overweighting of the incidence (Griffin and Tversky 1992; Choi and Hui 2014; Spohr 2014; Payne, Browning, and Kalenkoski 2016) and hence overreaction. But in a low sentiment period, investors find the extreme

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<sup>1</sup>See Amini et al. (2013) for a review.

<sup>2</sup>Defining an extreme event in terms of broader market movement avoids liquidity (Pastor and Stambaugh 2003) and microstructure issues that can distort the results (Cox and Peterson 1994). Also, this design virtually retains only events that are accompanied by new information, since an extreme market movement is uncommon in the absence of macro news.

<sup>3</sup><http://people.stern.nyu.edu/jwurgler/>. The Baker and Wurgler Sentiment Index is the first principal component of six measures of sentiment, namely, the closed-end fund discount, the NYSE share turnover, the number of and the average first-day returns on initial public offerings (IPOs), the equity share in new issues and the dividend premium. To control for macro-conditions, the raw values of the six sentiment measures are regressed on the growth of industrial production, the growth of durable consumption, the growth of nondurable consumption, the growth of service consumption, the growth of employment and a dummy variable for National Bureau of Economic Research recessions. When the index is positive (negative), the period corresponds to the high (low) sentiment regime. In naïve terms, a high (low) sentiment period can be considered a proxy for a bullish (bearish) market.

market event at a greater ‘contrast’ (Teigen and Keren 2003) to their prior belief than in a high sentiment period and hence overreact in a stronger fashion. In other words, when investors are pessimistic (sentiment is low), they are more perturbed by unusually large market movements, believing that their prior belief was grossly mistaken. This may be the case if people are less confident about their belief when pessimism rules.

## II. Data and methodology

Our data consist of the daily returns of the S&P 500 index and the 500 individual stocks in the index between August 1962 and July 2010 obtained from the CRSP database. We first identify the calendar dates,  $t_0$ , on which the event of an extreme market movement, as defined before, occurs. We then define an estimation window as trading days  $t_0 - 10$ – $t_0 - 136$  and an event window as trading days  $t_0 + 1$ – $t_0 + 20$ . Following the literature (e.g. Bouraoui 2015), this event time line is sketched Figure 1.

This results in 474 events (240 negative and 234 positive), representing 3.8% of the trading days in the sample.

For each individual stock, we estimate the Fama–French three-factor model over the estimation window using OLS regression.<sup>4</sup> The estimated coefficients along with the average Fama–French Factor values during the estimation window provide the estimated expected return for each stock. The daily return on a stock in excess of its expected return is defined as its abnormal return (AR) for the day; it is really an estimate of the stock’s alpha, here based on the Fama–French three-factor risk adjustment. For a given event, we require at least 30 continuous data points before using the resulting coefficients. Otherwise, the observation is deleted from our sample. The individual stocks are then ranked according

to their AR on the event day. The top and bottom deciles form, respectively, the equally weighted ‘Winner (W)’ and ‘Losers (L)’ portfolios. The contrarian strategy (Long Losers, Short Winners) return is then measured by its average cumulative abnormal return (ACAR) over the event window. With overreaction on the event day, the loser stocks should outperform the winners in the event window as the market reverts to proper valuation. Therefore, we test the overreaction hypothesis (OH) below:

OH: The ACAR of the contrarian strategy is positive following an extreme market event.

As explained earlier, our behavioural hypothesis (BH) is that when the sentiment is low, we expect a stronger overreaction.

BH: The overreaction is stronger (weaker) when the sentiment is low (high).

As the Sentiment Index is available on a calendar month basis while an event day may be in any part of the month, the Sentiment Index ( $S$ ) for an event  $j$  is calculated as a weighted average of the Baker–Wurgler Sentiment Index of the current month ( $m$ ) and the following month ( $m + 1$ ):

$$S_j = w_m S_m + (1 - w_m) S_{m+1} \quad (1)$$

We divide each calendar month into six intervals of approximately 5 days and the weight  $w_m$  decreases from 100% in the first interval of the month to 0% in the last interval. Thus, the Sentiment Index  $S_j$  for an event day falling in the second interval of a calendar month is calculated with 80% weighting for Baker–Wurgler Sentiment Index for the current month and 20% weighting for the next month.<sup>5</sup>

## III. Empirical results

Table 1, Panel A presents the contrarian strategy ACARs averaged over all events in the sample. The

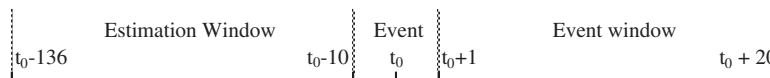


Figure 1. Event timeline.

<sup>4</sup>The factors are obtained from French’s website. Fama and French (1993) report that factors, namely size and book-to-market value ratio, can explain a good part of the cross section of the stocks returns that is not captured by the CAPM. The Fama–French model is more general than and nests the CAPM and as such is widely used in measuring abnormal returns (e.g. Pastor and Stambaugh 2003; Savor 2012; Stambaugh, Yu, and Yuan 2012; Novy-Marx 2012).

<sup>5</sup>The findings do not change if we simply employ the Baker–Wurgler Sentiment Index for the calendar month of an event date.

**Table 1.** Overreaction to extreme events.

	<i>N</i>	ACAR1	ACAR5	ACAR10	ACAR15	ACAR20
<b>Panel A: Overreaction after all events</b>						
All events ( <i>t</i> -Statistic)	475	0.65 (8.676***)	1.43 (9.293***)	1.55 (7.929***)	1.72 (7.639***)	1.72 (6.597***)
<b>Panel B: Overreaction after events during low and high sentiment levels</b>						
Low sentiment ( <i>t</i> -Statistic)	143	0.84 (6.238***)	1.83 (5.939***)	2.05 (5.594***)	2.34 (5.467***)	2.47 (4.831***)
Medium sentiment ( <i>t</i> -Statistic)	189	0.68 (5.242***)	1.51 (5.910***)	1.45 (4.289***)	1.89 (4.858***)	1.89 (4.429***)
High sentiment ( <i>t</i> -Statistic)	143	0.40 (3.476***)	0.94 (4.056***)	1.18 (3.976***)	0.88 (2.647***)	0.70 (1.762**)
Low–high	143	(2.826***)	(5.033***)	(5.146***)	(7.303***)	(9.176***)

\*\*\*Significant at the 5% level, \*\* at 1% level.

This table reports the daily average cumulative returns, %, of the contrarian strategy ( $ACAR_L - ACAR_w$ ) during the event window. For brevity, we report results for the event window days 1, 5, 10, 15 and 20 only. The *t*-statistics are in parentheses. The high (low) sentiment subsample represents events with the highest (lowest) 30% Sentiment Index levels ( $S_j$ ) in the sample; the remaining events comprise the medium sentiment subsample. The *t*-statistics for the difference between the ACARs of the low and high sentiment subsamples are in the last line labelled as low–high.

contrarian strategy generates significant positive ARs (Fama–French alphas) throughout the event window, its performance reaching an annualised alpha of 39.06% by Day 10 following an extreme market movement, and increasing somewhat thereafter. The statistical significance is also very high for the contrarian profits. The contrarian profit thus does not vanish even nearly a month after the event. The OH is thus strongly supported by these results, confirming prior evidence in this regard.

To examine the sentiment-based explanation BH, we divide the sample of events into three subsamples, namely, high sentiment, low sentiment and medium sentiment. The high (low) sentiment subsample represents events with the highest (lowest) 30% Sentiment Index levels ( $S_j$ ) in the sample; the remaining events comprise the medium sentiment subsample. If the BH is tenable, we should find clearly stronger overreaction (higher ACAR) in the low subsample compared to the high subsample.

As seen in Panel B of Table 1, all three subsamples exhibit economically and statistically significant ACARs. But more importantly, the ACARs monotonically decrease with increasing sentiment level, and the ACARs of the low subsample are virtually the double of the high subsample throughout the event window. By Day 10, the contrarian strategy earns an annualised alpha of 29.65% for the high subsample while for the low subsample, it reaches an impressive 51.64%. The distinction among the sentiment subsamples becomes even more statistically evident during the second half of the event window, when the low–high *t*-statistics of the difference

between the low and high subsample ACARs moves from 5.146 (Day 10) to 9.176 (Day 20). Further, after Day 10, the ACAR of the low (high) sentiment subsample keeps rising (falling) reaching an annualised ACAR of 31.17% (8.85%) on Day 20. Overall, these results provide strong evidence in support of the sentiment-based explanation (BH) of overreaction to extreme market events.

#### IV. Summary and conclusions

In this article, we investigated if investor psychology, driven by surprise and contrast of extreme market events and captured here by investor sentiment, can be helpful in explaining their overreactions. First, we confirm prior evidence of overreaction to extreme movements in the broader market. This is consistent with the emotion of surprise associated with low probability events that lead to overweighting of the extreme incidence and hence overreaction. Second, and as a more important contribution of this article, we provide strong evidence that the overreaction is economically and statistically more pronounced when investor sentiment is low rather than high. This is because when sentiment is low (pessimism rules and confidence are low), an extreme event appears to the investors with a greater contrast. The investors are thus more perturbed and overreact in a stronger fashion.

To conclude, our empirical evidence for the US market is congruent with a behavioural explanation of the overreaction to extreme market events seen in

the financial arena, and the literature in psychology that deals with emotional reactions and cognitive biases. Our results should thus be useful to finance researchers and practitioners as well as their counterparts in psychology.

### Disclosure statement

No potential conflict of interest was reported by the authors.

### References

- Amini, S., B. Gebka, R. Hudson, and K. Keasey. 2013. "A Review of the International Literature on the Short Term Predictability of Stock Prices Conditional on Large Prior Changes: Microstructure, Behavioral and Risk Related Explanations." *International Review of Financial Analysis* 26: 1–17. doi:10.1016/j.irfa.2012.04.002.
- Baker, M., and J. Wurgler. 2007. "Investor Sentiment in the Stock Market." *Journal of Economic Perspectives* 21 (2): 129–151. doi:10.1257/jep.21.2.129.
- Bouraoui, T. 2015. "The Effect of Reducing Quantitative Easing on Emerging Markets." *Applied Economics* 47 (15): 1562–1573. doi:10.1080/00036846.2014.1000524.
- Choi, D., and S. K. Hui. 2014. "The Role of Surprise: Understanding Overreaction and Underreaction to Unanticipated Events Using In-Play Soccer Betting Market." *Journal of Economic Behavior & Organization* 107 (B): 614–629. doi:10.1016/j.jebo.2014.02.009.
- Cox, D. R., and D. R. Peterson. 1994. "Stocks Returns following Large One-Day Declines: Evidence on Short-Term Reversals and Longer-Term Performance." *The Journal of Finance* 49 (1): 255–267. doi:10.1111/j.1540-6261.1994.tb04428.x.
- Fama, E. F., and K. R. French. 1993. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics* 33: 3–56. doi:10.1016/0304-405X(93)90023-5.
- Griffin, D., and A. Tversky. 1992. "The Weighing of Evidence and the Determinants of Confidence." *Cognitive Psychology* 24: 411–435. doi:10.1016/0010-0285(92)90013-R.
- Meyer, W. U., R. Reisenzein, and A. Schützwohl. 1997. "Towards a Process Analysis of Emotions: The Case of Surprise." *Motivation and Emotion* 21: 251–274. doi:10.1023/A:1024422330338.
- Novy-Marx, R. 2012. "Is Momentum Really Momentum?" *Journal of Financial Economics* 103: 429–453. doi:10.1016/j.jfineco.2011.05.003.
- Pastor, L., and R. F. Stambaugh. 2003. "Liquidity Risk and Expected Stock Returns." *Journal of Political Economy* 111 (3): 642–685. doi:10.1086/374184.
- Payne, P., C. Browning, and C. M. Kalenkoski. 2016. "Public Reaction to Stock Market Volatility: Evidence from the ATUS." *Applied Economics Letters* 32 (17): 1197–1200. doi:10.1080/13504851.2016.1142651.
- Reisenzein, R. 2000. "Exploring the Strength of Association between the Components of Emotion Syndromes: The Case of Surprise." *Cognition and Emotion* 14: 1–38. doi:10.1080/026999300378978.
- Savor, P. G. 2012. "Stock Returns after Major Price Shocks: The Impact of Information." *Journal of Financial Economics* 106: 635–659. doi:10.1016/j.jfineco.2012.06.011.
- Spohr, J. 2014. "The Share Is down 8% after the Profit Warning, Is It Time to Buy?" *Applied Economics Letters* 21 (8): 556–559. doi:10.1080/13504851.2013.875100.
- Stambaugh, R. F., J. Yu, and Y. Yuan. 2012. "The Short of It: Investor Sentiment and Anomalies." *Journal of Financial Economics* 104: 288–302. doi:10.1016/j.jfineco.2011.12.001.
- Teigen, K. H., and G. Keren. 2003. "Surprises: Low Probabilities or High Contrasts?" *Cognition* 87: 55–71. doi:10.1016/s0010-0277(02)00201-9.
- Yu, J., and Y. Yuan. 2011. "Investor Sentiment and the Mean-Variance Relation." *Journal of Financial Economics* 100: 367–381. doi:10.1016/j.jfineco.2010.10.011.