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Investor sentiment, style investing, and momentum

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ABSTRACT

Investor sentiment is an important condition for style investing in affecting asset price predictability. We find that style returns have predictive power for future stock returns in high sentiment periods, but not low sentiment periods. The correlation between style returns and stock returns explains the variation in momentum profits in high sentiment periods, but not low sentiment periods. Sentiment has an interaction effect with style returns, but not market returns. While positive style returns predict future stock returns under high sentiment, negative style returns do not. The effect of investor sentiment on style investing is independent of prior market returns.

1. Introduction

Numerous studies find that investor sentiment affects asset prices. In particular, Stambaugh et al. (2012, p. 302) find that 11 stock price anomalies are associated with high sentiment periods calling for "a richer understanding of how sentiment plays a role in pricing financial assets." In this paper, we provide insight into the mechanism through which investor sentiment affects the predictability of stock returns.

Central to our argument, we assume that sentiment affects investors' judgment of the likelihood of an uncertain event. This assumption is supported by evidence from behavioral and experimental studies. For instance, Wright and Bower (1992) report that people with happy moods view positive events with higher probability. Kuhnen and Knutson (2011) discover that people with positive emotions, such as excitement, are more confident in their ability to evaluate risky investment options. Furthermore, using a panel of questionnaire data from individual investors, Kaplanski et al. (2015) find evidence of a positive causal effect of sentiment on individuals' return expectations. To summarize, high sentiment induces optimism.

Driven by high sentiment and optimism, unsophisticated investors are more likely to enter the stock market (Grinblatt and Keloharju, 2001; Lamont and Thaler, 2003; Antoniou et al., 2016). In this study, we examine unsophisticated investors who suffer from extrapolative expectations and make investment decisions solely based on past style performance, where a style can be broadly defined as a class of assets with similar characteristics. These unsophisticated investors chase winner styles and dump loser styles. Barberis and

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Shleifer (2003) refer to their behavior as style investing.

We augment the Barberis and Shleifer (2003) arguments to establish a link between sentiment and style investing. In their model, a group of irrational investors, referred to as "switchers," allocate capital based on different investment styles' relative past performance. Styles that have performed well in the past attract more capital from those styles that have performed poorly. These capital inflows (outflows) positively (negatively) affect asset prices.[1] However, rational investors are unable to push prices back to fundamental values due to limits to arbitrage. Therefore, a style's return can predict the future return of an asset that belongs to the style. We argue that when driven by high sentiment, not only can more switchers enter the market, but existing switchers can make more aggressive investment decisions based on a style's past returns. Consequently, switchers can be more prevalent and impactful during high sentiment periods, creating a stronger positive correlation between past style returns and future stock returns.

Our first hypothesis states that style returns have greater predictive power for future stock returns in high sentiment periods than in low sentiment periods (*Hypothesis 1*). The sentiment hypothesis has important implications for the drivers of momentum. There are many rational and behavioral hypotheses for momentum.[2] Style investing generates momentum through the correlation between a stock's return and its style's return. That is, the comovement of a stock with its style (Barberis and Shleifer, 2003; Wahal and Yavuz, 2013). If high investor sentiment drives irrational style investing behavior, we would expect a more significant impact of style comovement on momentum profits during high sentiment periods than in low sentiment periods. Therefore, our second hypothesis states the comovement of a stock with its style can explain more variation in momentum profits in high sentiment periods than in low sentiment periods (*Hypothesis 2*).

To measure investor sentiment, we use three sentiment indices: the investor sentiment index constructed by Baker and Wurgler (2006, 2007), the University of Michigan's Consumer Sentiment Index, and the Consumer Confidence Index provided by the Organisation for Economic Co-operation and Development (OECD). Following the literature, we orthogonalize the last two indices with respect to the same set of macroeconomic variables used by Baker and Wurgler (2006, 2007). We define high (low) sentiment as above (below) the median of the sample period (Stambaugh et al., 2012). Our results are robust to defining high (low) sentiment as the top (bottom) 30% of the distribution.

Using all NYSE, AMEX, and NASDAQ listed stocks from 1965 to 2018, we find evidence that confirms our hypotheses. To test the first hypothesis, we estimate Fama and MacBeth (1973) regressions of individual stock returns on the past returns of the style to which the stock belongs (henceforth "style return"). Consistent with our first hypothesis, we find that style returns can predict future stock returns during high sentiment periods, but have little predictive power during low sentiment periods. The difference in the predictive power of style returns between high and low sentiment periods is both economically and statistically significant. Furthermore, we find that the predictive power of style returns during high sentiment periods holds in both the early sample period of 1965–1987 and the later sample period of 1988–2018. Our results are in sharp contrast to the findings in Wahal and Yavuz (2013) that style returns cannot predict future stock returns from 1965 to 1987, as they do not examine high and low sentiment periods separately. We demonstrate that style investing has asset pricing implications even during the early period. The results highlight the important role of investor sentiment in style investing.

To test the second hypothesis, we sort all stocks into style comovement terciles and compute the momentum returns from buying winners and selling losers. Wahal and Yavuz (2013) find that the momentum returns are higher in the high comovement tercile than in the low comovement tercile, suggesting that comovements can explain the variation in momentum profits. We expect style comovement to explain greater variation in momentum profits in high sentiment periods than in low sentiment periods. Consistent with our hypothesis, we find that the comovement of a stock with its style can explain the variation in momentum profits in high sentiment periods, but not low sentiment periods. The difference in the explanatory power of style comovement between the high and low sentiment periods is statistically significant and economically meaningful. Compared with the findings in Wahal and Yavuz (2013), we uncover a much stronger predictive ability of style comovement for momentum profits once we take into account the condition necessary for style investing to affect asset prices. Our results are robust to various portfolio and regression methods, as well as to defining investor sentiment as a dummy variable or a continuous variable. We also find that the winner-minus-loser momentum profits come mainly from shorting losers, consistent with the findings in Stambaugh et al. (2012).

In addition, we find that investor sentiment has an interaction effect with style returns, but not market returns. While positive style returns can be predictive of future stock returns during period of high sentiment, negative style returns cannot. In contrast, the effect of investor sentiment on the return predictability generated by style investing is independent of whether the prior market return is positive or negative.

We make four contributions to the literature. First, our findings not only add to the growing evidence on the impact of investor sentiment on asset prices, but also demonstrate an important channel through which investor sentiment affects asset prices. Stambaugh et al. (2012) find that investor sentiment plays an important role in 11 asset pricing anomalies. However, they do not discuss the exact mechanism through which investor sentiment affects each anomaly. A few studies demonstrate some specific channels through which sentiment affects asset pricing. Antoniou et al. (2013) examine investors' cognitive dissonance as a mechanism through which

[1] Intuitively, "if an asset performed well last period, there is a good chance that the outperformance was due to the asset's being a member of a 'hot' style enjoying inflows from switchers. If so, the style is likely to keep attracting inflows from switchers next period, making it likely that the asset itself also does well next period" (Barberis and Shleifer, 2003, pp. 183–184).

[2] See Conrad and Kaul (1998), Berk et al. (1999), Johnson (2002), and Sagi and Seasholes (2007) for rational explanations and Barberis et al. (1998), Daniel et al. (1998), Hong and Stein (1999), Barberis and Shleifer (2003), Antoniou et al. (2013), and Luo et al. (2021) for behavioral explanations.

sentiment affects financial asset prices. Antoniou et al. (2016) study how high beta stocks become overpriced in optimistic periods. It is important to fully understand the various channels through which sentiment drives asset prices away from their fundamental values. In this study, we take a step in this direction by showing that sentiment can affect the predictability of stock prices through style investing.

In addition, our results provide a better understanding of an important driver of momentum. In particular, we provide evidence of an important mechanism through which sentiment affects momentum. Two empirical studies are most relevant to our study in this regard. Stambaugh et al. (2012) confirm that sentiment affects momentum. Antoniou et al. (2013) argue that investors' cognitive dissonance is a mechanism through which sentiment affects the profitability of momentum strategies. Our study complements these two studies by demonstrating that style investing is another important mechanism through which sentiment affects momentum profits. Our study differs from Antoniou et al. (2013) in terms of the mechanism through which sentiment affects momentum profits. The style investing model of Barberis and Shleifer (2003) is the mechanism of interest in our study through which sentiment affects the predictability of stock returns and momentum profits. By contrast, Antoniou et al. (2013) do not examine style investing.

Moreover, our study enhances our understanding of style investing. Barberis and Shleifer (2003) conduct the first theoretical analysis of the implications of style investing. Chen and Bondt (2004), Teo and Woo (2004), Cooper et al. (2005), and Wahal and Yavuz (2013) provide empirical evidence consistent with the predictions of Barberis and Shleifer (2003). Using proprietary data on daily institutional flows, Froot and Teo (2008) find strong evidence of style-level trading by institutions highlighting the prevalence of style investing. Our paper complements these studies by identifying important empirical conditions in which style investing contributes to the predictability of stock returns.

Finally, as style investing causes comovement of a stock with its style, our findings also have implications for the literature on comovement (Shiller, 1989; Pindyck and Rotemberg, 1993; Froot and Dabora, 1999; Forbes and Rigobon, 2002; Barberis et al., 2005; Veldkamp, 2006; Kumar and Lee, 2006; Greenwood, 2008; Brockman et al., 2010; Boyer, 2011; Grullon et al., 2014). An unresolved issue in the literature is whether comovements are due to rational or behavioral reasons. Pindyck and Rotemberg (1993) find that excess comovements of stock returns are due to market segmentation. Veldkamp (2006) proposes a model of markets for information that generates high price covariance within a rational expectations framework. Brockman et al. (2010) present evidence that time-varying information production drives the comovement patterns observed in stock returns. Barberis et al. (2005) find increases (decreases) in comovement between a stock and the index stocks after the stock is added to (removed from) the S&P 500 Index. However, their evidence is inconclusive regarding the underlying reason as inclusion in the S&P 500 may cause changes in fundamentals (Denis et al., 2003). Boyer (2011) exploits an exogenous mechanical style reclassification of stocks by S&P/Barra and determines that economically meaningless index labels cause stocks to comove more (less) with the style they join (leave), providing evidence for behavioral reasons. Our study contributes to the discussion by showing different asset pricing implications of comovement across high and low sentiment periods, suggesting that behavioral theories play a role in explaining the results.

The remainder of the paper is organized as follows. In Section 2, we describe our data sources, sample selection, and main variables. In Section 3, we present our empirical results, while Section 4 provides our conclusions.

2. Data and methodology

2.1. Data sources

Our main data sources are the Center for Research in Securities Prices (CRSP) and Compustat. We use the linking tables provided by the CRSP/Compustat Merged Database to merge CRSP with Compustat. To calculate the firm size, we multiply the number of shares outstanding with the stock price at the end of June each year. Following Fama and French (1992), we calculate the book-to-market ratio by dividing the fiscal year-end book value of equity by the market value of equity at the end of December each year.

We use three sentiment indexes: the investor sentiment index constructed by Baker and Wurgler (2006, 2007), which is available at Jeffrey Wurgler's website, the University of Michigan's Consumer Sentiment Index, which is available at the FRED (Federal Reserve Economic Data), and the consumer confidence index (CCI) published by the Organisation for Economic Co-operation and Development (OECD), which is available at the OECD's website.

2.2. Sample filtering

Our sample consists of all NYSE, AMEX, and NASDAQ listed common stocks in the intersection of the CRSP and Compustat with shares codes of 10 and 11 for the period from January 1965 to December 2018. We apply the following five sample selection filters. First, the returns of the stock should be available in the current month and the previous 12 months. In addition, the information required to compute the book-to-market ratio as in Fama and French (1992) should be available from CRSP and Compustat and stocks with a negative book value of stockholder's equity in the previous month are excluded. Next, we exclude stocks below $5 at the time of portfolio formation and those in the lowest size decile (based on the NYSE size breakpoints) to ensure that the results are not driven by highly illiquid, small stocks or bid-ask bounce (Jegadeesh and Titman, 1993, 2001; Wahal and Yavuz, 2013). After the screening process, our sample has 15,850 unique firms.

2.3. Main variables

2.3.1. Investor sentiment

To ensure our results are robust, we use the three sentiment indexes mentioned above. Our first sentiment index is the monthly

market-based sentiment series formed by Baker and Wurgler (2006, 2007). These authors construct their composite index by taking the first principal component of six measures of investor sentiment. The principal component analysis filters out idiosyncratic noise in the six measures and captures their common component. The six measures are the closed-end fund discount, the number and the first-day returns of IPOs, NYSE turnover, the equity share in total new issues, and the dividend premium. To remove the effect of macroeconomic-related variables, they regress each of the six raw measures on six macroeconomic variables: growth in industrial production, real growth in durable consumption, nondurable consumption, services consumption, growth in employment, and the National Bureau of Economic Research (NBER) recession indicator. They use the regression residuals to proxy for sentiment. The Baker and Wurgler sentiment index has been widely used in many studies, such as Baker and Wurgler (2006, 2007, 2012), Yu and Yuan (2011), Baker et al. (2012), Stambaugh et al. (2012), and Antoniou et al. (2013, 2016).

The second sentiment index we use is the University of Michigan's Sentiment Index, which is based on a monthly survey that is mailed to 500 randomly-selected households. The survey asks participants their views about the economy. This index has been used to proxy for investor sentiment in studies including Lemmon and Portniaguina (2006), Bergman and Roychowdhury (2008), and Stambaugh et al. (2012).

The third sentiment index we use is the Consumer Confidence Index (CCI) provided by the OECD. This CCI is based on households' plans for major purchases and their economic situation. The CCI is similar to the Consumer Confidence Index by the Conference Board, which has also been used in the literature. However, an advantage of the OECD's CCI is that the data are available free of charge, while historical data on the Conference Board's CCI must be purchased.[3]

Following the literature (Baker and Wurgler, 2006; Stambaugh et al., 2012; Antoniou et al., 2013), we remove the effect of macroeconomic-related variables by orthogonalizing the last two indexes with respect to the same set of macroeconomic variables used by Baker and Wurgler (2007). Specifically, we regress each of the two indexes on six macroeconomic variables: growth in industrial production, real growth in durable consumption, nondurable consumption, services consumption, growth in employment, and the NBER recession indicator. We use the regression residuals to proxy for sentiment. We define a month as high (low) sentiment if the level of the sentiment index in the previous month is above (below) the median for the sample period (Stambaugh et al., 2012).

Fig. 1 illustrates the time series of the three sentiment indexes from 1965 to 2018. The horizontal line in each graph represents the median level for the sample period. While the high and low sentiment periods are not identical across the three sentiment indexes, all of our main results are similar across the three sentiment indexes. For brevity, we tabulate our results only for the Baker and Wurgler sentiment index throughout the paper. The Internet Appendix contains the main results using the other two sentiment indexes.

When we collected data on the sentiment index from Dr. Wurgler's website, the Baker and Wurgler (2006) sentiment index was available until the end of 2018. Given that data on the stock returns are available until the end of 2020, we try to use as many months of stock returns as possible in our analysis to address potential concerns about the statistical power of our tests. Therefore, even though we use the Baker and Wurgler sentiment index from 1965 to 2018 to determine whether a month has high or low sentiment, the stock returns we used may extend up to 12 months beyond 1965–2018 and the past market returns used in Table 7 may extend up to 36 months before 1965.

2.3.2. Style returns

We use size and the book-to-market ratio to identify styles as the value/growth categorization is widely used by retail and institutional investors (Cooper et al., 2005; Froot and Teo, 2008; Kumar, 2009; Boyer, 2011; Wahal and Yavuz, 2013). At the end of each June, we identify 25 different styles as the intersection between five size quintiles and five book-to-market quintiles. We use the NYSE size breakpoints obtained from Kenneth French's website to determine the size quintiles.[4] Using the market capitalization of each stock at the beginning of each month as the weight, we calculate monthly value-weighted style returns.

2.3.3. Style comovement

As Barberis and Shleifer (2003) argue, style investing can generate the comovement of a stock with its style. We measure the style comovement by the style beta (β_{is}) calculated from the following regression of daily stock returns on the daily style returns (Wahal and Yavuz, 2013):

$$R_{i,st} = a_i + \beta_{is} R_{st} + \varepsilon_{ist}. \tag{1}$$

$R_{i,st}$ is the return on stock i on day t where stock i belongs to style s. R_{st} is the value-weighted return of style s on day t. The return of the style portfolio, R_{st}, is constructed after removing stock i from the portfolio. The regression is estimated using the past three months of daily returns requiring each stock to have at least 20 return observations. We roll forward the regression, one month each time, to generate the time series of style comovement measures (i.e., estimates of style betas, β_{is}).

[3] We compared the time series of the OECD's CCI to those by the Conference Board as plotted in Fig. 1 of Antoniou et al. (2013) and find that they look remarkably similar.

[4] All NYSE firms are sorted by size to determine quintile breakpoints where size is measured as the share price times the number of shares outstanding.

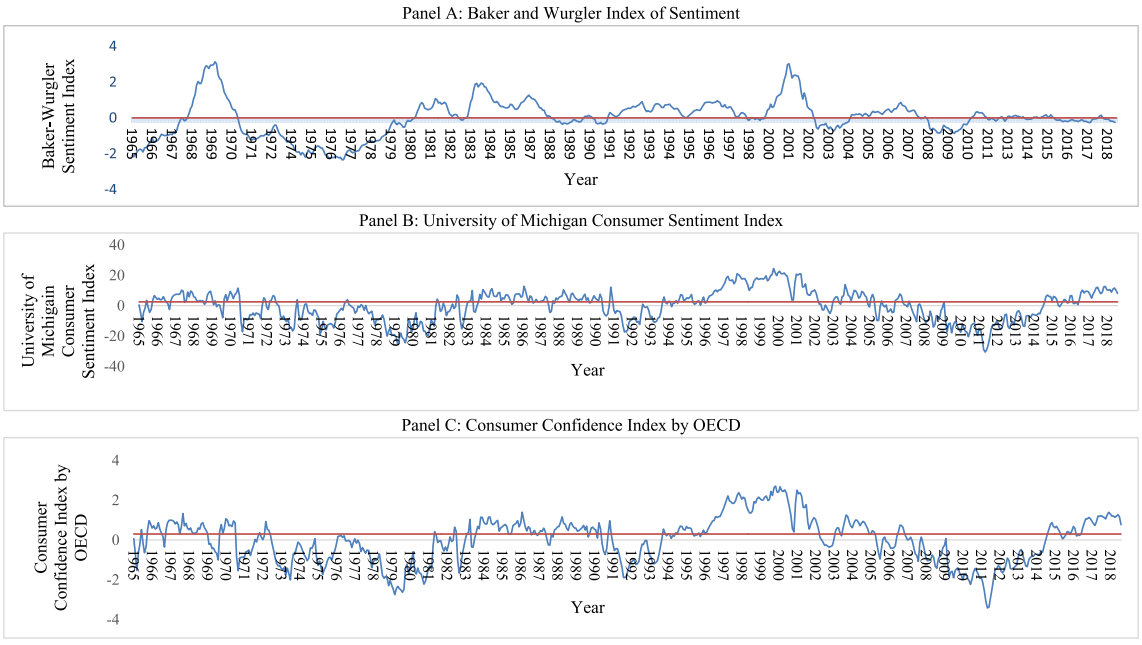

Fig. 1. Three investor sentiment indexes: 1965–2018. Fig. 1 reports three investor sentiment indexes from 1965 to 2018: the Baker and Wurgler Sentiment Index in Panel A, the University of Michigan Consumer Sentiment Index in Panel B, and the Consumer Confidence Index by OECD in Panel C. In each panel, the horizontal line represents the median level for the sample period.

3. Results

3.1. Sentiment and the predictive ability of style returns for future stock returns

In this subsection, we examine whether the predictive power of style returns for future stock returns is stronger for high sentiment periods than low sentiment periods (Hypothesis 1). We find robust evidence for the hypothesis using the regression approach of Fama and MacBeth (1973). To test our hypothesis, we divide all the months during our sample period into two groups based on the sentiment measure in the previous month (Stambaugh et al., 2012). We estimate Fama and MacBeth (1973) regressions of future stock returns on past style returns, past stock returns, size, and book-to-market ratios for high and low sentiment periods, respectively (Wahal and Yavuz, 2013). If a stock is delisted, then we consider the future return after delisting as zero when computing holding period returns.

Panels A and B of Table 1 report the regression results when style returns are measured over the prior six months and 12 months, respectively. The dependent variables in Panels A1-A4 (or Panels B1–B4) are stock returns measured over the next one, three, six, and 12 months, respectively. We observe sentiment-conditional patterns in the effect of the style returns as the style return effect is present only during high sentiment periods. Specifically, the coefficients on style returns are highly significant in all of the regressions for high sentiment periods, but not significantly different from zero for the low sentiment periods, suggesting that style returns are consistently predictive of future stock returns during high sentiment periods, but have little predictive power for future stock returns during low sentiment periods.

We conduct *t*-tests for the differences in the style return coefficients between the high and low sentiment periods and report the results in Table IA.1 of the Internet Appendix. All of the differences in the style return coefficients between the high and low sentiment periods are statistically significant at the 5% or 1% levels regardless as to whether we control for past stock returns in the regression, rejecting the hypothesis that style return coefficients are equal for the high and low sentiment periods.[5] Consider, for example, the coefficients of the regression of one-month future stock returns on six-month prior stock and style returns in Panel A1 of Table 1. In Model 3, the coefficient on style return is 2.30 (*t*-stat. = 2.81) for high sentiment and −0.30 (*t*-stat. = −0.31) for low sentiment. A *t*-test for the difference of 2.60 between the two coefficients on style returns across high and low sentiments safely rejects the hypothesis that they are equal (*t*-stat. = 2.37). The results in Table 1 (and Table IA.1 of the Internet Appendix) provide strong evidence that the predictability of the style returns for future stock returns is significantly higher during high sentiment periods than low sentiment periods.

The average coefficients from the Fama and MacBeth (1973) regressions of future one-month stock returns in Panels A1 and B1 of Table 1 are in line with those reported in Table 5 of Antoniou et al. (2016). The size effect is present only during low sentiment periods,

[5] The medians of the style return coefficients during high and low sentiment periods are also statistically different, as shown in Table IA.1 of the Internet Appendix.

Table 1

Fama-MacBeth regressions of future stock returns on prior style returns for different sentiment periods. This table reports the results from the Fama and MacBeth (1973) regressions of future stock returns on prior style returns. The regressions include controls for prior stock returns, the log of the firm size, and the log of the book-to-market ratio. The regressions are estimated for high and low sentiment periods separately. A high sentiment month is one in which the value of the Baker and Wurgler Sentiment Index in the previous month is above the median value for the sample period and the low sentiment months are those with below median values. In Panel A (B), future one-, three-, six-, and 12-month returns are regressed on the past six-month (12-month) returns. We allow one month between the end of the portfolio formation period and the subsequent holding period. The size, book-to-market, and past stock return regressors are winsorized at the 1st and 99th percentile each month. The sample consists of NYSE, AMEX, and NASDAQ stocks from 1965 to 2018. Stocks with missing or negative book values are excluded from the regressions. The intercept is included in the regressions, but is not reported. The *t*-statistics are in parentheses and are calculated using the Newey and West (1987) approach with lags equal to four for one- and three-month future returns, nine for six-month future returns, and 18 for 12-month future returns. R^2 is the average adjusted R^2. There are 320 low sentiment months and 320 high sentiment months. The average number of companies in each cross-sectional regression is 3286 in the high sentiment periods and 2832 in the low sentiment periods. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Style and stock return regressors measured over prior six months

Dependent variable	Panel A1: One-Month Future Stock Return						Panel A2: Three-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3
Style Return		−0.33	−0.30		2.10***	2.30***		1.31	0.80		4.16***	4.10***
		(-0.40)	(-0.31)		(2.70)	(2.81)		(1.60)	(0.44)		(2.59)	(2.77)
Stock Return	−0.08		−0.11	0.77***		0.75***	1.32		1.36	2.50***		2.45***
	(-1.15)		(-1.20)	(3.30)		(3.28)	(1.55)		(1.58)	(3.34)		(3.28)
Log Size	−0.18***	−0.22***	−0.21***	−0.04	−0.03	−0.02	−0.50***	−0.52***	−0.51***	−0.16	−0.16	−0.23
	(-3.11)	(-3.74)	(-3.54)	(-1.11)	(-1.00)	(-1.12)	(-2.66)	(-2.73)	(-2.77)	(-1.09)	(-1.10)	(-1.62)
Log BM	0.25**	0.24**	0.28	0.38***	0.35***	0.33***	1.05***	1.12***	1.18***	0.88***	0.85***	0.76**
	(2.31)	(2.17)	(1.18)	(4.11)	(3.86)	(3.49)	(3.24)	(3.27)	(3.48)	(2.77)	(2.76)	(2.49)
R^2	3.0%	2.3%	3.2%	3.9%	3.5%	4.2%	4.0%	3.3%	4.2%	4.7%	4.0%	4.8%
Dependent variable	Panel A3: Six-Month Future Stock Return						Panel A4: Twelve-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3
Style Return		1.70	1.04		5.42***	5.10***		2.92	2.35		11.98***	9.65***
		(0.61)	(1.10)		(3.10)	(2.76)		(1.52)	(1.51)		(3.65)	(2.77)
Stock Return	0.75		0.90	3.00**		3.10**	1.12		1.08	3.63*		3.56
	(1.00)		(1.11)	(2.16)		(2.19)	(0.83)		(0.79)	(1.74)		(1.63)
Log Size	−0.99***	−0.86***	−0.79***	−0.44	−0.29	−0.25	−1.12**	−1.24***	−1.23***	−0.27	−0.31	−0.39
	(-2.98)	(-3.10)	(-3.11)	(-1.20)	(-1.23)	(-1.14)	(-2.49)	(-2.85)	(-2.80)	(-0.88)	(-0.96)	(-1.24)
Log BM	1.40***	1.20***	1.19***	1.18***	0.99***	0.95***	1.99***	1.70**	2.02***	2.02***	1.83***	1.79***
	(3.78)	(3.11)	(3.60)	(3.20)	(2.76)	(3.16)	(2.66)	(2.08)	(2.65)	(3.42)	(3.04)	(3.19)
R^2	4.0%	3.2%	4.1%	4.6%	4.0%	4.7%	4.1%	3.4%	4.3%	4.9%	4.2%	5.2%

Panel B: Style and stock return regressors measured over prior 12 months

Dependent variable	Panel B1: One-Month Future Stock Return						Panel B2: Three-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3
Style Return		−0.37	−0.23		2.20**	2.11**		0.57	0.36		3.78***	3.16***
		(-0.30)	(-0.21)		(2.50)	(2.31)		(0.50)	(0.31)		(3.17)	(2.95)
Stock Return	−0.11		−0.06	−0.07***		−0.08***	0.87		0.87	1.20**		1.17**
	(-1.05)		(-0.20)	(-3.20)		(-3.28)	(1.03)		(1.03)	(1.99)		(2.18)
Log Size	−0.18***	−0.17***	−0.16***	−0.07	−0.05	−0.03	−0.63***	−0.71***	−0.72***	−0.15	−0.17	−0.23*

(*continued on next page*)

Table 1 (*continued*)

Panel B: Style and stock return regressors measured over prior 12 months												
Dependent variable	Panel B1: One-Month Future Stock Return						Panel B2: Three-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3
	(-3.11)	(-3.75)	(-3.35)	(-1.11)	(-1.13)	(-1.15)	(-2.88)	(-3.06)	(-3.25)	(-1.02)	(-1.19)	(-1.67)
Log BM	0.34**	0.27**	0.21	0.35***	0.33***	0.35***	1.10***	0.97***	1.11***	0.96***	0.82***	0.87***
	(2.32)	(2.18)	(1.20)	(4.02)	(3.89)	(3.99)	(3.68)	(3.17)	(3.23)	(3.11)	(2.71)	(2.83)
R^2	3.4%	2.4%	3.5%	4.0%	3.9%	4.4%	3.9%	3.2%	4.0%	4.6%	3.6%	4.7%
Dependent variable	Panel B3: Six-Month Future Stock Return						Panel B4: Twelve-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3
Style Return		0.87	0.74		6.31***	6.12***		4.87	3.53		10.16***	9.28***
		(0.67)	(0.51)		(3.20)	(2.89)		(1.38)	(1.59)		(2.91)	(2.69)
Stock Return	0.80		0.59	1.81*		1.90**	0.41		0.36	1.75*		1.57*
	(1.00)		(0.80)	(1.91)		(2.00)	(0.26)		(0.22)	(1.82)		(1.78)
Log Size	−0.90***	−0.70***	−0.61***	−0.20	−0.29	−0.21	−1.87***	−2.03***	−2.02***	−0.73	−0.87*	−0.95*
	(-2.98)	(-3.10)	(-2.91)	(-1.20)	(-1.23)	(-1.60)	(-3.17)	(-3.41)	(-3.42)	(-1.62)	(-1.70)	(-1.89)
Log BM	1.64***	1.80***	1.21***	1.30***	1.00***	0.93***	3.45***	3.33***	3.67***	3.73***	3.83***	3.31***
	(3.11)	(3.11)	(3.55)	(3.70)	(2.85)	(2.66)	(3.44)	(3.23)	(3.55)	(3.94)	(3.65)	(3.23)
R^2	4.1%	3.1%	4.2%	4.5%	4.1%	4.8%	3.9%	3.5%	4.2%	4.7%	4.2%	5.2%

Table 2

Coefficients on prior style returns for different time periods and sentiment periods conditional on past style returns. This table reports the average coefficients on prior style returns from Fama and MacBeth (1973) regressions of future stock returns for the early subperiod (1965–1987) in Panel A and the later subperiod (1988–2018) in Panel B. Regressions include controls for prior stock returns, the log of the firm size, and the log of the book-to-market ratio. Future stock returns are measured over one, three, six, and 12 months. Prior stock and style returns are measured over six and 12 months. The regressions are estimated for high and low sentiment periods separately. A high sentiment month is one in which the value of the Baker and Wurgler Sentiment Index in the previous month is above the median value for the sample period and the low sentiment months are those with below median values. The size, book-to-market, and past stock return regressors are winsorized at the 1st and 99th percentile each month. The sample consists of NYSE, AMEX, and NASDAQ stocks from 1965 to 2018. Stocks with missing or negative book values are excluded from the regressions. The *t*-statistics are in parentheses and are calculated using Newey and West (1987) approach with lags equal to four for three-month future returns, nine for six-month future returns, and 18 for 12-month future returns. R^2 is the average adjusted R^2. There are 144 low sentiment months and 125 high sentiment months in Panel A. There are 176 low sentiment months and 195 high sentiment months in Panel B. The average number of companies in each cross-sectional regression is 2554 in the high sentiment periods and 2296 in the low sentiment periods in Panel A and 3580 in the high sentiment periods and 3140 in the low sentiment periods in Panel B. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Future stock return horizon	Low Sentiment				High Sentiment			
	1 Month	3 Months	6 Months	12 Months	1 Month	3 Months	6 Months	12 Months
Panel A: 1965–1987								
Prior 6-month style and stock returns	−0.20	−1.11	−1.23	−2.41	2.12**	3.33**	4.82***	9.11***
	(-0.43)	(-0.35)	(-0.46)	(-1.61)	(1.99)	(2.41)	(4.49)	(6.71)
Prior 12-month style and stock returns	−0.22	−0.55	−0.78	−1.01	2.21**	2.61***	5.22***	8.16***
	(-0.51)	(-0.18)	(-0.45)	(-1.50)	(2.26)	(2.96)	(3.47)	(5.91)
Panel B: 1988–2018								
Prior 6-month style and stock returns	−0.43	2.21	3.12	5.85	2.40***	4.93***	6.32***	10.52***
	(-0.22)	(1.16)	(1.38)	(1.48)	(2.63)	(3.54)	(5.51)	(7.39)
Prior 12-month style and stock returns	−0.23	1.22	2.01	7.01**	2.32***	3.78***	7.11***	10.41***
	(-0.21)	(0.52)	(1.23)	(2.01)	(2.57)	(2.96)	(4.98)	(7.01)

and the value effect is present in both types of sentiment periods, consistent with Baker and Wurgler (2006) and Antoniou et al. (2016). For example, the results from model 1 in Panel A1 of Table 1 indicate that the coefficient on size is −0.18 (*t*-stat. = −3.11) for low sentiment and −0.04 (*t*-stat. = −1.11) for high sentiment, close to the coefficient of −0.17 (*t*-stat. = −3.13) for low sentiment and 0.04 (*t*-stat. = 0.85) for high sentiment in the fourth row (model) in Table 5 of Antoniou et al. (2016). The coefficient on the book-to-market ratio is 0.25 (*t*-stat. = 2.31) for low sentiment and 0.38 (*t*-stat. = 4.11) for high sentiment in Panel A1 of our Table 1 comparable to the coefficient of 0.22 (*t*-stat. = 2.46) for low sentiment and 0.38 (*t*-stat. = 4.17) for high sentiment in Antoniou et al. (2016).

In addition, we replicate our regressions in Table 1 without dividing the sample into high and low sentiment periods. The results are reported in Table IA.2 of the Internet Appendix. The average coefficients and the associated *t*-statistics from the monthly regressions are similar to those reported in Table 2 of Wahal and Yavuz (2013). For example, consider the regression of one-month future stock returns on six-month prior stock and style returns in Table IA.2 of the Internet Appendix. The coefficients on prior style and stock returns are 1.11 (*t*-stat. = 1.95) and 0.40 (*t*-stat. = 1.70), respectively, comparable to the coefficients on prior style and stock returns of 1.17 (*t*-stat. = 1.97) and 0.46 (*t*-statistic = 1.77), respectively, in Table 2 of Wahal and Yavuz (2013). Our results for 1965–2018 corroborate the findings of Wahal and Yavuz (2013) for 1965–2009 that the regression coefficients on style returns are larger than the coefficients on stock returns. More importantly, the results in Table 1 show that the coefficients on style returns are larger during high sentiment periods than low sentiment periods.

We further replicate the regressions in Table 1 for two subperiods, 1965–1987 and 1988–2018, and report the coefficients of style returns in Panels A and B of Table 2. Wahal and Yavuz (2013) report that style returns mostly fail to predict future stock returns during the early period (1965–1987). However, after dividing the sample during the early period (1965–1987) into two subsamples according to the Baker and Wurgler investor sentiment index, we find that style returns are significantly predictive of future stock returns during periods of high sentiment.[6]

3.2. Sentiment and the explanatory power of style comovement for momentum profits

In this subsection, we examine the ability of investor sentiment to explain the comovement-momentum relation (Hypothesis 2). We present the portfolio results in Subsection 3.2.1 and the regression results in Subsection 3.2.2.

3.2.1. Main results

We construct the stock level momentum strategies each month by taking a long position in winners (the top decile portfolio of the best performing stocks) and a short position in losers (the bottom decile portfolio of the worst performing stocks). Consistent with Hypothesis 2, we find that the comovement of a stock with its style, which is generated by style investing, can explain the variation in

[6] Table IA.3 in the Internet Appendix reports that almost all of the coefficients on style returns are significantly higher during high sentiment periods than during low sentiment periods.

Table 3

Monthly returns and three-factor alphas for momentum and comovement based portfolios conditional upon investor sentiment. The table reports the monthly returns and Fama and French (1993) three-factor alphas for winner-minus-loser, winner (top decile), and loser (bottom decile) portfolios in each comovement tercile (C1, C2, and C3), as well as the return difference between the top comovement tercile and the bottom comovement tercile (C3–C1) conditional upon investor sentiment. Panels A1, A2, and A3 report the equally-weighted stock returns measured over three-, six-, and 12-month holding periods (K) after portfolio formation, respectively. Panels B1, B2, and B3 report the value-weighted stock returns measured over three-, six-, and 12-month holding periods (K) after portfolio formation, respectively. Each month, all NYSE, AMEX, and NASDAQ stocks that exist in the intersection of CRSP and Compustat from 1965 to 2018 are ranked independently into ten deciles based on the return in the past six months and into three comovement terciles (C1, C2, and C3) based on their comovement (style beta). The top comovement tercile is C3 and the bottom comovement tercile is C1. We exclude stocks in the smallest NYSE size decile and stocks under $5 at the time of portfolio formation. The stocks with negative BE/ME are excluded from our analysis. A high sentiment month is one in which the value of the Baker and Wurgler Sentiment Index in the previous month is above the median value for the sample period and the low sentiment months are those with below median values. There are 320 low sentiment months and 320 high sentiment months. The *t*-statistics are in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Equally-weighted long-short (winners-losers) momentum portfolio profits

	High Sentiment Periods ($N = 320$)				Low Sentiment Periods ($N = 320$)				High Sentiment – Low Sentiment			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
Panel A1: Three-month future stock return ($K = 3$)												
Winner-loser returns	1.85***	2.01***	2.47***	0.62***	0.20	0.27**	0.31***	0.11	1.65***	1.74***	2.16***	0.51***
	(4.85)	(5.52)	(6.12)	(2.92)	(1.47)	(2.05)	(2.66)	(1.50)	(5.37)	(5.95)	(6.27)	(2.99)
Winner-loser alphas	1.55***	1.59***	2.45***	0.90***	0.15	0.20	0.38	0.23	1.40***	1.39***	2.07***	0.67***
	(4.00)	(4.11)	(6.33)	(3.90)	(1.00)	(1.14)	(1.23)	(1.43)	(4.94)	(4.66)	(6.98)	(3.35)
Winner returns	0.75***	0.80***	0.92***	0.17	2.00***	2.10***	2.15***	0.15	−1.25***	−1.30***	−1.23***	0.02
	(3.31)	(3.40)	(3.88)	(1.14)	(5.51)	(6.08)	(6.16)	(0.34)	(-4.29)	(-4.16)	(-4.12)	(0.17)
Winner alphas	1.10***	1.10***	1.20***	0.10	1.67***	1.70***	1.87***	0.20	−0.57***	−0.60***	−0.67***	−0.10
	(4.12)	(4.28)	(4.50)	(1.05)	(5.06)	(4.44)	(2.76)	(1.09)	(-2.85)	(-2.94)	(-2.98)	(-0.77)
Loser returns	−1.10***	−1.21***	−1.55***	−0.45***	1.80***	1.83***	1.84***	0.04	−2.90***	−3.04***	−3.39***	−0.49***
	(-4.18)	(-4.36)	(-4.66)	(-2.80)	(4.83)	(4.69)	(4.97)	(0.12)	(-6.65)	(-6.74)	(-7.30)	(-2.74)
Loser alphas	−0.45**	−0.49***	−1.25***	−0.80***	1.52***	1.50***	1.49***	−0.03	−1.97***	−1.99***	−2.74***	−0.77***
	(-2.22)	(-2.65)	(-4.00)	(-3.49)	(4.81)	(4.63)	(4.98)	(-0.19)	(-4.94)	(-5.03)	(-6.99)	(-3.06)
Panel A2: Six-month future stock return ($K = 6$)												
Winner-loser returns	2.20***	2.49***	2.86***	0.66***	0.40**	0.40**	0.60***	0.20	1.80***	2.09***	2.26***	0.46***
	(5.45)	(5.62)	(6.12)	(3.22)	(2.06)	(2.07)	(2.99)	(1.58)	(5.80)	(6.15)	(6.87)	(2.88)
Winner-loser alphas	1.73***	1.85***	2.55***	0.82***	0.30	0.40*	0.53*	0.23	1.43***	1.45***	2.02***	0.59***
	(4.71)	(4.62)	(6.91)	(3.89)	(1.65)	(1.74)	(1.80)	(1.44)	(5.04)	(5.06)	(6.70)	(3.28)
Winner returns	1.00***	1.10***	1.16***	0.16	2.10***	2.15***	2.25***	0.15	−1.10***	−1.05***	−1.09***	0.01
	(4.00)	(3.90)	(4.19)	(1.10)	(5.58)	(6.15)	(6.30)	(0.33)	(-4.00)	(-4.01)	(-4.07)	(0.11)
Winner alphas	1.15***	1.20***	1.30***	0.15	1.75***	1.80***	1.90***	0.15	−0.60***	−0.60***	−0.60***	0.00
	(4.23)	(4.40)	(4.62)	(1.15)	(5.17)	(5.40)	(5.70)	(0.44)	(-2.93)	(-2.96)	(-2.95)	(0.00)
Loser returns	−1.20***	−1.39***	−1.70***	−0.50***	1.70***	1.75***	1.65***	−0.05	−2.90***	−3.14***	−3.35***	−0.45***
	(-4.30)	(-4.55)	(-4.79)	(-2.89)	(5.12)	(5.19)	(4.85)	(-0.19)	(-6.75)	(-6.88)	(-7.40)	(-2.67)
Loser alphas	−0.58**	−0.65***	−1.25***	−0.67***	1.45***	1.40***	1.37***	−0.08	−2.03***	−2.05***	−2.62***	−0.59***
	(-2.57)	(-2.66)	(-4.00)	(-3.00)	(4.76)	(4.49)	(4.27)	(-0.37)	(-5.04)	(-5.33)	(-6.21)	(-2.96)
Panel A3: 12-month future stock return ($K = 12$)												
Winner-loser returns	1.95***	2.06***	2.52***	0.57***	0.25*	0.30**	0.32**	0.07	1.70***	1.76***	2.20***	0.50***
	(5.10)	(5.31)	(6.14)	(2.70)	(1.95)	(2.05)	(2.55)	(1.06)	(4.50)	(5.90)	(5.25)	(2.71)
Winner-loser alphas	1.62***	1.67***	2.35***	0.73***	0.16	0.25	0.44	0.28	1.46***	1.42***	1.91***	0.45***
	(4.30)	(4.79)	(6.25)	(3.24)	(1.10)	(1.10)	(1.48)	(1.20)	(4.10)	(4.10)	(3.85)	(2.73)
Winner returns	0.80***	0.83***	0.89***	0.09	2.00***	2.00***	2.01***	0.01	−1.20***	−1.17***	−1.12***	0.08
	(3.13)	(3.58)	(3.45)	(0.62)	(5.01)	(4.90)	(5.19)	(0.48)	(-4.12)	(-4.16)	(-4.12)	(0.57)
Winner alphas	1.12***	1.17***	1.32***	0.20	1.64***	1.75***	1.88***	0.24	−0.52**	−0.58***	−0.56***	−0.04

(*continued on next page*)

Table 3 (*continued*)

Equally-weighted long-short (winners-losers) momentum portfolio profits												
	High Sentiment Periods ($N = 320$)				Low Sentiment Periods ($N = 320$)				High Sentiment – Low Sentiment			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
	(4.18)	(4.13)	(4.48)	(1.22)	(4.90)	(4.61)	(2.79)	(1.33)	(-2.45)	(-2.64)	(-2.64)	(-0.30)
Loser returns	−1.15***	−1.23***	−1.63***	−0.48***	1.75***	1.70***	1.69***	−0.06	−2.90***	−2.93***	−3.32***	−0.42***
	(-4.24)	(-4.40)	(-4.72)	(-2.86)	(4.89)	(4.45)	(4.59)	(-0.07)	(-6.74)	(-6.66)	(-7.38)	(-2.90)
Loser alphas	−0.50**	−0.50**	−1.03***	−0.53***	1.48***	1.50***	1.44***	−0.04	−1.98***	−2.00***	−2.47***	−0.49***
	(-2.50)	(-2.45)	(-3.80)	(-2.92)	(4.03)	(4.42)	(4.79)	(-0.20)	(-4.99)	(-4.88)	(-6.19)	(-2.79)
Value-weighted long-short (winners-losers) momentum portfolio profits												
	High Sentiment Periods ($N = 320$)				Low Sentiment Periods ($N = 320$)				High Sentiment – Low Sentiment			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
Panel B1: Three-month future stock return ($K = 3$)												
Winner-loser returns	1.96***	2.10***	2.64***	0.68***	0.24	0.40***	0.40***	0.16	1.72***	1.70***	2.24***	0.52***
	(4.99)	(5.67)	(6.90)	(3.11)	(1.60)	(2.89)	(2.90)	(1.58)	(6.20)	(6.10)	(7.17)	(2.67)
Winner-loser alphas	1.64***	1.62***	2.55***	0.91***	0.17	0.27	0.44	0.27	1.47***	1.35***	2.11***	0.64***
	(4.65)	(4.35)	(6.70)	(3.94)	(1.03)	(1.14)	(1.23)	(1.55)	(4.94)	(4.66)	(6.98)	(3.30)
Winner returns	0.79***	0.84***	0.99***	0.20	2.05***	2.16***	2.23***	0.18	−1.26***	−1.32***	−1.24***	0.02
	(3.38)	(3.52)	(3.95)	(1.24)	(5.31)	(6.12)	(6.01)	(0.41)	(-4.13)	(-4.03)	(-4.00)	(0.19)
Winner alphas	1.15***	1.20***	1.30***	0.15	1.69***	1.75***	1.90***	0.21	−0.54***	−0.55**	−0.60***	−0.06
	(4.23)	(4.40)	(4.62)	(1.20)	(5.10)	(4.50)	(2.79)	(1.11)	(-2.91)	(-2.51)	(-2.60)	(-0.10)
Loser returns	−1.17***	−1.26***	−1.65***	−0.48***	1.81***	1.76***	1.83***	0.02	−2.98***	−3.02***	−3.48***	−0.50***
	(-4.22)	(-4.42)	(-4.73)	(-2.96)	(4.85)	(4.60)	(4.91)	(0.11)	(-6.75)	(-6.64)	(-7.20)	(-2.80)
Loser alphas	−0.49**	−0.42**	−1.25***	−0.76***	1.52***	1.48***	1.46***	−0.06	−2.01***	−1.90***	−2.71***	−0.70***
	(-2.57)	(-2.55)	(-4.01)	(-3.32)	(4.80)	(4.60)	(4.90)	(-0.15)	(-4.96)	(-4.84)	(-6.85)	(-3.15)
Panel B2: Six-month future stock return ($K = 6$)												
Winner-loser returns	2.22***	2.60***	2.96***	0.74***	0.30**	0.30**	0.55***	0.25	1.92***	2.30***	2.41***	0.49***
	(5.50)	(5.80)	(6.30)	(3.40)	(2.11)	(2.40)	(3.16)	(1.63)	(5.97)	(6.45)	(6.69)	(2.94)
Winner-loser alphas	1.85***	2.00***	2.70***	0.85***	0.20	0.25	0.45	0.25	1.65***	1.75***	2.25***	0.60***
	(4.71)	(4.62)	(6.90)	(3.94)	(1.10)	(1.24)	(1.63)	(1.60)	(5.13)	(5.50)	(6.90)	(3.29)
Winner returns	1.10***	1.15***	1.16***	0.06	2.00***	2.15***	2.15***	0.15	−0.90***	−1.00***	−0.99***	−0.09
	(4.12)	(4.25)	(4.20)	(1.00)	(5.29)	(6.14)	(6.14)	(0.44)	(-4.19)	(-4.16)	(-4.03)	(-0.21)
Winner alphas	1.25***	1.30***	1.35***	0.10	1.70***	1.77***	1.86***	0.16	−0.45***	−0.47***	−0.51***	−0.06
	(4.35)	(4.65)	(4.70)	(1.01)	(5.08)	(5.34)	(5.76)	(0.59)	(-2.85)	(-2.94)	(-2.98)	(-0.03)
Loser returns	−1.12***	−1.45***	−1.80***	−0.68***	1.70***	1.85***	1.60***	−0.10	−2.82***	−3.30***	−3.40***	−0.58***
	(-4.10)	(-4.86)	(-4.86)	(-2.94)	(5.13)	(5.69)	(4.77)	(-0.49)	(-6.75)	(-6.88)	(-6.40)	(-2.74)
Loser alphas	−0.60***	−0.70***	−1.35***	−0.75***	1.50***	1.52***	1.41***	−0.09	−2.10***	−2.22***	−2.76***	−0.66***
	(-2.63)	(-2.73)	(-4.25)	(-3.49)	(4.81)	(4.79)	(4.61)	(-0.49)	(-5.20)	(-5.43)	(-6.35)	(-3.06)
Panel B3: 12-month future stock return ($K = 12$)												
Winner-loser returns	1.90***	2.00***	2.44***	0.54***	0.30**	0.37**	0.40***	0.10	1.60***	1.63***	2.04***	0.44***
	(5.00)	(4.99)	(6.02)	(2.60)	(2.00)	(2.35)	(2.76)	(1.56)	(4.37)	(4.90)	(5.12)	(2.68)
Winner-loser alphas	1.69***	1.70***	2.55***	0.86***	0.15	0.20	0.38	0.23	1.54***	1.50***	2.17***	0.63***
	(4.49)	(4.92)	(6.86)	(4.12)	(1.00)	(1.14)	(1.23)	(1.43)	(4.14)	(4.30)	(4.45)	(2.95)
Winner returns	1.00***	0.80***	1.09***	0.09	2.10***	2.12***	2.09***	−0.01	−1.10***	−1.32***	−1.00***	0.10
	(3.32)	(3.50)	(3.55)	(0.64)	(5.10)	(5.00)	(5.40)	(-0.54)	(-4.22)	(-4.36)	(-5.12)	(0.44)
Winner alphas	1.15***	1.20***	1.32***	0.17	1.67***	1.70***	1.87***	0.20	−0.52**	−0.50**	−0.55***	−0.03

(*continued on next page*)

Table 3 (*continued*)

Value-weighted long-short (winners-losers) momentum portfolio profits												
	High Sentiment Periods ($N = 320$)				Low Sentiment Periods ($N = 320$)				High Sentiment – Low Sentiment			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
	(4.10)	(4.24)	(4.50)	(1.15)	(4.96)	(4.44)	(2.76)	(1.29)	(-2.43)	(-2.40)	(-2.61)	(-0.27)
Loser returns	−0.90***	−1.20***	−1.35***	−0.45***	1.80***	1.75***	1.69***	−0.11	−2.70***	−2.95***	−3.04***	−0.34**
	(-4.11)	(-4.20)	(-4.30)	(-2.70)	(4.83)	(4.69)	(4.97)	(-0.19)	(-6.65)	(-6.74)	(-7.30)	(-2.10)
Loser alphas	−0.54***	−0.50***	−1.23***	−0.69***	1.52***	1.50***	1.49***	−0.03	−2.06***	−2.00***	−2.72***	−0.66***
	(-2.64)	(-2.61)	(-3.95)	(-3.19)	(4.82)	(4.61)	(4.94)	(-0.19)	(-5.02)	(-4.91)	(-7.00)	(-3.05)

Table 4

Monthly benchmark-adjusted returns for momentum and comovement based portfolios conditional upon investor sentimnt. The table shows benchmark-adjusted returns for value-weighted winner minus loser, winner, and loser portfolios in each comovement tercile (C1, C2, and C3) over a six-month post-portfolio formation holding period. The average adjusted returns in the high and low sentiment periods are estimates of a_H and a_L in the following regression, respectively: $R_{i,t} = a_H d_{H,t} + a_L\ d_{L,t} + bMKT_t + sSMB_t + hHML_t + \varepsilon_{i,t}$, (2) where $d_{H,t}$ and $d_{L,t}$ are dummy variables indicating high and low sentiment periods and $R_{i,t}$ is the excess return in month t for each comovement tercile (C1, C2, and C3) or the return difference between the top comovement tercile and the bottom comovement tercile (C3–C1). $MKT_t, SMB_t,$ and HML_t are returns on the Fama and French (1993) three factors in month t. Each month, all NYSE, AMEX, and NASDAQ stocks that exist in the intersection of CRSP and Compustat from 1965 to 2018 are ranked independently into ten deciles based on the return in the past six months and into three comovement terciles (C1, C2, and C3) based on their comovement (style beta). The top comovement tercile is C3, and the bottom comovement tercile is C1. We exclude stocks in the smallest NYSE size decile and the stocks under $5 at the time of portfolio formation. The stocks with negative BE/ME are excluded from our analysis. A high sentiment month is one in which the value of the Baker and Wurgler Sentiment Index in the previous month is above the median value for the sample period and the low sentiment months are those with below median values. There are 320 low sentiment months and 320 high sentiment months. The t-statistics are in parentheses, and they are based on the heteroskedasticity-consistent standard errors of White (1980). ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	High Sentiment (coefficient a_H)				Low Sentiment (coefficient a_L)				High Sentiment – Low Sentiment (a_H-a_L)			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
Winner-loser benchmark-adjusted return	0.85***	1.18***	1.45***	0.60***	0.89***	0.93***	1.03***	0.14	−0.04	0.25*	0.42***	0.46***
	(6.40)	(7.50)	(8.50)	(5.80)	(6.70)	(7.40)	(7.80)	(1.45)	(-1.03)	(1.95)	(3.50)	(3.60)
Winner benchmark-adjusted return	0.80***	0.83***	0.86***	0.06	1.05***	1.05***	1.10***	0.10	−0.25***	−0.22**	−0.24***	−0.01
	(6.50)	(6.70)	(7.07)	(0.56)	(7.35)	(8.10)	(8.11)	(1.00)	(-2.60)	(-2.23)	(-2.62)	(-0.20)
Loser benchmark-adjusted return	−0.05	−0.35***	−0.59***	−0.54***	0.16	0.12	0.07	−0.09	−0.21**	−0.47***	−0.66***	−0.45***
	(-0.28)	(-3.75)	(-4.50)	(-4.92)	(1.04)	(1.32)	(1.35)	(-0.32)	(-2.05)	(-4.80)	(-5.07)	(-4.40)

Table 5

Main results conditional upon different past style returns and investor sentiment. This table reports the results of replicating the main analyses for Tables 1–3 after dividing the sample into two subsamples with positive vs. negative prior style returns. Panels A1 and A2 of this table correspond to Panel A of Table 1 and report the results from Fama and MacBeth (1973) regressions of future stock returns on prior style returns for the subsamples with positive and negative past style returns, respectively, where style and stock return regressors are measured over the prior six months. Panels B1 and B2 of this table correspond to Table 2 and report the average coefficients on prior style returns from Fama and MacBeth (1973) regressions of future stock returns for the subsamples with positive and negative past style returns, respectively. Panels C1 and C2 of this table correspond to Panel B1 of Table 3 and report monthly returns and Fama and French (1993) three-factor alphas over a three-month holding period for winner minus loser, winner (top decile), and loser (bottom decile) portfolios in each comovement tercile (C1, C2, and C3), as well as the return difference between the top comovement tercile and the bottom comovement tercile (C3–C1) conditional upon investor sentiment for the subsamples with positive and negative past style returns, respectively. There are 675,580 stock-month observations for the subsample with high sentiment and positive past style returns, 462,625 stock-month observations for the subsample with low sentiment and positive past style returns, 247,723 stock-month observations for the subsample with high sentiment and negative past style returns, and 300,582 stock-month observations for the subsample with low sentiment and negative past style returns. In Panels A1 and C1, there are 279 low sentiment months and 294 high sentiment months. In Panels A2 and C2, there are 249 low sentiment months and 219 high sentiment months. In Panel B1, there are 145 low sentiment months and 105 high sentiment months in the early subperiod, and there are 134 low sentiment months and 189 high sentiment months in the later subperiod. In Panel B2, there are 107 low sentiment months and 88 high sentiment months in the early subperiod, and there are 142 low sentiment months and 131 high sentiment months in the later subperiod. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Re-estimating the Regressions in Panel A of Table 1, Conditional on Past Style Returns Being Positive or Negative																		
Panel A1: Past Style Returns are Positive																		
Dependent variable	Three-Month Future Stock Return						Six-Month Future Stock Return						Twelve-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Style Return		1.41	0.60		4.40***	3.80***		1.57	0.95		8.78***	8.16***		3.32*	2.55		14.78***	14.17***
		(1.50)	(0.54)		(4.19)	(3.27)		(1.50)	(1.31)		(5.87)	(4.45)		(1.72)	(1.11)		(7.65)	(6.77)
Stock Return	1.22		1.24	3.70***		3.80***	0.90		0.91	4.20***		4.17***	1.32		1.08	3.63*		3.56
	(1.45)		(1.40)	(3.40)		(3.88)	(1.03)		(1.03)	(4.26)		(4.18)	(0.83)		(0.79)	(1.74)		(1.63)
Log Size	−0.62***	−0.64***	−0.63***	−0.30	−0.28	−0.35	−1.20***	−0.70***	−0.75***	−0.45*	−0.47*	−0.49**	−1.44	−1.60***	−1.23***	−0.40	−0.35	−0.45
	(-2.76)	(-2.83)	(-2.77)	(-1.59)	(-1.22)	(-1.37)	(-2.88)	(-3.06)	(-3.25)	(-1.82)	(-1.69)	(-1.97)	(-1.49)	(-2.75)	(-2.80)	(-0.88)	(-0.98)	(-1.24)
Log BM	1.25***	1.30***	1.40***	0.90***	0.96***	0.90***	1.60***	1.37***	1.51***	1.20***	1.29***	1.35***	2.05***	1.99***	1.97***	1.02***	1.93***	1.79***
	(3.54)	(3.60)	(3.88)	(3.10)	(3.26)	(2.80)	(3.68)	(3.67)	(3.73)	(3.31)	(3.21)	(3.44)	(5.22)	(4.58)	(4.40)	(4.02)	(4.21)	(3.93)
R^2	4.4%	3.9%	4.6%	4.9%	4.5%	5.4%	4.1%	3.3%	4.3%	4.8%	4.1%	5.5%	4.2%	3.5%	4.6%	4.9%	4.3%	5.6%
Panel A2: Past Style Returns are Negative																		
Dependent variable	Three-Month Future Stock Return						Six-Month Future Stock Return						Twelve-Month Future Stock Return					
	Low Sentiment			High Sentiment			Low Sentiment			High Sentiment			Low Sentiment			High Sentiment		
Model	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Style Return		1.00	0.23		3.16	1.82		1.04	0.96		3.55	3.20		2.62	2.30		6.98	6.25*
		(1.20)	(0.24)		(1.59)	(1.57)		(0.60)	(0.71)		(1.37)	(1.45)		(1.50)	(1.20)		(1.65)	(1.67)
Stock Return	0.80		0.90	2.10		2.15	0.67		0.85	2.10*		2.24*	0.91		1.00	2.00		2.56
	(0.95)		(1.01)	(1.54)		(1.58)	(1.03)		(1.03)	(1.70)		(1.75)	(1.22)		(0.89)	(1.44)		(1.51)

(*continued on next page*)

Table 5 (*continued*)

Log Size	−0.40**	−0.42**	−0.41**	−0.10	−0.11	−0.13	−0.63**	−0.91***	−0.72***	−0.10	−0.19	−0.20*	−1.32**	−1.04***	−1.23***	−0.07	−0.31	−0.39
	(-2.26)	(-2.33)	(-2.27)	(-1.09)	(-1.10)	(-1.62)	(-2.40)	(-3.10)	(-3.19)	(-1.02)	(-1.19)	(-1.68)	(-2.32)	(-2.75)	(-2.80)	(-0.88)	(-0.98)	(-1.24)
Log BM	1.05***	1.12**	1.18**	0.88**	0.80**	0.66**	1.10***	1.07***	1.19***	0.66**	0.72***	0.77**	1.59***	1.30***	1.02***	0.62**	0.73**	0.71**
	(3.00)	(2.27)	(2.48)	(2.17)	(2.10)	(2.31)	(3.43)	(3.05)	(3.00)	(2.31)	(2.71)	(2.13)	(3.66)	(3.08)	(2.85)	(2.06)	(2.09)	(2.07)
R^2	2.5%	3.2%	3.0%	3.1%	3.2%	3.4%	2.9%	3.1%	3.9%	3.6%	3.9%	4.2%	3.1%	3.4%	4.1%	3.8%	4.1%	4.3%

Re-estimating the Regressions in Table 2, Conditional on Past Style Returns Being Positive or Negative

Future stock return horizon	Low Sentiment						High Sentiment					
	Three Months		Six Months		Twelve Months		Three Months		Six Months		Twelve Months	
	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.
Panel B1: Past Style Returns are Positive												
	1965–1987											
Prior 6-month style and stock returns	−2.26	(-1.39)	−3.30	(-1.28)	−4.67	(-1.45)	3.97***	(2.75)	5.98***	(2.99)	12.64***	(2.78)
Prior 12-month style and stock returns	−0.44	(-0.38)	−1.96	(-1.05)	−2.68	(-1.02)	3.65***	(2.63)	5.59***	(2.85)	11.96***	(4.93)
	1988–2018											
Prior 6-month style and stock returns	3.62	(1.42)	5.53	(1.57)	10.86*	(1.72)	3.69***	(3.77)	9.72***	(4.52)	15.10***	(3.99)
Prior 12-month style and stock returns	1.72	(0.90)	4.86	(1.42)	11.55*	(1.89)	2.89**	(1.99)	5.38***	(2.96)	12.49***	(3.98)
Panel B2: Past Style Returns are Negative												
	1965–1987											
Prior 6-month style and stock returns	−0.31	(-0.49)	1.10	(0.60)	2.67	(1.01)	0.65	(1.39)	3.18*	(1.67)	8.21*	(1.71)
Prior 12-month style and stock returns	−1.04	(-0.58)	1.12	(0.65)	1.48	(0.75)	0.55	(1.21)	1.29	(1.64)	4.16*	(1.85)
	1988–2018											
Prior 6-month style and stock returns	0.62	(0.67)	0.93	(0.77)	2.16	(0.88)	1.69*	(1.76)	2.32*	(1.82)	4.11*	(1.85)
Prior 12-month style and stock returns	0.71	(0.77)	0.86	(1.14)	2.85	(1.25)	1.89*	(1.90)	2.58*	(1.86)	6.49*	(1.92)

Re-conducting the Analyses in Panel B1 of Table 3, Conditional on Past Style Returns Being Positive or Negative

	High Sentiment Periods				Low Sentiment Periods				High Sentiment – Low Sentiment			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
Panel C1: Past Style Returns are Positive												
Winner-loser returns	1.80***	1.90***	2.80***	1.00***	0.35*	0.34**	0.52***	0.17	1.45***	1.56***	2.28***	0.83***
	(3.85)	(4.12)	(6.30)	(4.00)	(1.80)	(2.20)	(2.80)	(1.48)	(3.37)	(3.00)	(5.07)	(3.22)
Winner-loser alphas	1.62***	1.81***	2.50***	0.88***	0.15	0.27	0.40	0.25	1.47***	1.54***	2.10***	0.63***
	(5.25)	(5.80)	(6.10)	(3.76)	(1.00)	(1.24)	(1.23)	(1.43)	(4.98)	(5.36)	(5.10)	(3.16)

(*continued on next page*)

Table 5 (*continued*)

Winner returns	0.10***	0.12***	0.30***	0.20	2.00***	2.01***	2.10***	0.10	−1.90***	−1.89***	−1.80***	0.10
	(3.50)	(3.70)	(3.64)	(0.87)	(5.80)	(6.10)	(6.23)	(0.29)	(-5.09)	(-5.32)	(-5.15)	(0.10)
Winner alphas	0.70***	0.74***	0.80***	0.10	1.40***	1.51***	1.63***	0.23	−0.70*	−0.77*	−0.83*	−0.13
	(3.62)	(3.68)	(3.90)	(0.90)	(5.06)	(4.44)	(2.76)	(1.33)	(-1.95)	(-1.94)	(1.90)	(-0.21)
Loser returns	−1.70***	−1.78***	−2.50***	−0.80***	1.65***	1.67***	1.58***	−0.07	−3.35***	−3.45***	−4.08***	−0.73***
	(-5.20)	(-5.54)	(-6.85)	(-3.10)	(4.90)	(4.95)	(5.12)	(-0.11)	(-6.15)	(-6.34)	(-6.00)	(-3.98)
Loser alphas	−0.92***	−1.07***	−1.70***	−0.78***	1.25***	1.24***	1.23***	−0.02	−2.17***	−2.31***	−2.93***	−0.76***
	(-2.87)	(-3.13)	(-4.75)	(-3.59)	(3.91)	(4.23)	(4.98)	(-0.00)	(-6.44)	(-4.03)	(-5.25)	(-3.96)
Panel C2: Past Style Returns are Negative												
Winner-loser returns	2.06***	2.21***	2.35***	0.29	0.20*	0.40*	0.32*	0.12	1.86***	1.81***	2.03**	0.17
	(5.97)	(6.20)	(6.36)	(1.22)	(1.81)	(1.75)	(1.86)	(1.00)	(3.11)	(3.10)	(2.29)	(0.55)
Winner-loser alphas	1.06***	1.20***	1.30***	0.24	0.02	0.20	0.17	0.15	1.04***	1.00***	1.13***	0.09
	(3.03)	(3.23)	(3.90)	(1.18)	(0.80)	(0.90)	(1.20)	(1.43)	(3.03)	(2.92)	(3.10)	(0.50)
Winner returns	0.80**	0.90***	1.00***	0.20	1.90***	2.00***	1.91***	0.01	−1.10***	−1.10***	−0.91***	0.19
	(2.50)	(2.60)	(3.00)	(0.90)	(5.20)	(6.10)	(5.84)	(0.66)	(-3.40)	(-3.30)	(3.20)	(0.37)
Winner alphas	0.75***	0.83***	0.80***	0.05	1.02***	1.10***	1.12***	0.10	−0.27	−0.27	−0.32	−0.05
	(2.56)	(2.79)	(3.56)	(0.10)	(3.06)	(3.24)	(3.36)	(0.69)	(-1.10)	(-1.20)	(-1.29)	(-0.22)
Loser returns	−1.26*	−1.31*	−1.35*	−0.09	1.70***	1.60***	1.59***	−0.11	−2.96***	−2.91***	−2.94***	0.02
	(-1.70)	(-1.89)	(-1.90)	(-0.56)	(4.94)	(4.62)	(4.44)	(-0.25)	(-5.22)	(-5.19)	(-5.77)	(0.51)
Loser alphas	−0.31	−0.37	−0.50**	−0.19	1.00***	0.90***	0.95***	−0.05	−1.31***	−1.27***	−1.45***	−0.14
	(-1.17)	(-1.53)	(-2.25)	(-1.41)	(4.05)	(3.98)	(3.66)	(-0.19)	(-4.50)	(-4.13)	(-5.35)	(-1.22)

momentum profits during high sentiment periods, but not low sentiment periods. The results are robust across the three sentiment indexes.

Specifically, we first construct momentum portfolios using the methodology of Jegadeesh and Titman (1993). In each month, we sort all of the stocks into deciles according to their past six-month returns. The top decile is referred to as the "winner portfolio" and the bottom decile is referred to as the "loser portfolio." Next, we independently sort all of the stocks into terciles based on their style comovement, which is measured by the style beta as explained in Subsection 2.3.3. After the six-month portfolio formation period ($J =$ 6 months), we skip a month and then compute the stock returns over the next three-, six-, and 12-month horizons ($K = 3$, 6, and 12 months).

In Table 3, Panels A1 - A3 show the equally-weighted stock returns and Panels B1 – B3 show the value-weighted stock returns. In each panel, we report our results for the "High Sentiment Periods" in the first four columns, "Low Sentiment Periods" in the middle four columns, and the difference between the high and low sentiment periods, "High Sentiment – Low Sentiment," in the last four columns. Under "High Sentiment Periods" and "Low Sentiment Periods," columns (C1) – (C3) report the results for the three comovement terciles with C1 representing the lowest comovement tercile and C3 representing the highest comovement tercile. The top two numbers in columns (C1) – (C3) represent the returns to a momentum portfolio that buys winners and sells losers. Specifically, "Winner-loser Returns" refer to the raw returns and "Winner-loser Alphas" refer to the Fama and French (1993) three-factor alphas.

Note that Winner-loser Returns and Winner-loser Alphas in columns (C1) – (C3) under High Sentiment Periods and Low Sentiment Periods are momentum returns, but those in the columns (C3 – C1) are not momentum returns. Instead, they are differential momentum returns that represent the momentum returns in the highest comovement tercile (column (C3)) minus the momentum returns in the lowest comovement tercile (column (C1)). The results in Table 3 indicate that the differential momentum returns are significantly positive for the high sentiment periods, but insignificant for the low sentiment periods. The rightmost column of each panel (i.e., column (C3–C1) under "High Sentiment - Low Sentiment") reports the difference in the differential momentum returns between the high and low sentiment periods. All of the differences in the differential momentum returns are significant at the 1% level, suggesting that the explanatory power of comovement for momentum profits is significantly higher for high sentiment periods than low sentiment periods.[7]

Table 3 also shows that the winner-minus-loser returns, regardless as to the raw returns or Fama and French (1993) three-factor alphas, come mainly from shorting losers, consistent with the findings in Stambaugh et al. (2012). The asymmetric profits from shorting losers and buying winners are due to two factors. First, investors are reluctant to sell poorly performing stocks immediately. In addition, short sale constraints make it harder to short losers than buy winners, delaying the price discovery process for loser stocks. The two factors lead to the greater profitability from shorting losers than buying winners (Stambaugh et al., 2012).

Our results in Table 3 are in line with those in Table 6 of Wahal and Yavuz (2013) and Table 2 of Antoniou et al. (2013). To make our results directly comparable to Table 6 of Wahal and Yavuz (2013), we do not divide our sample into high and low sentiment periods. The results in Table IA.4 of the Internet Appendix confirm that our average returns and *t*-statistics are comparable to those in Table 6 of Wahal and Yavuz (2013). Our results from the updated sample period of 1965–2018 corroborate the findings of Wahal and Yavuz (2013). To make our results in Table 3 directly comparable to Table 2 of Antoniou et al. (2013), we do not divide our sample into comovement terciles. The results in Table IA.5 of the Internet Appendix indicate that our average returns and *t*-statistics are in line with those in Table 2 of Antoniou et al. (2013). For example, the winner-minus-loser returns over the three-month post-portfolio formation holding period are 2.28% per month (*t*-stat. = 6.05) for the high sentiment periods and 0.31% per month (*t*-stat. = 1.62) for the low sentiment periods, which are comparable to 2.38% per month (*t*-stat. = 6.09) for the high sentiment periods and 0.45% per month (*t*-stat. = 1.05) for the low sentiment periods in Panel B of Table 2 of Antoniou et al. (2013).

To confirm that our main results in Tables 1 and 3 are robust to alternative measures of investor sentiment, we replicate the regression analysis for Hypothesis 1 and the portfolio analysis for Hypothesis 2 using the University of Michigan's Sentiment Index and the OECD's CCI. Tables IA.6 and IA.7 in the Internet Appendix present the regression results for these indexes, while Tables IA.8 and IA.9 report the portfolio results. We find robust evidence for Hypotheses 1 and 2 using these two sentiment indexes.

3.2.2. Robustness tests

While we report the portfolio results in Table 3, we also report the regression results in Table 4 as a robustness check. The average benchmark-adjusted returns for the high and low sentiment periods are coefficient estimates a_H and a_L in the following regression (Stambaugh et al., 2012).

$$R_{i,t} = a_H d_{H,t} + a_L d_{L,t} + bMKT_t + sSMB_t + hHML_t + \varepsilon_{i,t}, \tag{2}$$

where $d_{H,t}$ and $d_{L,t}$ are dummy variables indicating high and low sentiment periods and $R_{i,t}$ is the excess return in month t on either the comovement terciles (C1, C2, and C3) or the difference in the top and bottom comovement terciles (C3–C1). $MKT_t, SMB_t, and\ HML_t$ are returns on the Fama and French (1993) three factors in month t.

Table 4 reports the coefficient estimates a_H under High Sentiment, a_L under Low Sentiment, and a_H - a_L under High Sentiment - Low

[7] For example, the results in Panel B1 of Table 3 indicate that the value-weighted differential momentum returns between the highest and lowest comovement terciles (C3–C1) over the three-month holding period after portfolio formation are 0.68% per month (*t*-stat. = 3.11) for the high sentiment periods and 0.16% per month (*t*-stat. = 1.58) for the low sentiment periods, resulting in a difference of 0.52% per month (*t*-stat. = 2.67) between the high and low sentiment periods.

Table 6

Monthly returns and three-factor alphas for momentum- and comovement-based portfolios conditional upon different market states and investor sentiment. The table reports the monthly returns and Fama and French (1993) three-factor alphas for value-weighted winner, loser, and winner-minus-loser momentum portfolios in each comovement tercile (C1, C2, and C3), as well as C3–C1 over a six-month holding period, conditional upon investor sentiment and market state. The state of the market is defined as up (down) if the return of the value-weighted market index (including dividends) over the 12-month period prior to the beginning of the holding period, as measured by Cooper et al. (2004), is positive (negative). We allow one month between the end of the formation period and the holding period. Each month, all NYSE, AMEX, and NASDAQ stocks that exist in the intersection of CRSP and Compustat from 1965 to 2018 are ranked independently into ten deciles based on the return in the past six months and into three comovement terciles (C1, C2, and C3) based on their comovement (style beta). The top comovement tercile is C3, and the bottom comovement tercile is C1. We exclude stocks in the smallest NYSE size decile and stocks under $5 at the time of portfolio formation. The stocks with negative BE/ME are excluded from our analysis. A high sentiment month is one in which the value of the Baker and Wurgler Sentiment Index in the previous month is above the median value for the sample period and the low sentiment months are those with below median values. The *t*-statistics are in parentheses, and they are based on the heteroskedasticity-consistent standard errors of White (1980). ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Up Markets								Down Markets							
	High Sentiment Periods (Number of months = 265, Average number of unique firms per month = 3098)				Low Sentiment Periods (Number of months = 221, Average number of unique firms per month = 2466)				High Sentiment Periods (Number of months = 55, Average number of unique firms per month = 2546)				Low Sentiment Periods (Number of months = 99, Average number of unique firms per month = 2665)			
	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1	C1	C2	C3	C3–C1
Winner-loser returns	2.27***	2.51***	2.80***	0.53**	0.44	0.72*	0.70***	0.26	1.72***	1.99***	2.56***	0.84**	0.02	0.06	0.07	0.05
	(6.13)	(6.58)	(7.42)	(2.28)	(1.38)	(1.80)	(2.93)	(1.48)	(4.70)	(5.00)	(5.30)	(2.40)	(0.10)	(0.67)	(0.70)	(0.43)
Winner-loser alphas	1.88***	2.32***	2.76***	0.88***	0.25	0.49	0.51	0.26	1.83***	1.85***	2.55***	0.72***	−0.03	−0.01	0.15	0.18
	(5.33)	(6.84)	(6.99)	(2.85)	(0.53)	(0.93)	(0.62)	(0.40)	(5.40)	(5.66)	(7.25)	(4.49)	(-0.15)	(-0.20)	(0.76)	(1.56)
Winner returns	0.69***	0.70***	0.80***	0.11	2.10***	2.21***	2.30***	0.20	0.82***	0.90***	0.91***	0.09	1.66***	1.67***	1.70***	0.04
	(3.28)	(3.21)	(4.18)	(1.32)	(6.28)	(6.67)	(6.60)	(1.00)	(3.40)	(3.50)	(3.60)	(0.88)	(3.16)	(4.04)	(4.09)	(0.84)
Winner alphas	1.38***	1.50***	1.53***	0.15	1.75***	1.85***	1.86***	0.11	1.33***	1.45***	1.50***	0.17*	1.40***	1.50***	1.51***	0.11
	(4.94)	(5.41)	(5.28)	(1.12)	(5.12)	(5.25)	(5.30)	(1.03)	(4.70)	(4.69)	(4.92)	(1.80)	(4.22)	(4.38)	(4.42)	(0.00)
Loser returns	−1.58***	−1.81***	−2.00***	−0.42***	1.66***	1.49***	1.50***	−0.16	−0.90***	−1.09***	−1.65***	−0.75***	1.64***	1.61***	1.63***	−0.01
	(-4.29)	(-4.64)	(-6.16)	(-2.60)	(4.26)	(4.10)	(3.90)	(-1.31)	(-2.70)	(-2.80)	(-3.59)	(-5.20)	(6.70)	(6.83)	(5.75)	(-0.17)
Loser alphas	−0.50***	−0.81***	−1.23***	−0.73***	1.50***	1.36***	1.35***	−0.15	−0.50**	−0.40*	−1.05***	−0.55***	1.43***	1.51***	1.36***	−0.07
	(-2.67)	(-3.30)	(-4.78)	(-3.55)	(4.40)	(4.20)	(4.13)	(-1.22)	(-2.60)	(-1.99)	(-3.54)	(-2.96)	(4.23)	(5.14)	(5.47)	(-0.62)

Sentiment. Consistent with Hypothesis 2, the winner-minus-loser benchmark-adjusted return in column (C3–C1) (i.e., the difference in the top and bottom comovement terciles) is positive and significant for the high sentiment periods (t-stat. = 5.80), but not statistically significant for the low sentiment periods (t-stat. = 1.45). The difference in the differential momentum returns between the high and low sentiment periods, as reported in the rightmost column of Table 4 under High Sentiment - Low Sentiment and C3–C1, is positive and significant at the 1% level (t-stat. = 3.60), suggesting that the explanatory power of comovement for momentum profits is consistently higher for the high sentiment periods than for the low sentiment periods.

We conduct additional robustness checks using the methods used for Tables 4, 5, and 9 of Stambaugh et al. (2012). We estimate the following three regressions.

$$R_{i,t} = a + s_1 S_{t-1} + u_{i,t}, \tag{3}$$

$$R_{i,t} = a + s_2 S_{t-1} + bMKT_t + sSMB_t + hHML_t + +u_{i,t}, \tag{4}$$

$$R_{i,t} = a + s_3 S_{t-1} + bMKT_t + sSMB_t + hHML_t + \sum_{j=1}^{s} m_j X_{jt} + u_{i,t}, \tag{5}$$

where $R_{i,t}$ is the excess return in month t for the winner, loser, or winner-minus-loser portfolio i. S_{t-1} is the lagged level of the Baker and Wurgler sentiment index. In equation (3), excess returns are regressed on just the lagged sentiment index. In equation (4), excess returns are regressed on the lagged sentiment index, as well as the returns on the Fama and French (1993) three factors. In equation (5), we also controls for $X_{j,t}$ (j = 1–5), which are five additional macroeconomic variables not used by Baker and Wurgler (2006) when removing macro-related fluctuations in sentiment: the default premium, the term premium, the real interest rate, inflation, and the consumption-wealth ratio (cay).

Table IA.10 in the Internet Appendix reports the results. We find that all of the three estimates, s_1, s_2, and s_3, for the Winners–Losers portfolio differences between the top and bottom comovement terciles (C3–C1) are positive and significant, suggesting that comovement has consistently higher explanatory power for momentum profits during high sentiment periods than during low sentiment periods regardless as to whether momentum profits are measured as excess returns or benchmark-adjusted returns. The results are robust to including macroeconomic variables in addition to those already controlled for by Baker and Wurgler (2006). For example, the coefficient on sentiment, s_2, is 0.36 (t-stat. = 2.96), indicating that our results continue to hold when sentiment is a continuous variable. In summary, we find highly robust evidence for Hypothesis 2.

3.3. Sentiment and style returns

Thus far, we have confirmed our primary hypothesis that high sentiment is a critical condition for style investing significantly affecting asset prices. To better understand the exact mechanism through which high sentiment leads to more active style investing behavior, we further examine whether the effect of investor sentiment on return predictability depends on whether the past style return is positive. We argue in the Introduction that periods of high sentiment can drive more unsophisticated investors to enter the market, and can also drive the unsophisticated investors who are already in the market to make more aggressive investment decisions based on a style's past returns. We conjecture that positive past style returns can play a moderating role in the relation between sentiment and style investing through two channels.

The first channel is related to the overconfidence of the unsophisticated investors (the overconfidence channel). Positive style returns, combined with the high sentiment, are more likely to lead to investor overconfidence in picking the winning styles due to an attribution bias in learning (Griffin and Tversky, 1992; Gervais and Odean, 2001). As Gervais and Odean (2001) describe, a trader initially does not know his own ability and he infers his ability from his successes and failures. The success of investors' initial trades leads to an inflated sense of their own superior skills and ability to achieve positive abnormal returns. Therefore, investors become overconfident after a run of good performance in a particular style and seek other stocks within the same class. While positive style returns help breed overconfidence, high sentiment helps feed this overconfidence. Overconfident traders tend to trade more frequently (Odean, 1998), especially during high sentiment periods. Conversely, when asset prices are down, overconfident investors respond by holding onto their losing positions confident that the market will eventually see its own error and the price will soon rise again.[8] Consequently, overconfidence has an asymmetric effect on the correlation between past style returns and future stock returns as overconfidence increases the correlation between past style returns and future stock returns only when past style returns are positive, but not when the past style returns are negative.

The second channel is associated with another bias that challenges the unsophisticated investors during periods of superior returns: a social anxiety that is referred to as the fear of missing out (the fear of missing out channel). According to Przybylski et al. (2013, p. 1841), fear of missing out is "a pervasive apprehension that others might be having a rewarding experience from which one is absent." Unsophisticated investors who see others profiting from investments in a particular style may experience this anxiety, leading them to follow suit to avoid being left behind. As high sentiment affects investors' judgment of the likelihood of an uncertain event, this "keep

[8] More generally, the desire for investors to avoid the feeling of regret that comes from poorly timed sales of losing stocks is not limited to overconfident style investors. It exists widely and is part of the disposition effect ("sell winners and keep losers"). However, overconfidence makes investors more prone to keeping losers.

Table 7

Regression of momentum comovement profits on market returns and investor sentiment. Panel A presents the regression results based on the model in Table V of Cooper et al. (2004) augmented with investor sentiment as follows: $Profits = b_0 + b_1 SENT + b_2 MKT + b_3 MKT^2 + u$, (6) where *MKT* is the lagged return of the value-weighted market index (including dividends) over the 12, 24, and 36 month periods prior to the beginning of the holding period, and MKT^2 is the square term of *MKT*. *SENT* is the three-month weighted rolling average of the sentiment residual ending in month *t* - 1 divided by 1000. The dependent variable *Profits* is the difference in the value-weighted winner-minus-loser momentum profits between the top and bottom comovement terciles (C3–C1) in month *t*. The momentum portfolios are constructed based on stock returns in the past six months and are held for six months. We also report the results for two variations of the regression. In Panel B, we omit MKT^2 from the regression model. In Panel C, we measure sentiment *SENT* as the residual from the regression of the raw sentiment on the macroeconomic variables and market returns (over the same period as *MKT* is measured). The *t*-statistics are calculated using Newey and West (1987) standard errors, where the lag is set as five. There are 15,850 unique firms in the sample. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: $Profits = B_0 + B_1 SENT + B_2 MKT + B_3 MKT^2 + u$

		12-month market return			24-month market return			36-month market return		
	Parameter	Estimate	*t*-stat.	Adj. R^2	Estimate	*t*-stat.	Adj. R^2	Estimate	*t*-stat.	Adj. R^2
Constant	B_0	0.02***	3.80	3.15%	0.02***	3.60	2.80%	0.00*	1.66	2.12%
SENT	B_1	0.27***	2.70		0.38**	2.55		0.42***	2.73	
MKT	B_2	0.04*	1.85		0.02	0.59		0.02**	2.50	
MKT^2	B_3	−0.12***	−2.88		−0.03	−1.30		−0.01	−1.30	

Panel B: $Profits = B_0 + B_1 SENT + B_2 MKT + u$

		12-month market return			24-month market return			36-month market return		
	Parameter	Estimate	*t*-stat.	Adj. R^2	Estimate	*t*-stat.	Adj. R^2	Estimate	*t*-stat.	Adj. R^2
Constant	B_0	0.01**	2.10	2.63%	0.00	1.65	2.45%	0.00*	1.89	1.94%
SENT	B_1	0.34**	2.60		0.34**	2.30		0.44***	2.74	
MKT	B_2	−0.01	−0.50		−0.01	−0.81		−0.01	−0.39	

Panel C: $Profits = B_0 + B_1 SENT + B_2 MKT + B_3 MKT^2 + u$, where sentiment *SENT* is orthogonal to macroeconomic variables and market returns

		12-month market return			24-month market return			36-month market return		
	Parameter	Estimate	*t*-stat.	Adj. R^2	Estimate	*t*-stat.	Adj. R^2	Estimate	*t*-stat.	Adj. R^2
Constant	B_0	0.01***	2.73	2.60%	0.00***	2.63	2.34%	0.01*	1.85	1.70%
SENT	B_1	0.38**	2.30		0.40**	2.29		0.64***	2.90	
MKT	B_2	−0.02	−0.81		0.00	−0.55		0.03	1.38	
MKT^2	B_3	−0.10***	−2.75		−0.03	−1.33		−0.02	−1.39	

up with the Joneses" mentality may become stronger during periods of high sentiment with positive returns as unsophisticated investors are more likely to believe that they will harvest the superior returns once they enter the market. Intuitively, fear of missing out also has an asymmetric effect on the correlation between past style returns and future stock returns. When past style returns are positive, fear of missing out will increase the correlation between past style returns and future stock returns, but it will not when past style returns are negative.[9]

To examine whether the effect of high sentiment on style investing depends on the past style return being positive, we replicate the main analyses for Tables 1–3 after dividing the sample into two subsamples with positive and negative past style returns. Table 5 reports the main results. Overall, we find strong evidence for an interaction effect between sentiment and style returns. While positive past style returns are predictive of future stock returns during high sentiment periods, negative past style returns are not.

Corresponding to Panel A of Table 1, Panels A1 and A2 of Table 5 report the results from Fama and MacBeth (1973) regressions of future stock returns on the past six-month style returns for the subsamples with positive and negative past style returns, respectively. We find that only positive style returns are significantly predictive of future stock returns during periods of high sentiment. Negative style returns are not predictive of future stock returns regardless of the sentiment level. It is unlikely that our insignificant results for some subsamples are driven by an insufficient number of observations. For example, when style and stock returns are measured over the prior six months and future stock returns are measured over a three-month holding period, there are 675,580 firm-month observations in 294 months for the subsample with high sentiment and positive style returns, 462,625 firm-month observations in 279 months for the subsample with low sentiment and positive style returns, 247,723 firm-month observations in 219 months for the subsample with high sentiment and negative style returns, and 300,582 firm-month observations in 249 months for the subsample with low sentiment and negative style returns.

Corresponding to Table 2, Panels B1 and B2 in Table 5 report the coefficients of style returns for two subperiods, 1965–1987 and 1988–2018, after dividing the sample into two subsamples with positive and negative past style returns. The overall results in Panels B1 and B2 confirm that positive past style returns are significantly predictive of future stock returns during periods of high sentiment,

[9] While both overconfidence and fear of missing out imply that positive instead of negative style returns are predictive of future stock returns during periods of high sentiment, the asymmetric predictability does not contradict the model in Barberis and Shleifer (2003) because investors may invest beyond the stock market. To the extent that investment categories other than stock represent other investment styles, we would not be able to detect any negative price impact of withdrawing funds from poorly performing styles beyond the stock market since our sample includes only stock data. However, we can test the positive price impact of investing more capital in certain styles in the stock market.

but negative past style returns are not.

Corresponding to Panel A of Table 3, Panels C1 and C2 in Table 5 report monthly returns and Fama and French (1993) three-factor alphas over a three-month holding period for winner-minus-loser, winner (top decile), and loser (bottom decile) portfolios in each style comovement tercile (C1, C2, and C3), as well as the return difference between the top and bottom comovement terciles (C3–C1) conditional on investor sentiment and style returns. Panels C1 and C2 report the results when style returns are positive and negative, respectively. We confirm that the effect of investor sentiment on the predictive power of style comovement for momentum profits depends on past style returns. In summary, we find that a style's past return being positive is an essential condition for high sentiment to affect return predictability through style investing.

3.4. Sentiment and market states

In this subsection, we further explore whether the prior market return plays a moderating role in the relationship between investor sentiment and the predictive power of style comovement for momentum profits. Our tests are motivated by Cooper et al.'s (2004) findings that momentum profits are significant only after the prior market return is positive. They argue that the result is consistent with two behavioral theories. First, according to Daniel et al. (1998), market gains contribute to greater overconfidence among investors, leading to stronger overreaction and greater momentum. In addition, increased wealth can reduce risk aversion, leading to greater delayed overreaction, according to the theory in Hong and Stein (1999). Both behavioral theories predict greater momentum after positive prior market returns than negative prior market returns. They do not necessarily predict zero momentum after negative prior market returns.

Next, we examine whether our findings in Table 3 are sensitive to prior market returns. Following Cooper et al. (2004), we define up (down) markets as positive (negative) returns on the CRSP value-weighted index (including dividends) over the prior 12, 24, or 36 months.[10] The main results (untabulated) are similar across the different horizons over which prior market returns are measured. For brevity, Table 6 reports only the six-month holding period returns following positive or negative market returns that are measured over the prior 12 months. In other words, Table 6 reports the results corresponding to those in Panel B of Table 3 after we split both the high sentiment periods and the low sentiment periods into two subsamples based on the prior market return: up markets and down markets.

The results in Table 6 indicate that style comovement can predict momentum profits for high sentiment periods regardless as to whether the prior market return is positive or negative. Specifically, the winner-loser returns and winner-loser alphas in columns (C3–C1) are positive and significant for high sentiment periods regardless as to whether the prior market is up or down, even though the magnitude of the momentum profits varies with prior market returns as shown in columns (C1) – (C3) across the up and down markets. Our findings suggest that the effect of investor sentiment on the predictive power of style comovement for momentum profits is independent of the prior market returns.

As a robustness check, we also estimate the same regression model as in Table V of Cooper et al. (2004) augmented with investor sentiment as follows.

$$Profits = b_0 + b_1 SENT + b_2 MKT + b_3 MKT^2 + u, \tag{6}$$

Where *MKT* is the lagged return of the value-weighted market index (including dividends) over the 12-, 24-, and 36-month periods prior to the beginning of the holding period and MKT^2 is the square term of *MKT*. *SENT* is the three-month weighted rolling average of the sentiment index ending in month t - 1 divided by 1000. The dependent variable *Profits* is the difference in the value-weighted winner-minus-loser momentum profits between the top and bottom style comovement terciles (C3–C1) in month t, which reflects the explanatory power of style comovement for momentum profits. The momentum portfolios are constructed based on the stock returns in the past six months and are held for six months. The t-statistics are calculated using Newey and West (1987) standard errors.

Panel A of Table 7 reports the regression results for Equation (6). We also report the results for two variations of the regression. In Panel B, we omit MKT^2 from the regression model. In Panel C, we measure sentiment as the residual from the regression of the raw sentiment on the macroeconomic variables and market returns (over the same period as *MKT* is measured). No matter which regression model is used, how sentiment is measured, and which horizon is used to measure market returns, the coefficient on investor sentiment is consistently positive and statistically significant, suggesting that sentiment is a robust determinant for the explanatory power of style comovement for momentum profits. We conclude that the effect of investor sentiment on style investing is independent of the prior market returns.

3.5. Short sale constraints

Table 3 shows that the winner-minus-loser momentum profit differences between the highest and lowest comovement terciles in columns (C3–C1) come mainly from loser stocks. We argue that this is because short sale constraints delay the price discovery process, which contributes to greater momentum profits for shorting loser stocks. To confirm this argument, we conduct further tests using three proxies for short sale constraints: institutional ownership, options listing status, and analyst forecast dispersion. Specifically, we first divide the sample into two groups based on each of the three short sale constraints. High short sale constraints are indicated by low institutional ownership, no options listing, or high analyst forecast dispersion. Then, we replicate the test for Table 3 for the

[10] We skip one month between the end of the formation period and the holding period.

subsamples of stocks with high and low short sale constraints, respectively. Table IA.11 of the Internet Appendix reports the results. We find that the main results in Table 3 are more pronounced for the stocks with high short sale constraints.

4. Conclusion

Style investing has become increasingly important for both institutional and retail investors. In particular, style investing is found to be a driver of momentum. The purpose of this paper is to study how investor sentiment plays a role in pricing financial assets through style investing. We find that the impact of style investing on asset prices is conditional upon investor sentiment. Style returns are significantly predictive of future stock returns only when investor sentiment is high. Furthermore, style investing drives momentum only when investor sentiment is high. Our findings are robust to various portfolio and regression methods, as well as all the three sentiment indexes that have been widely used in the literature: the investor sentiment index constructed by Baker and Wurgler (2006, 2007), the University of Michigan's Consumer Sentiment Index, and the Consumer Confidence Index.

Moreover, we find that investor sentiment has an interaction effect with style returns, but not market returns. While positive style returns can be predictive of future stock returns during period of high sentiment, negative style returns cannot. Only when style returns are positive does style investing contribute to momentum profits under high sentiment. By contrast, investor sentiment has an independent effect on how style investing contributes to momentum profits regardless as to whether the prior market return is positive or negative.

By showing that investor sentiment can affect asset prices through style investing, our study contributes to the discussion regarding how sentiment affects the predictability of stock returns. While we examine how investor sentiment affects the style chasing behavior in the stock market, to the extent that a style can be broadly defined as a class of assets with similar characteristics, our findings can be generalized to other asset pricing anomalies that are related to style chasing behavior.

Declaration of competing interest

None.

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Appendix. Definitions of Variables

Variable	Explanation [Data Source]
Sentiment Variables	
Baker and Wurgler (2006) Sentiment Index	Baker and Wurgler construct their composite index by taking the first principal component of six measures of investor sentiment: the closed-end fund discount, the number and the first-day returns of IPOs, NYSE turnover, the equity share in total new issues, and the dividend premium, each with the effect of macroeconomic conditions removed. To remove the effect of macroeconomic-related variables, Baker and Wurgler regress each of the six raw measures on six macroeconomic variables (i.e., growth in industrial production, real growth in durable consumption, nondurable consumption, services consumption, growth in employment, and NBER recession indicator) and use the regression residual as sentiment proxies. [Data Source: Jeffrey Wurgler's website at http://people.stern.nyu.edu/jwurgler/]
The University of Michigan's Index of Consumer Sentiment	The University of Michigan's Consumer Sentiment Index is based on a monthly survey that is mailed to a random set of 500 households and asks their views about the economy. To remove the effect of macroeconomic-related variables, we regress the index on the six macroeconomic variables used by Baker and Wurgler (i.e., growth in industrial production, real growth in durable consumption, nondurable consumption, services consumption, growth in employment and NBER recession indicator). We use the residuals to proxy for sentiment. [Data Source: Federal Reserve Economic Data (FRED), The Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/UMCSENT]
The Consumer Confidence Index	The Consumer Confidence Index is based on households' plans for major purchases and their economic situation, both currently and their expectations for the immediate future. Opinions compared to a "normal" state are collected and the difference between the positive and negative answers provides a qualitative index on economic conditions. To remove the effect of macroeconomic-related variables, we regress the index on the six macroeconomic variables used by Baker and Wurgler (i.e., growth in industrial production, real growth in durable consumption, nondurable consumption, services consumption, growth in employment and NBER recession indicator). We use the residuals to proxy for sentiment. [Data Source: Organisation for Economic Co-operation and Development (OECD). https://data.oecd.org/leadind/consumer-confidence-index-cci.htm]
High/Low Sentiment	A high sentiment month is one in which the value of the sentiment proxy in the previous month is above the median value for the sample period and the low sentiment months are those with below median values.
Style Investing Variables	

(*continued on next page*)

(*continued*)

Variable	Explanation [Data Source]
Investment Styles	At the end of each June, all of the stocks with shares codes 10 and 11 traded on the NYSE, AMEX, and NASDAQ in the merged CRSP/Compustat database are independently sorted into five size quintiles and five book-to-market quintiles. The intersection delivers $5 \times 5 = 25$ size and book-to-market style portfolios. [Data Source: CRSP/Compustat]
Style returns	Monthly value-weighted style returns measured over the prior six months and 12 months, respectively, where the weight is the beginning of the month market capitalization of each security in that month. [Data Source: CRSP/Compustat]
Comovement (style beta) Portfolios	We estimate the comovement (β_{is}) of each security i with respect to its style portfolio s (determined by size and book-to-market) by regressing daily stock returns on the daily style returns as in Equation (1): $R_{i,st} = a_i + \beta_{is} R_{st} + \varepsilon_{ist}$. $R_{i,st}$ is the return on stock i on day t, where stock i belongs to style s. R_{st} is the value-weighted return of style s on day t. The return of the style portfolio, R_{st}, is constructed after removing stock i from the portfolio. The regression is estimated using the past three months of daily returns requiring each stock to have at least 20 return observations. We roll forward the regression one month each time to generate a time series of comovement measures (i.e., estimates of style betas, β_{is}). Each month, all stocks are sorted into terciles (C1, C2, and C3) based on their β_{is}. The top comovement tercile is C3 and the bottom comovement tercile is C1. [Data Source: CRSP/Compustat]
Firm Characteristics Variables	
Book-to-Market ratio	The Fama and French (1992) book-to-market ratio, where the value for July of year y to year $y + 1$ is computed using the book value of equity for the fiscal year end in calendar year y - 1 from Compustat and the market value of equity at the end on December of year y - 1 from CRSP. [Data Source: CRSP/Compustat]
Size	The market capitalization at the time of portfolio formation (updated monthly). [Data Source: CRSP]
Additional Macroeconomic Variables	
Default premium	The yield spread between BAA and AAA bonds. [Data Source: St. Louis Federal Reserve]
Term premium	The yield spread between 20-year and one-year Treasuries. [Data Source: St. Louis Federal Reserve]
Real interest rate	The most recent monthly difference between the 30-day T-bill return and the consumer price index inflation rate. [Data Source: St. Louis Federal Reserve]
Inflation rate	Measured based on the consumer price index (CPI). [Data Source: St. Louis Federal Reserve]
Consumption wealth ratio (cay)	The consumption wealth variable defined in Lettau and Ludvigson (2001). [Data Source: Sydney Ludvigson's website at http://www.econ.nyu.edu/user/ludvigsons/.]
Short Selling Constraints Variables	
Institutional ownership	The percentage of common shares held by institutional investors based on Thomson Reuters Institutional 13(f) filings. [Data Source: Thomson Reuters]
Options listing status	To obtain option listing status, we use the first and last date that the company has data on traded options in the OptionMetrics database. [Data Source: OptionMetrics]
Analyst forecast dispersion	Standard deviation of the fiscal year earnings forecasts divided by the absolute mean value as reported in the IBES summary file. [Data Source: IBES]

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.finmar.2022.100755.

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